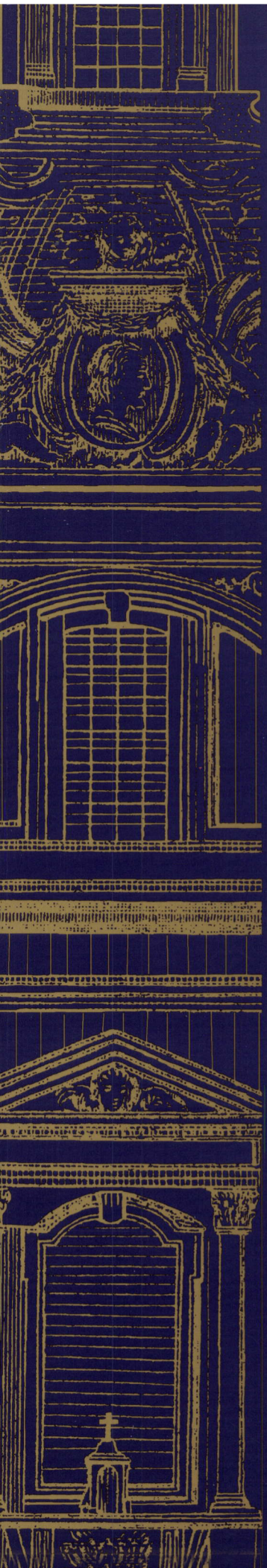

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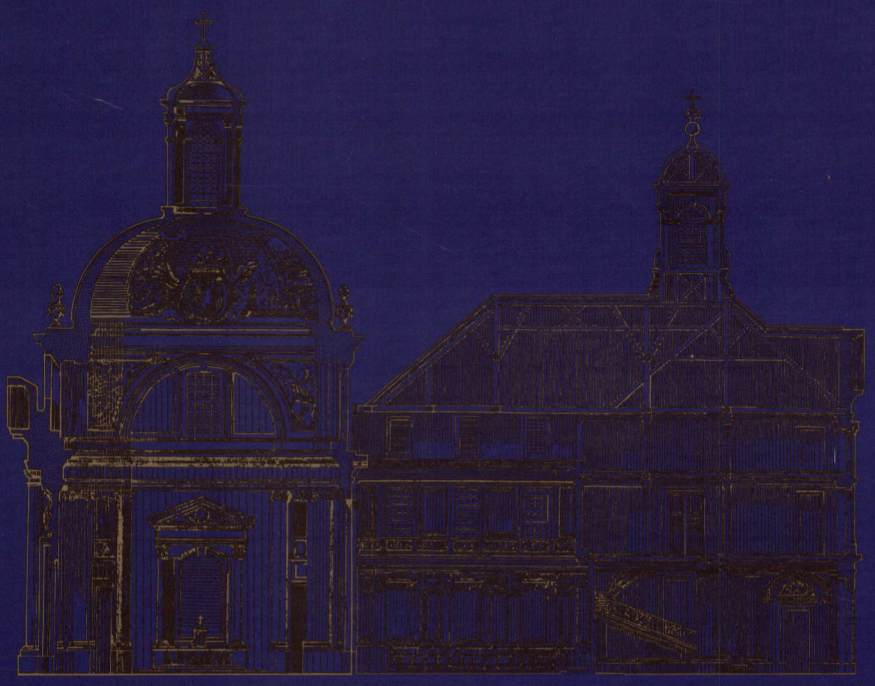
The Conservation of Heritage Interiors

La conservation des intérieurs patrimoniaux



Canadian Heritage

Patrimoine canadien

Canada

The Conservation of Heritage Interiors

Preprints of a Conference
Symposium 2000
The Conservation of Heritage Interiors
Ottawa, Canada
May 17 to 20, 2000

Organized by the Canadian Conservation Institute and the Association for Preservation Technology International

Canadian Conservation Institute
Ottawa, Canada
2000

La conservation des intérieurs patrimoniaux

Les prétirages de la conférence
Symposium 2000
La conservation des intérieurs patrimoniaux
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du 17 au 20 mai 2000

Organisé par l'Institut canadien de conservation et l'Association pour la préservation et ses techniques

Institut canadien de conservation
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Foreword

Symposium 2000 - The Conservation of Heritage Interiors is the latest in a series of international symposia organized by the Canadian Conservation Institute (CCI) which are an important part of our mandate to develop and disseminate new knowledge in conservation. In this case, we are pleased to be collaborating with the Association for Preservation Technology International, the Heritage Conservation Program of Real Property Services for Canadian Heritage and Environment Canada (HCP), the Canadian Association for the Conservation of Cultural Property, and the National Gallery of Canada in presenting this discussion forum.

We are delighted to welcome delegates from around the world to this important event, which marks the increasing recognition of the need to address preservation in an holistic manner. Architectural conservation is an intrinsic element of heritage preservation, and is inseparable from the objects and events that speak to us about our shared history.

In recent years CCI has gained experience in a range of conservation projects in heritage buildings, perhaps the most notable of which is the comprehensive renovation of the nation's Parliamentary Precinct. This major multi-year project is intended to modernize the facilities that house Canada's parliamentary function while ensuring that the heritage character of the buildings and the site is fully respected. As part of a planning project of the HCP, CCI has played an important role in establishing the standards that will guide the ongoing work in coming years. This intervention has had the happy consequence of ensuring that a large program of work will be made available to private-sector conservators.

Exchanging information such as this is, of course, the primary goal of Symposium 2000. If past experience is a reliable guide, we can be confident in expecting lively debate during the sessions; we look forward to engaging in this discussion with you and then disseminating the results to the larger community.

Bill Peters
Director General
Canadian Conservation Institute

Préface

Symposium 2000 - *La conservation des intérieurs patrimoniaux* est le plus récent d'une série de symposiums organisés par l'Institut canadien de conservation (ICC). Ces symposiums constituent une part importante de notre mandat visant à développer et à faire connaître les nouvelles connaissances dans le domaine de la conservation. Dans le cas présent, il nous fait plaisir de collaborer avec l'Association pour la préservation et ses techniques, le Programme pour la conservation du patrimoine (PCP) des Services immobiliers pour Patrimoine canadien et Environnement Canada, l'Association canadienne pour la conservation et la restauration des biens culturels et le Musée des beaux-arts du Canada pour la présentation de ce forum de discussion.

Nous sommes heureux d'accueillir des délégués du monde entier à cet important événement visant à souligner le besoin croissant de traiter la préservation d'une manière holistique. La conservation architecturale constitue un élément intrinsèque de la préservation patrimoniale et est indissociable des objets et des événements qui nous parlent de notre histoire commune.

Au cours des dernières années, l'ICC a acquis de l'expérience dans une foule de projets de conservation d'immeubles historiques, le plus connu étant la rénovation complète de la Cité parlementaire. Cet important projet pluriannuel vise à moderniser les édifices dans lesquels se déroulent les activités parlementaires du Canada tout en préservant le caractère patrimonial des édifices et des sites. Dans le cadre du projet de planification du PCP, l'ICC a joué un rôle important dans l'adoption de normes qui guideront le travail des prochaines années. Cette intervention a eu l'heureuse conséquence d'assurer que de nombreux travaux seront exécutés par des restaurateurs du secteur privé.

Les échanges d'information de cette nature constituent, bien sûr, le principal objectif de Symposium 2000. Si l'on peut se fier à l'expérience passée, on peut s'attendre à des débats enjoués. Nous sommes impatients d'entreprendre la discussion avec vous et de communiquer les résultats à la collectivité en général.

Bill Peters
Directeur général
Institut canadien de conservation

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Association canadienne pour la conservation et la restauration des biens culturels
Programme pour la conservation du patrimoine

Introduction

Conservation assessments and planning, skilled teams and partners, communication at all levels, quality control of conservation site work, the *post mortem* — we know the importance of all of these ingredients in successful architectural conservation projects. Each of the papers presented at *Symposium 2000 - The Conservation of Heritage Interiors* explores architectural conservation from the inside-out through the personal experiences, both good and not-so-good, of conservators, scientists, architects, project managers, and trades. I think that all of the authors would agree that problems with site projects begin to occur when there is a breakdown in one of these necessary elements. The purpose of this symposium is to look at the process of uncovering and conserving the material language of historic architecture in order to breathe life into a moribund interior, what worked and what did not, from project planning to the *post mortem* and the sign off.

Many of the projects discussed were not undertaken within museums but in working buildings with heritage designations. These historical interiors present their own challenges. In the long run, the best way to preserve these 'living museums' is to help the occupants carry out enlightened maintenance so that neither careless renovations, neglect, nor too much well-intentioned scrubbing can cause irreversible damage to a fragile historical interior. At the Canadian Conservation Institute we have been working with the Heritage Conservation Program and the Federal Heritage Buildings Review Office to develop conservation guidelines and training for the users of historical government buildings that are beyond the scope of the restoration project. We feel that this preventive conservation approach is important to extend the effectiveness of our intervention into the future.

Just as every conservation project finishes with recommendations for long-term care, the program of Symposium 2000 finishes with a panel discussion, our own *post mortem* on the conservation process in heritage interiors. The thread running through this symposium is that our professions must adapt and co-operate to deal effectively with the challenges posed by the scale of architectural projects and the fragility of fine art surfaces and objects found in historical interiors. We hope that this collection of papers will give insights into how the professions and trades can learn from each other. It is our attention to detail, despite the size of the project, that will make the difference in the preservation of the heritage interiors that have been entrusted to our care.

James Bourdeau,
Program Chair, Symposium 2000

Introduction

Les évaluations et la planification dans le domaine de la conservation, des équipes et des partenaires qualifiés, la communication à tous les niveaux, le contrôle de la qualité du travail effectué sur les sites de conservation, l'analyse rétrospective — nous savons tous l'importance de ces éléments dans la réussite de projets de conservation de l'architecture. Chacune des présentations au Symposium 2000 - *La conservation des intérieurs patrimoniaux* traite de la conservation architecturale par le biais d'expériences personnelles, heureuses et non, de restaurateurs, de scientifiques, d'architectes, de gestionnaires de projet et d'artisans. Je crois que tous les auteurs seraient d'accord pour dire que les problèmes surgissent lorsqu'il y a défaillance de l'un de ces éléments nécessaires. L'objectif du symposium est d'étudier le processus permettant de dévoiler et de préserver la signification des matériaux utilisés dans l'architecture patrimoniale afin d'infuser une nouvelle vie à un intérieur moribond, ainsi que de déterminer ce qui fonctionne et ce qui ne fonctionne pas (de la planification à l'analyse rétrospective et à l'achèvement de projet).

Bon nombre des projets discutés n'ont pas été réalisés dans des musées, mais bien dans des bâtiments de travail classés édifices patrimoniaux. Ces intérieurs historiques comportent des défis. À long terme, la meilleure façon de conserver ces « musées vivants » est d'aider les occupants à procéder à un entretien éclairé afin qu'aucune rénovation négligente ni aucun nettoyage trop bien intentionné ne cause de dommages irréversibles à un intérieur historique fragile. À l'Institut canadien de conservation, nous travaillons en collaboration avec le Programme pour la conservation du patrimoine et le Bureau d'examen des édifices fédéraux du patrimoine pour élaborer des lignes directrices de conservation et organiser de la formation pour les utilisateurs des édifices fédéraux du patrimoine qui dépassent le cadre du projet de restauration. Nous sommes d'avis que cette approche préventive est importante si nous voulons étendre l'efficacité de nos interventions dans l'avenir.

Tout comme chaque projet de conservation se termine par l'élaboration de recommandations à long terme, le programme de Symposium 2000 conclura avec une discussion d'experts, notre propre analyse rétrospective sur le processus de conservation des intérieurs patrimoniaux. Avec ce symposium, nous voulons que notre profession soit en mesure de s'adapter et de coopérer afin de pouvoir relever efficacement les défis que représentent l'ampleur des projets architecturaux et la fragilité des surfaces et des objets d'art de ces intérieurs historiques. Nous espérons que ces présentations vous aideront à comprendre comment les professionnels et les artisans qui travaillent dans ce domaine peuvent apprendre les uns des autres. C'est notre attention aux détails, malgré l'importance du projet, qui fera toute la différence dans la préservation des intérieurs patrimoniaux qui nous ont été confiés.

James Bourdeau,
président du Programme, Symposium 2000

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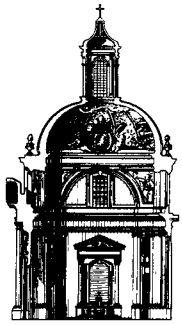
The Preparations: Conservation Assessment

Les préparatifs : Évaluation de l'état de conservation



The Planning Process: The Role of Conservation Assessments and the New Orleans Charter

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Abstract

Conservation assessments of architecture and collections have proven to be an important tool in the physical improvement of historic structures and the collections housed therein. Unfortunately, many conservators have found that a lack of follow-up (particularly as regards the continuing input of professional expertise) is a large obstacle to the appropriate use of such assessments. In short, when (and if) an institution carries out the measures recommended in an assessment report, those who wrote the report are often not contacted. There is no commonly accepted model for using an assessment as a first step in a potentially lengthy process in which the measures recommended in the New Orleans Charter can be followed. [A copy of the New Orleans Charter can be found in Section 8 of this book of preprints.]

The team process has been accepted by many preservation professionals as the best way to approach the complex problems presented by the restoration, renovation, or re-use of an historic interior, but the increasingly business-oriented professionals who supervise such projects seem less willing to accept this model (possibly because of the apparent surrender of authority to outside experts).

Introduction

A detailed and deliberate planning process is a necessary part of every historic preservation project. Such projects are very complex and every decision has consequences for many aspects of the institution's functioning; therefore no decision can have its intended outcome if it is made by one individual acting alone, no matter how expert he or she might be. When the result of a project is unsatisfactory, or when a decision has a poor outcome in one way or another, the fault seldom lies in a single bad decision but rather in the lack of a consciously crafted decision-making process. The New Orleans Charter rightly recommends a team approach for decision-making, and establishes guidelines by which projects should be judged. However, making the team approach work is seldom simple. In order to create a reliable process, some structure is needed. This paper suggests that conservation assessments be a first step in the process, which can then be used as a model for other kinds of input into the decision-making process.

Preservation projects are exceedingly complex in two separate ways: deciding what should be done, and then deciding how to accomplish it. In other words, the fact that many individuals agree that such a project should be undertaken does not presuppose a specific goal; each concerned professional and each constituency that is to be served will judge the ultimate success of the project by different criteria. To assure that goals will be established and met, the potential uses of the restoration must be described in full. Given the number of interests to be served (the collection and the structure, visitors and staff, docents and registrars, aesthetes and maintenance workers, idealists and bean-counters), the whole will be looked at from many different points of view.

The New Orleans Charter and the team approach

The New Orleans Charter provides a model for the interaction of a number of professionals in projects involving the alteration of historic structures. Although curatorial and administrative personnel from many institutions participated in the discussions that led to the creation of the Charter, few professionals not directly involved in preservation are familiar with it. Therefore, if the Charter is to be useful in guiding deliberations, all participants must first be furnished with a copy of it.

The team approach seems to be the best way to address a complex problem and assure that the proposed project has the highest probability of serving its end users (e.g. the institution's education department, technical researchers, visitors, and staff alike). Aside from technical expertise, it takes a number of people reviewing architectural drawings and specifications to assure that errors are avoided, i.e. that light switches are within reach of the first person to walk into a dark room, that doorways are bigger than objects, that workmen do not need to traipse through storage rooms to reach shut-off valves, etc.

As anyone who has ever attended a meeting can attest, a meaningful and productive group-decision-making process is difficult to achieve and rarely occurs. There are many pitfalls. Meetings often throw together people on different organizational rungs, making it difficult to express opinions freely (e.g. how can an employee critique a proposal openly if it has been presented or approved by his or her boss). No one wants to be seen as a pest and someone who criticizes too much risks being shunned, which can make saying nothing (but complaining in private later) seem to be the best tactic. It may only take one person to make a first tentative suggestion that all is not well for others to join in, but unless someone takes that first step the tendency for everyone to want to get out of the room as quickly as possible may allow a flawed proposal to win the day. Some participants may have received little or no information on the proposal before the meeting, and therefore feel they do not understand it well enough to offer meaningful input. And finally, those who run the meeting may project the idea that it is to be a rubber stamp, making it that much more difficult for a dissenting voice. Yet only if disagreements are aired can they be discussed and resolved.

The membership in the kind of team proposed in the New Orleans Charter has been discussed elsewhere,[1] but strategies for making the process work have not, at least in this context. [Undoubtedly such matters are discussed *ad infinitum* in other fields of endeavour.] Team members must, from the start, have some assurance that some serious thought and some specific tactics will be used against these all-too-common difficulties.

The first author, having attended many unsatisfactory meetings, served on a jury in July of 1999 and found that the jury process worked exactly as a group-decision-making process is supposed to work. The specifics of this setting are instructive. A jury knows exactly what its job is, and knows that there are people in authority who expect them to succeed in doing it. All jury members are equal in status and they have no prior expectations of each other. Each person is required to assent to the final decision and no one can leave until they agree; this is a powerful incentive for each person to contribute to the arguments and to proceed as efficiently as possible. By law, each person starts with exactly the same information. They have firm rules to follow (e.g. that no deliberation be carried out unless every juror is in the room, and that each person must be willing to change their mind based on the evidence and discussion of its significance) and no distractions from their 'other' lives are allowed.

In contrast, the team process of decision-making on historic preservation projects does not begin with a set goal. The setting of goals is often mixed with discussion of how each goal might be achieved; initial plans may have been drawn up without complete input, so that many parties with legitimate interests in the outcome are forced either to give up from the start or to force alterations in what has already been planned. No matter how constructive the comments, they can only be seen as criticism. A better process would be for each party to establish goals that can be shared with the group before further discussion is carried out. For example, a docent might set a goal of providing enough space for up to 20 adults to be accommodated in each historic space, with original material far enough out of reach that visitors do not have to be monitored. Those responsible for monitoring the condition of historic materials may request that there be a bright setting for lights that can be used for examination; the docent might be reminded by this that a bright setting would improve the quality of visits by the elderly or sight-impaired. The process of agreeing on a list of goals allows the group to see itself as united in striving to attain a full set of goals that will guide the whole rest of the deliberations.

Many employees have never been asked to consider the effects of a facility on their everyday work, but unless they do so their ability to contribute to the decision-making process will be compromised.

The conservation assessment can be used as a model for the way that each member of the team prepares for full participation in the process.

The conservation assessment

In the United States, the conservation assessment has been accepted by a wide range of cultural resource professionals as an essential step in helping institutions improve the physical preservation of historic structures and the collections housed therein. The centrality of collections to museums and historical societies makes conservation assessments a vital step in the long-range planning for all institutional activities including, specifically, the re-installation and interpretation of historic interiors.

Historic Preservation, formerly the National Institute for Conservation, has awarded about 1400 grants for assessments over the last decade, and others have been funded through other sources. Some American granting agencies require that assessment reports be submitted as part of every application related to collections management projects. However, the conservation assessment as a tool was designed not as the first step in a long process but as a stand-alone procedure.

For those who are not familiar with it, the typical assessment process is as follows: a collections conservator and (for institutions housed in historic structures) an architectural conservator visit the site, review relevant documents, interview members of the staff and governing board, and inspect all collection spaces and (just as importantly) non-collection spaces such as attics, offices, and equipment

rooms. Examination of individual collection objects by the collections conservator is commonly limited to those that have been identified by staff as being in unstable condition and to superficial examination of groups of objects. In other words, unlike collections surveys, the assessment is a top-down rather than bottom-up way of looking at an institution.

The assessment report addresses all matters that the conservator considers might affect the preservation of collections. In some cases, the conservator may limit topics to the most obvious issues such as temperature and relative humidity, lighting, pest management, and disaster planning.

More sophisticated assessments look at an institution from a wider vantage point and address some of the following items.

The mission statement—Is it a true reflection of the current activities of the institution? Is it specific enough to justify turning down gifts of objects that the staff believe will be more liability than asset? Do other policies and programs relate to it in a meaningful way?

Collections management policies—Are they an actual reflection of what is being done? Do they help guide the day-to-day operations of the institution in a consistent and helpful way? Is their level of detail established so that constant changes can be avoided?

The staff (including administrators)—Are they trained appropriately to handle and care for collections? Do they have direct access to technical expertise when they need it, and do they seem to know when they need it? Are they working well together or at odds with each other?

Exhibitions—Are individual collections objects presented in a state that reflects an accurate view of their appearance based on the institution's interpretation? Aside from the contribution of lighting to their preservation, is the existing lighting scheme appropriate to the historic interpretation and does it make a positive contribution to how the visitor sees them?

This is only the beginning of a long list of issues that a conservator may see as affecting the preservation of collections. Even these few preliminary inquiries show how intimately the conservator becomes involved with the institution in the process of carrying out the assessment. The days spent by the two conservators on site with the staff are very intense. The conservators are literally looking under beds while listening to a number of people talk about their problems, trying to remember the full cast of characters and the history of the institution, taking notes, and consulting together. On the first day, a rosy picture of a united staff is often presented; by the second day, as some time is spent with individuals, more complex relationships start to emerge. Physical observations are of course important, but the more knotty issues related to personalities and capabilities are just as important in judging the potential of the institution to carry out projects. The fact that two conservators, both with substantial experience with comparable institutions, are in possession of all this information, together with that generated by contact before and after the site visit, is (or at least ought to be) an important long-term asset for an institution. Unfortunately, in many cases the conservators never hear from the institution again.

The assessment report itself includes prioritized recommendations for action in all areas seen as unsatisfactory, but usually cannot present elaborate details of the recommended actions. Some recommendations may deal with topics that are outside the conservators' expertise, and would require further advice from experts in fields like fire detection, lighting, or the treatment of individual objects. The specifics of recommended projects often depend on decisions to be made after consideration of costs, staff resources, the particular aims of the institution, future programming, and a host of other matters. The assessment report should therefore not be seen as the last word, or as all the information that a conservator is capable of providing. Although institutions commonly request more details than conservators feel they can provide, the need for integration of the institution's priorities and an honest assessment of its resources make it necessary for the decision-making process to continue long past the time that the assessment report is written. This makes it all the more unfortunate if the conservators are not kept 'in the loop'.

The fact that an institutional staff may not see why a conservator cannot tell them exactly what to do seems like an irritation, another example of a client not 'getting it'. However, seeing that this is a common reaction, perhaps conservators should take this as another opportunity for client education and address the situation directly. Perhaps assessment reports should include more detail about the future decision-making processes that will be required to assure that appropriate actions can be taken on the recommendations.

One possible reason that conservators are not called in more often to participate in a continuing process of decision-making is that many are reticent about recommending themselves as future consultants. Perhaps the lingering idea that solicitation of clients is unethical drives this; if so, conservators must get over this.

Recommendations in an assessment, no matter how sophisticated they are, must (in order to be ethical) be based on preservation needs rather than on other needs of the institution. This does not mean that every recommendation is carved in stone or that in compromising later a conservator is acting unethically or is endangering collection material. Many different courses of action can contribute to the same end; the conservator must be one part of the ongoing decision-making process in order to provide the best protection for collections while factoring in other goals. This

brings us back to the matter of complexity and multiple potentially conflicting interests, which were the original justifications for the New Orleans Charter.

Assessments of other types

In conservation assessments, a collections and an architectural conservator establish priorities that will contribute to optimal preservation as a model for the beginning of the decision-making process. Just as those conservators have looked at existing facilities and procedures from the point of view of preservation of collections and structure, and judge renovation plans from that perspective, other parties must do the same. Docents, for example, should be encouraged to note exactly what in the existing system serves their purposes well or hinders them; curators, electricians, exhibition technicians, reference librarians, and other parties must do the same. If staff are encouraged to set aside time for the study of existing conditions, they will be reassured that their input is considered valuable and they will be more likely to participate actively in the process. In addition, analysis of current facilities will increase the probability that any changes made will actually be an improvement.

It may help to refer back to the primary goals of a museum (i.e. research, collection, exhibition, interpretation, and preservation) to assure that each factor is represented by at least one member of the team. Other matters as varied as cleaning routines, community involvement, and money, money, money, must be represented as well.

The establishment of goals for the proposed project must not be a substitute for ongoing participation of all parties. A small group cannot do appropriate planning based on the perusal of a pile of reports. Every change has unforeseen consequences, and optimal solutions are always group efforts.

Refereeing the process

With everyone coming to the process armed with their own opinions, members of the team begin on a more equal level. A group of well-prepared participants will help to assure full participation in the process, but the process itself also needs to be defined. Someone has to act as the judge, setting rules for engagement and for the circulation of information, and someone needs to chair the individual meetings. Relevant information must be circulated to each person with a role in the process, and the means for their reply should be established (e.g. should comments on a particular plan be written and forwarded to one person, should they be copied to everyone on the team, or should they be telephoned to one person who collects them and circulates the whole list). Agendas for meetings should be circulated so that everyone can be prepared, and the chair can confine discussion to the topic at hand. Either at meetings or in writing, every participant should be asked for a response so that positive responses will be included as well as negative ones. Although dissenting voices must be heard, they should not be allowed to overwhelm the process; this is one reason that supporting voices must also be heard.

Most importantly, a positive open atmosphere where everyone feels free to speak up must be established from the start. Rules must be repeated and reinforced, and the idea that there is no foregone conclusion must be reiterated. The result of a proper group-decision-making process is something that no single person could have created, and that each participant can take credit for. With some thought in advance, and with a certain amount of applied psychology, the quality of interactions in the team process can be improved; this can only lead to an improved output.

Paying for planning

There is one other entirely different reason that the decision-making process is often slighted: money. One of the reasons that an institution may want details in the recommendations of an assessment is that details will be necessary for the grant request that will fund the project. In order to produce a budget, someone must know how many sheets of light-reducing Plexiglas will be required, and of what type, and the model number of the vacuum cleaner they should buy. But whose money can be used to bring in consultants for the planning process? In order to apply for grant money, detailed plans are required, but how is it possible to pay for the experts that are needed to provide those details?

A growing number of granting agencies will pay for planning grants, but money can be raised in other ways. Business-oriented board members and other donors should be able to understand that sound planning is as important to historic preservation as it is to business.

As a simple example of the way consultation can be used to assure that the planned project fills the specific needs of the institution, the authors were recently consulted by an engineer being asked to design an environmental control system for a new museum located in an existing structure. He had asked that a conservator be consulted because, as he explained, working alone he would have to plan for the most stringent requirements for every environmental factor. Working with a conservator he could focus his efforts on the specific needs of the collection at hand and therefore could possibly save a great deal of money. It is vital to note that a thorough planning process does not necessarily add to the cost of a project; it can just as easily save money, both in the short term and in the long term, helping to avoid expensive mitigation of mistakes and overbuilding.

Conclusions

The soundness of historic preservation projects depends on the soundness of the decision-making process. Assuring the engagement of a variety of professionals in such a process can be difficult, and a great deal of thought must go into the creation of the team, the choice of the professions to be represented and the individuals to represent them, the preparation of each of its members, and the conduct of the team's business once it is convened. The New Orleans Charter sets some valuable guidelines for decision-making and the conservation assessment provides a model for the way various facets of the institution's responsibilities can be integrated into the process.

Endnotes

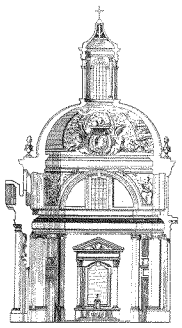
1. Himmelstein, P., and B. Appelbaum. "The Process of Compromise: A Team Approach to Conservation Environments." *APT Bulletin* XXVII, 3 (1996), pp. 8–11.

Résumé

Le processus de planification : Le rôle des évaluations de conservation et la Charte de la Nouvelle-Orléans

Les évaluations de conservation d'ouvrages d'architecture et de collections se sont avérées un outil important pour l'amélioration physique des structures historiques et des collections qui y sont logées. Malheureusement, de nombreux restaurateurs ont constaté que l'absence d'un suivi (particulièrement en ce qui concerne l'apport continu d'expertise professionnelle) est un obstacle considérable à l'utilisation appropriée de ces évaluations. En bref, lorsque (et dans le cas où) un établissement met en application les mesures recommandées dans un rapport d'évaluation, les auteurs du rapport n'en sont bien souvent pas informés. Il n'existe pas de modèle généralement accepté pour utiliser une évaluation comme première étape d'un processus vraisemblablement de longue durée dans le cadre duquel les mesures recommandées dans la Charte de la Nouvelle-Orléans *peuvent être appliquées. [On trouvera à la Section 8 du présent ouvrage une copie de la* Charte de la Nouvelle-Orléans.*]*

Le processus d'équipe a été accepté par de nombreux professionnels de la conservation comme la meilleure façon d'aborder les problèmes complexes que présentent la restauration, la rénovation ou la réutilisation d'un intérieur historique, mais les professionnels de plus en plus axés sur les affaires qui supervisent de tels projets semblent de moins en moins prêts à accepter ce modèle (peut-être à cause de l'apparent abandon de leur autorité à des experts de l'extérieur).



Resurrecting John Singer Sargent's Triumph of Religion: *Issues and Considerations for Future Conservation*

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Abstract

John Singer Sargent painted three mural projects during his career, the most elaborate of which is *Triumph of Religion* at the Boston Public Library (BPL). The mural cycle depicts a history of Western religion and adorns a barrel-vaulted gallery on the third floor of the BPL. The murals were painted in oils on canvas in England and mounted to the gallery walls in four stages from 1895 to 1919 using the marouflage technique. Unlike the traditional mural painting techniques of the time, Sargent applied elaborate relief elements to the mural surfaces. These included high relief plaster figure groupings, and low relief gilt elements made of plaster, composition, wood, papier-mâché, metal, and commercial wall-covering, many of which were gilded and painted. Sargent was also responsible for designing the architectural gilded relief mouldings in the vaulted ceiling, the decorative scheme on the walls, and the brass lighting fixtures that supplemented daylight from the skylights in the vault.

During World War II, the roof above the gallery skylights was covered over for structural reasons. Not only was the natural light that lit the space eliminated but, worse, fluorescent lights were later installed in the skylight openings.

The murals were last restored in 1953 and the cleaning at that time appears to have resulted in abrasion of the paint layers. The application of a wax coating during that restoration, along with the subsequent accumulation of soot and dust, has obscured the murals considerably. At the time of the last restoration some of the original light sconces were removed, the remaining light sconces were extinguished, and new fixtures were installed to the further detriment of the murals and the space.

The gallery containing the Sargent murals is slated for conservation in the near future as part of an ongoing renovation of the BPL. During the first half of 1999, conservators from the Straus Center for Conservation undertook a thorough examination of the technique and condition of the murals in preparation for future treatment. This work included cleaning tests and analysis, and was intended to provide a foundation for treatment recommendations to be made to the BPL and the architects overseeing the renovation. This paper discusses the complexities of the varied materials, the problem of cleaning the murals (which vary considerably in technique), the plans for re-introducing daylight through the skylights, and the possibilities for restoring the lighting as designed by Sargent. The planning and implementation of a successful restoration program for the gallery will hinge on the expertise of those who must collaborate on the project.

Introduction

John Singer Sargent (1856–1925) achieved celebrated fame as a painter of portraits and landscapes in the late 19th century. Today, however, few are aware that during the last 30 years of his life he immersed himself in the production of monumental mural projects. *Triumph of Religion* at the BPL was the first and most elaborate of the three mural projects that the artist executed, all of which are to be found in the Boston area (Figure 1). In 1890, Sargent was asked to participate in the decoration of the newly constructed BPL, designed by the renowned architectural firm of McKim, Mead, and White. He chose a narrow and dimly lit, barrel-vaulted hall on the third floor of the building. For the hall, he created a complex program depicting a history of Western religion including scenes from Jewish and Christian scripture. He laboured on the project for the better part of 29 years (from 1890 to 1919). The mural cycle was intended to comprise 17 mural panels, but for various reasons Sargent did not paint the final panel that was to be the focal point of the work, and thus the project was never completed.[1]

The mural program and its elaborate surfaces create an imposing yet highly enigmatic work. Aside from the complicated theme, the long, narrow shape of the gallery [which measures 25.6 m (84 ft.) in length, just 7.01 m (23 ft.) in width, and 7.92 m (26 ft.) in height] and the high position of the murals on the walls and ceilings make viewing the images difficult. Since his death in 1925, serious problems created by human intervention (including restoration treatments and lighting alterations) have

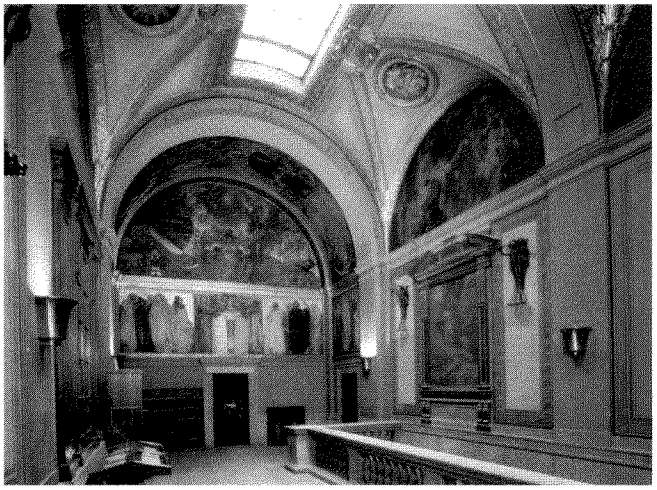

Figure 1. Sargent Hall looking north, 1999.

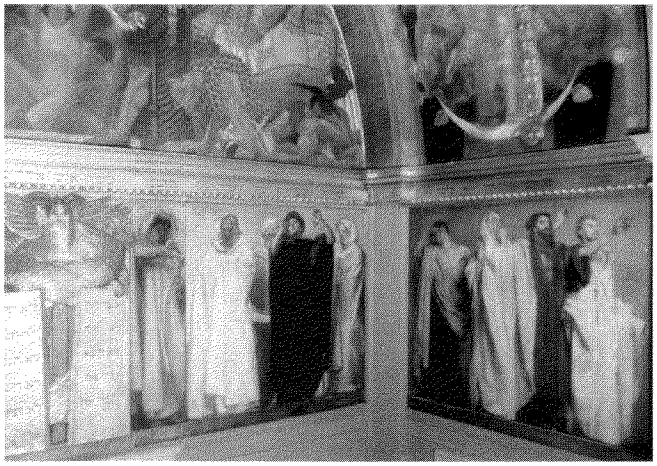

Figure 2. Frieze of Prophets *with* Israelites Oppressed *and* Pagan Gods *panels above. Northeast corner, Sargent Hall.*

dramatically distorted many of Sargent's intended visual effects. In 1999, the Straus Center for Conservation was contracted by the BPL to assess the condition of the murals and the prospects for their future conservation. This paper presents a brief overview of Sargent's innovative technique but focuses mainly on the challenges of the future conservation in light of the artist's technique and the complications created by previous restorations. It also considers the problem of lighting in the gallery, which was an essential component of Sargent's overall decorative scheme.

History, materials, and technique of the murals

The murals were painted in England, and throughout the project Sargent made four trips to Boston to make final adjustments to the works and to supervise their installation. He experimented with diverse materials and visual effects, ultimately creating unconventional mural surfaces more akin to a mixed or multimedia decoration. The canvas portions of the murals were painted using traditional techniques (namely oil paint on primed, linen canvas), but the consistency of the paint layers varied greatly among a number of the murals. The painted canvasses, which totalled 193.3 m^2 (2132 sq. ft.), were attached to the plaster walls and ceilings by means of the marouflage technique using lead white pigment in a drying oil, adhesive paste. Sargent also chose to decorate the murals with ornate relief elements, a mode of expression with which he had never before experimented. With the exception of just one of the panels, the mural surfaces were embellished using a rich variety of relief elements, which totalled well over 600. These included sculptural, plaster figure groupings, and relief elements made of plaster, composition, wood, papier-mâché, metal, cut glass, and commercial wall-covering. Most of these were gilded, painted, and glazed, and in the case of the decorative borders, highly ornamental stencil patterns were employed.

Sargent created his most ambitious arrangements at the beginning of the project and, in this regard, the group of murals installed in the north end of the gallery in 1895 provides some of the most fascinating examples (Figure 2). Befitting their pagan themes, these murals were filled with complex and highly ornamental material. Most of the relief elements were composed of plaster and composition materials that were first sculpted as positives in clay. These were then gilded with gold or silver leaf and toned with oil glazes to produce a translucent and slightly reflective surface. The reliefs were then affixed to the ceiling with nails and wires.

After producing the majority of his relief work in plaster at the north end, Sargent soon recognized that the material was far too brittle for the task. While working on *Trinity*, installed in 1903, Sargent began using more lightweight and flexible materials. On the south wall almost all the pieces were composed of papier-mâché. Although many of these were low relief objects subtly textured with ornate patterns, many (such as the angel's wings in *Frieze of Angels*) retained highly sculptural characteristics (Figure 3). These were also fabricated in the same manner as described for the plaster elements, with the exception that layers of wet and dampened paper were pressed into the moulds. Once dry, the surfaces of these hollow pieces were similarly treated with gold leaf and paint. They were then pinned to the wall along flat projecting edges left for this purpose.

The highly sculptural plaster *Crucifix* (Figure 4), with its innovative figure arrangement, confirms that, for Sargent, modelling in clay was an important technique for achieving striking visual effects in the hall. The robe was painted with a solidly applied layer of red paint but the figures

were thinly coated with a translucent warm glaze that gave the surface a soft lustre. In contrast to this, Christ's halo was fashioned from a piece of sheet metal that is now corroded. This massive piece projects more than 0.3 m (1 ft.) from the wall and stands in marked contrast to the flat, painted canvas background.

Figure 3. Detail of Frieze of Angels *on the south wall. Papier-mâché relief elements applied over painted canvas.*

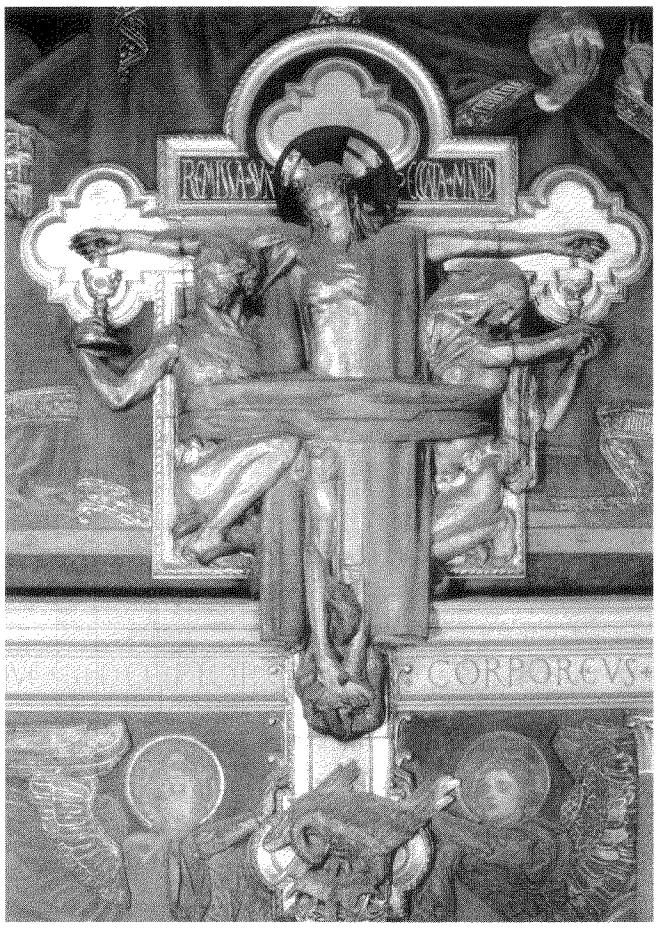

Figure 4. Crucifix on south wall. Painted relief plaster with metal halo behind Christ's head.

Toward the end of the project, Sargent drastically simplified his working technique. This change is especially notable in the lunettes that were affixed to the east and west walls in 1916. Here he used Lincrusta (a commercial wall-covering made of paper fibre and linseed oil) extensively. Although available in many styles for interior decoration, Sargent chose a simple corduroy-pattern that he ornamented with paint and gold, and then glued and nailed to selected portions of the lunettes. Commenting on Sargent's working practices in 1916, the critic Coburn explained the reason for the use of this material. "Mr. Sargent worked daily on the scaffolding, modelling and gilding every least bit of ornament...attaching to them yards of corduroy so applied as to make the diffusion of light more interesting than from flat surfaces."[2] Sargent's extensive and innovative use of elaborate relief materials applied over the painted mural surfaces of *Triumph of Religion* clearly sets his work apart from the conventional mural painting technique of his time and warrants further study.

Restoration history and the present condition of the murals

The examination conducted by the Straus Center for Conservation revealed a number of significant problems and challenging conservation issues. Of these, the most serious were the painting techniques employed by Sargent and the deleterious effects of previous restorations. The murals, which span 26 years of Sargent's artistic career, vary considerably in their technique. In general, the earlier, more traditionally painted surfaces, such as *Frieze of Prophets*, are composed of pigments that are well bound in the oil medium. In contrast, the paint layers in a number of the later murals, such as *Frieze of Angels*, are highly under-bound and readily soluble.

Although the paint layers on most of the murals were found to be well adhered to the underlying canvas support, areas of flaking were present in two of the lunettes (*Fall of Gog and Magog* and *Messianic Era*). Examination revealed that these two murals had been entirely reworked by Sargent, and that the flaking was occurring at the interface of the first campaign and the final reworked image. The flaking paint was consolidated and re-adhered with BEVA 371 adhesive. The most obvious but benign problem was the presence of heavy layers of dust that had settled on the murals over the last 45 years. Conservators took the opportunity to dust and remove the layers of dust with a HEPA vacuum and this resulted in a general improvement in the appearance of the surfaces.

Since Sargent's death the murals have been cleaned twice. The first cleaning, sometime around 1940, is undocumented and the extent of the treatment unknown. By 1949 discussions again surfaced about the need to

clean the murals. The BPL's executive assistant described the situation at that time as follows, "Unfortunately the area in which the building is located is one filled with heavy deposits of dust from the near-by railroad yards, and the need for cleaning becomes acute far more frequently than we would wish."[3] In 1953, the last time the murals were cleaned, Finlayson Brothers were contracted to carry out the restoration work. The only indication of what was done comes from the BPL contracts with Finlayson, which stipulated the "cleaning, making necessary repairs, and surfacing of the murals and the six gold medallions in the Sargent Gallery."[4] This work, along with the repainting of the decorative wall surfaces, was to be completed within 3 months. It was also at this time that significant alterations were made to the lighting scheme.

The cleaning and lighting changes caught the eye of Ives Gammell, a Boston painter who was well acquainted with the murals and was highly critical of the restoration. In a letter to the Mayor of Boston, dated August 11, 1953, Gammell wrote that upon revisiting the gallery after the restoration he was "horrified to find that substantial portions of the these superb decorations have been...damaged beyond possible repair."[5] Gammell's observations may have exaggerated the problem, perhaps in part because he was viewing the murals under altered lighting conditions. Nonetheless, the work was completed within 3 months, an astonishingly short period of time to carry out a restoration of this magnitude. The Straus Center for Conservation examination revealed that significant abrasion of the paint layers and loss of delicate glazes had indeed occurred to portions of the murals, and this suggests the use of inappropriate cleaning solutions. The 1953 restoration may not be wholly to blame, however, as the effects of the earlier cleaning are not known. To confuse the issue further, examination of photographic images dating from the time of the mural installations suggests that glazes on at least one of the lunettes were abraded during the installation procedure itself.[6]

Equally as problematic as the issue of abrasion, however, was the buildup of grime, soot, and a wax layer that had been applied to the mural surfaces during the last restoration. GC/MS analysis of paint samples taken from the murals confirmed the presence of a wax coating material.[7] Furthermore, cross sections also revealed a layer of grime under the wax at various sample sites. This indicated that most of the surfaces were cleaned in a cursory fashion or that the last restorers were unable to remove the grime thoroughly on portions of the murals.[8] The presence of wax on the murals was not surprising as it was commonly used by restorers as a low-gloss surface coating on paintings in the 1950's and 1960's.

Once the nature of the materials present on the murals was established, the focus of the study turned to devising methods that might be employed in the future to lift the grime and wax layers safely and efficiently from the paint surfaces. After considerable testing a two-part cleaning system was developed that, for the most part, produced encouraging results. The first step in this process was to remove the upper layer of grime and wax with non-polar hydrocarbon solvents. The remaining grime and unidentified layers, which appeared as a milky haze on the paint surface, were removed with a pH-adjusted and thickened aqueous solution containing chelating agents and non-ionic surfactants.[9] Although there is confidence that this cleaning system will be effective on most of the murals, there nonetheless remain significant challenges. The surfaces of *Frieze of Angels*, where Sargent intended a matte appearance, are composed of highly under-bound paint layers which make them particularly difficult to clean. This, combined with the use of alkaline cleaning solutions during the last restoration, makes the paint highly susceptible to all types of aqueous and solvent cleaning solutions. Some success was found in the removal of the upper grime layers but the complete removal of the wax coating is next to impossible here because the paint layers are highly soluble, even in non-aromatic mineral spirits. In the end, the extreme paint sensitivity may allow for only a partial cleaning to be undertaken. Any such cleaning, however, must also take into account the potential imbalances that may occur between thoroughly and partially cleaned surfaces throughout the hall.

The cleaning tests brought to light yet another problem that will need to be addressed in any future treatment. In a number of instances, the thorough removal of the grime and wax layers uncovered blanched surfaces that could not be eliminated by cleaning. This surface phenomenon was indicative of the effects of aggressive cleaning and explained why the 1953 restorers applied a wax coating to the murals (namely to re-saturate the paint layers). With the exception of two lunettes on the east wall, and the

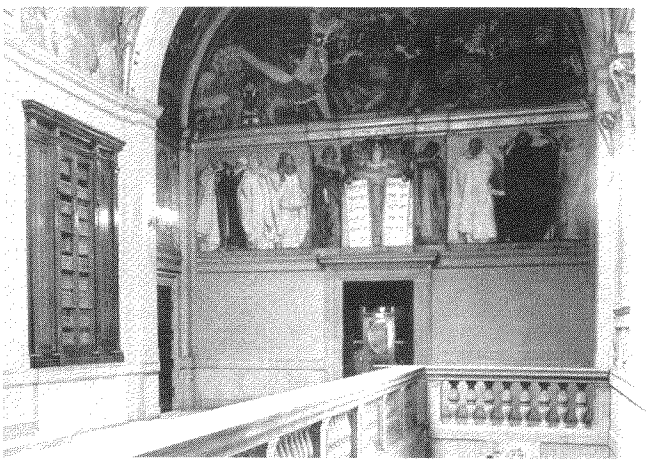

Figure 5. Sargent Hall looking north, after 1919. Original commercial lamp dating from 1895 at left, and brass sconces designed by Sargent in 1916 at right. Photo: Trustees of the Boston Public Library.

Synagogue panel, scant evidence was found to suggest that a varnish was originally applied to all the murals.[10] Even if Sargent did not apply a varnish, the future application of one to portions of the murals may be a necessary step in the conservation procedure to eliminate the blanching problem and re-saturate the paint surfaces. Although this will improve the appearance of the paint it does have the potential for creating other problems such as imparting too much gloss in some areas, not to speak of the potential difficulties conservators would face should it become necessary to remove the varnish in the future. In *Frieze of Angels*, the surfaces, which are highly under-bound, will undoubtedly require re-saturation, and here any applied varnish coating will in effect become a permanent component of the paint matrix. Therefore, the varnish resin selected for this purpose must possess the most stable aging characteristics.

Issues in the lighting of Sargent Hall

Although not directly a mural conservation issue, the relighting of Sargent Hall promises to be an equally challenging issue in the future restoration. Few, if any, visitors to the BPL realize that the present lighting arrangement in Sargent Hall bears no resemblance to the original scheme. Early photographic images of the space reveal how the lighting arrangements and later alterations evolved in the gallery. In 1895 the gallery was lit with natural light from the three skylights above, and large, evenly spaced, commercial lamps that were part of the original building construction. By 1916, Sargent reconfigured the lighting by eliminating all but two of the original lamps and introducing six electric sconces that he designed himself (see Figures 5 and 6). The fixtures were carefully arranged in concert with the natural light from the ceiling to illuminate the murals in very specific ways. It has been noted that Sargent's murals were perhaps the first major decorations that considered electric lighting as part of the overall scheme.[11] Architect Thomas Fox, Sargent's close collaborator on the project, states that the artist "fully appreciated in advance the conditions of light and all other circumstances, and intended his finished work to be seen in connection with them."[12] It was at this time that the artist redesigned the vaulted ceiling to include highly ornate, gilded relief mouldings. Occasionally, Sargent's correspondence provides us with important insight regarding his concern about the appearance of the murals. In 1915, while making arrangements to send the third group of murals to the BPL, Sargent states his reservation about their arrival in Boston long before he can come to install them and where they might be stored in the interim. Among other things he says, "I shouldn't like them to be exhibited in a Museum or an Exhibition, as the light would be entirely different from that for which they are meant."[13]

Sargent's original lighting scheme remained in place until WWII when the roof openings above the skylights were closed, presumably to stop leaks. After that, banks of fluorescent lights were installed just above the skylights to increase the light levels, but this imparted a harsh artificial effect on the space. The next major lighting change occurred during the 1953 restoration of the murals. At that time Sargent's lights were deemed inadequate and the electric glass bulbs in the wall sconces were removed and replaced with similar-sized brass balls for decorative purposes (see Figure 6 for the appearance of the glass bulbs before their removal). Fortunately, the brass sconces themselves were left on the walls. The gallery was relit with eight, brass bucket-shaped lights installed in exactly the same location as the early commercial lamps that existed prior to Sargent's lighting scheme. The buckets now throw direct light along certain surfaces and cast unwanted shadows on portions of the murals, an effect in sharp contrast to the illumination intended by Sargent (compare Figure 1 with lighting in Figure 5).

Documentary evidence indicates the lighting of Sargent Hall was considered problematic in the years preceding the 1953 lighting alteration. As early as 1936, complaints from the general public included comments such as "The lighting of the Sargent murals is atrocious. The lights shine in the eyes of the viewer and very poorly illuminate the paintings."[14] Expressing hope that the lighting would be improved in the near future, the BPL's then Director wrote a telling response. "At the time the pictures were being painted and installed, lighting developments had not proceeded to their present stage. Were the painter alive today, I think that he would probably wish to have attention given now to the lighting of the murals, which at the time he believed to be adequate, but which no longer seems so."[15] One might assume that the numerous letters concerning this matter and the subsequent redesign that transpired were simply about efforts to correct perceived poor

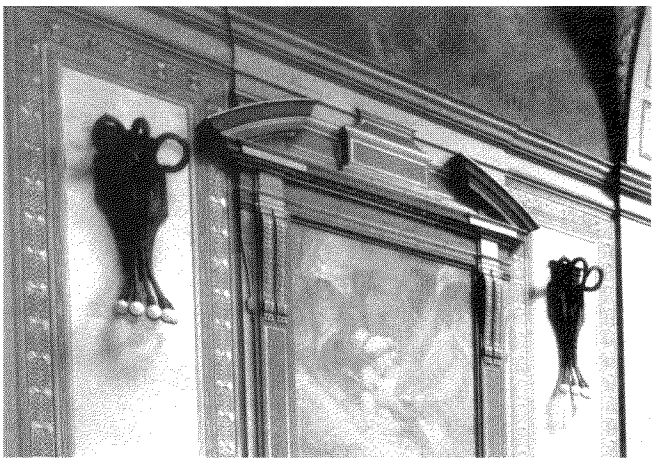

Figure 6. Pair of Sargent brass sconces on either side of Synagogue *mural, circa 1919. Note glass bulbs on sconces that were subsequently removed in 1953 and replaced with non-functioning brass ball replicas. Photo: Trustees of the Boston Public Library.*

lighting, but by this time the murals had accumulated considerable grime and dust which probably made the original lighting appear ineffective. It also is evident that just a few decades after Sargent's death his intentions for lighting the space were not understood. Promey's recent work describes Sargent's calculated arrangement of the mural program and lighting within the hall.[16] One of the most important effects was to have the murals at the centre of the gallery, where the narrative of the cycle was to culminate, flooded with natural light from the skylights above. At the ends of the gallery, which the artist portrayed as darker times in the history of religion, the lighting was to be more subdued and dim (see Figure 5). It is no coincidence that these murals are painted in the darkest tones and adorned with the most elaborate gold relief elements. Ives Gammell understood the subtle optical effects that were to occur on these surfaces. In 1946, 7 years before Sargent's lighting was extinguished, he remarked that "Mr. Sargent made the lighting an integral part of his scheme. His purpose quite evidently was to add solemnity and mystery to his decoration by adjusting the lighting so that glints on the gold and the relief contributed to the effect."[17] This astute observation underscores the necessity for a full understanding of the subtle nuances and effects that Sargent was creating in the space before the implementation of any restoration campaign. It is worth noting that Sargent Hall is not a reading room or repository for books. It was and remains a passage to the Special Collections rooms and thus there may be more latitude in the restoration plans for replicating and maintaining the lighting as designed by Sargent.[18]

Conclusions

The multiple problems of previous restorations, artist's technique, and lighting alterations described in this paper would seem to imply something of a less than hopeful situation. No doubt the difficult conservation and lighting issues pose serious challenges for those entrusted with the restoration of Sargent Hall. Moreover, the mural cycle in its incomplete form may be less than satisfactory. All of this said, Sargent's mural cycle at the BPL remains an extraordinary work, both artistically and historically. There are few if any mural programs where the artist is asked to paint a major mural cycle and is then encouraged to design the surrounding decorative elements and the lighting scheme as well.

In spite of the difficulties that lie ahead, there is reason to be hopeful. Renovation plans are underway for the reopening the roof over the skylights and ultimately the re-introduction of natural light into the gallery. It is also expected that every effort will be made to remove the fixtures installed in 1953 and restore Sargent's original lighting scheme. That is not to say that some judiciously applied supplemental lighting may not be desirable or necessary. Perhaps the space could be lit in two modes, one an historically authentic rendering and the other a brighter illumination of the surfaces for study purposes. The cleaning of the murals, difficult as that process may be, will result in a distinct improvement in their appearance making many of the obscured features visible once more. Therefore, the restoration of the murals and decorative surfaces and the redesign of the lighting scheme must be thoughtfully integrated to create an effect that is sensitive and respectful of Sargent's intentions.

The history of Sargent Hall reminds us that interventions, no matter how well intentioned, can have serious consequences on a work of art. The inappropriateness of the 1953 relighting of the space makes this painfully clear. It also cautions us about the tendencies of one period imposing its aesthetic notions on an earlier one. The BPL has before it a momentous opportunity to return Sargent Hall, as closely as is possible, to its former splendour. The moment is certainly right. The renewed interest in Sargent's mural projects by a number of scholars is an important development that provides us with valuable knowledge about the artist's intentions. Sargent's conception of the murals and the hall demands that the planning and implementation of the restoration be approached from an enlightened perspective. The success of the future restoration campaign will depend on the collaborative efforts of the owners, funding and regulatory agencies, as well as the participating architects, general contractors, craftsmen, scholars, and conservators. As Ives Gammell warned in 1946, "Just what should be done is a very serious problem, as it is no light thing to tamper with major work of art."[19]

Acknowledgements

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Straus Center for Conservation conservators working on the Sargent study include Rikke Foulke, Paintings Conservation Intern; Teri Hensick, Paintings Conservator; Philip Klausmeyer, Contract Paintings Conservator; Nancy Lloyd, Assistant Objects Conservator; Kate Olivier, Senior Conservator; Gianfranco Pocobene, Associate Paintings Conservator.

Endnotes

1. For recent substantive scholarship on the mural program see *Painting Religion in Public: John Singer Sargent's Triumph of Religion at the Boston Public Library* (Promey 1997), *Sargent's Truncated Triumph: Art and Religion at the Boston Public Library, 1890–1925* (Promey 1999), and *Sargent in Public* (Volk 1998).

2. See *The Sargent Decorations in the Boston Public Library* (Coburn 1917, p. 130).

3. Russell Scully letter dated September 14, 1949 (Ms. Bos. Li. B18h).

4. Contract dated May 19, 1953, between the City of Boston and Finlayson Brothers, Boston, pp. 6–7.

5. Gammell letter to Mayor Hynes dated August 11, 1953 (Ms. Bos. Li. B18a.4). His opinions about the treatment, no less vehement than the letter, were published years later as *A Masterpiece Dishonored* (Gammell 1977).

6. Before and after installation photographs of the lunette mural, *Gog and Magog*, in the Research Department of the BPL reveal that large passages of glazes were abraded from the mural during its attachment to the wall.

7. GC/MS analyses were carried out by Richard Newman, Research Scientist, Museum of Fine Arts, Boston, on a Hewlett Packard 5890 capillary GC with an attached HP 5971A mass selective detector. The coating was found to contain wax, most likely beeswax and a hydrocarbon wax. Oil may also be present (MFA Boston Analytical Report, February 24, 1999).

8. Samples were taken for cross section analysis by Philip Klausmeyer, who also performed staining analysis.

9. Numerous cleaning solutions were formulated by Philip Klausmeyer for the testing phase of the project. Although a number gave good results, one of the most effective formulas was a thickened aqueous solution composed of 2 mL Pluronic L64 surfactant (BASF), 1 g Pluronic F-68 surfactant (BASF), 1.5 g citric acid diammonium salt (Sigma), 1 g NH_4Cl, 0.6 g Trizma (Sigma), 1 g hydroxypropyl-methyl-cellulose (Sigma), 100 mL de-ionized water adjusted to pH 7.0 with NH_4OH.

10. A number of cross sections analysed by Philip Klausmeyer suggested the presence of a coating layer on the paint surface. This layer was badly worn and intermittent, and could not be identified through staining techniques. Further analysis will be required in the future to determine its nature and if it does indeed represent an original surface coating.

11. See *The Mural Decorations of John Singer Sargent* (Gammell, undated manuscript, p. 29).

12. Thomas Fox, untitled manuscript, p. 2, Boston Atheneum, John Singer Sargent – Thomas A. Fox Papers.

13. Sargent letter to Benton, November 21, 1915 (Ms. Bos. Li. B18a.8).

14. G.E Davis writes on a visitor suggestion card to the BPL, September 4, 1936 (Ms. Bos. Li. B18h).

15. The BPL Director letter to Mr. G.E. Davis, dated September 11, 1936 (Ms. Bos. Li. B18h).

16. See *Painting Religion in Public: John Singer Sargent's Triumph of Religion at the Boston Public Library* (Promey 1999).

17. Gammell letter to Milton Lord, the BPL, dated June 20, 1946 (Ms. Bos. Li. B18h).

18. This idea was suggested to the author by William Barry of the architectural firm Shepley, Bulfinch, Richardson, and Abbott.

19. Gammell letter to Milton Lord, the BPL, dated June 20, 1946 (Ms. Bos. Li. B18h).

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Résumé

La résurrection de la peinture murale Triumph of Religion, *de John Singer Sargent : Problèmes et considérations pour la conservation future*

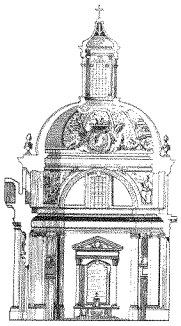
John Singer Sargent a exécuté trois peintures murales au cours de sa carrière dont la plus distinguée est celle qui s'intitule Triumph of Religion, *à la Boston Public Library (BPL). Le cycle que dépeint cette peinture murale est une histoire de la religion occidentale, et orne une galerie à voûte en berceau au troisième étage de la BPL. Les peintures murales ont été peintes à l'huile sur toile en Angleterre, et fixées aux murs de la galerie en quatre étapes, de 1895 à 1919, à l'aide de la technique de marouflage. À la différence des techniques traditionnelles de peintures murales de l'époque, Sargent a appliqué des éléments de relief aux surfaces murales. Ces éléments comprenaient des groupes de personnages en plâtre en haut-relief, des éléments dorés en bas-relief faits de plâtre, de composés, de bois, de papier mâché, de métal et d'un revêtement mural commercial, dont beaucoup étaient dorés et peints. Sargent est également l'auteur du dessin des moulures architecturales dorées en relief dans la voûte en berceau, du plan décoratif des murs, et des luminaires en cuivre qui complétaient la lumière du jour pénétrant par les lucarnes dans la voûte.*

Au cours de la Deuxième Guerre mondiale, le toit au-dessus des lucarnes de la galerie a été recouvert pour des raisons structurales. Non seulement a-t-on ainsi éliminé la lumière naturelle éclairant la galerie, mais bien pire, on a installé plus tard des fluorescents dans les ouvertures des lucarnes.

Les peintures murales ont été restaurées pour la dernière fois en 1953, et le nettoyage fait à ce moment-là semble avoir conduit à une certaine usure des couches de peinture. Au cours de cette restauration, l'application d'une couche de cire, et l'accumulation subséquente de suie et de poussière, ont obscurci considérablement les peintures murales. Au moment de la dernière restauration, quelques-unes des appliques originales ont été enlevées, les appliques restantes ont été éteintes, et de nouveaux luminaires ont été installés, encore une fois au détriment des peintures murales et de l'espace.

La galerie qui abrite les peintures murales de Sargent doit profiter d'une restauration dans un avenir rapproché, dans le cadre de la rénovation en cours de la BPL. Au cours de la première moitié de l'année 1999, des restaurateurs du Straus Center for Conservation ont entrepris un examen approfondi de la technique et de l'état des peintures murales en vue de leur traitement. Ces travaux ont inclus des essais de nettoyage et des analyses, devant servir de fondement aux recommandations de traitement à faire à la BPL et aux architectes surveillant la rénovation. Cet article traite des complexités des divers matériaux, du problème de nettoyer des peintures murales (qui varient beaucoup en ce qui concerne les techniques utilisées), des plans pour faire pénétrer à nouveau la lumière du jour par les lucarnes, et des possibilités de restaurer l'éclairage tel que conçu par Sargent. La planification et l'exécution d'un programme de restauration réussi pour la galerie dépendront de l'expertise de tous ceux qui devront collaborer à ce projet.

The Examination and Analysis of the Interior and Exterior Decorative Elements of the Library of Parliament



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Abstract

The original Centre Block on Parliament Hill (designed in 1859) was destroyed by fire on the night of February 3, 1916. The Library of Parliament (completed in 1877) remained standing after this fire, and its original structure was intact until another fire occurred in the dome in 1952. This event necessitated significant alterations over the next 4 years, and these affected the heritage fabric, design, and character of the building.

This paper describes a recent conservation examination and analysis of architectural features and coatings on the interior and exterior of the Library of Parliament. The purpose of the examination and analysis was to document and characterize the materials that were used in both the original construction and the later renovations. The study established a baseline reference for the materials used and their present condition, which will assist in the development of treatment protocols.

Introduction

The conservation examination and analysis of the architectural features and coatings on the interior and exterior of the Library of Parliament was undertaken at the request of Ogilvie & Hogg Architects Inc., Desnoyers Mercure et associés Architectes, Spencer R. Higgins Architect Inc., and Lundholm Associates Architects (Architects in Joint Venture for the Conservation, Rehabilitation, and Upgrade of the Library of Parliament, Parliament Hill, Ottawa, Canada). The purpose of this examination was to identify the significant construction materials and their condition in an effort to distinguish original or earlier materials from those used in later renovation campaigns. The results were to provide a baseline reference of the materials and their present condition, information that would then assist in the development of treatment protocols.

Building history

The Library of Parliament is considered one of Canada's finest examples of High-Victorian Gothic-Revival architecture. It was designed by Thomas Fuller and Chillion Jones, and was built between 1859 and 1876. Three major events occurred after its construction that led to significant alterations of its original character. The first occurred on July 11, 1888, when a cyclone caused extensive damage to the original banded slate roof. Thomas Fuller (who had by then become the Chief Architect of the Department of Public Works) authorized the removal of the existing dormers and slates, and subsequent replacement of the roof by sheet copper. The second major event occurred less than 30 years later, on the night of February 3, 1916, when the Centre Block was destroyed by fire (the Library was saved by the timely closure of the heavy iron entrance doors). The subsequent rebuilding of the Centre Block, with a different architectural style, scale, and proximity, transformed the visual relationship of the buildings and resulted in the Library losing key exterior architectural elements in the process. The bulk of the original structure of the Library remained intact until the third major event, a fire that occurred in the dome structure on August 4, 1952. The efforts to extinguish the blaze caused extensive water damage to the Reading Room and the collections below. The remedial alterations and renovations over the next 4 years significantly affected the heritage fabric, design, and character of the building.

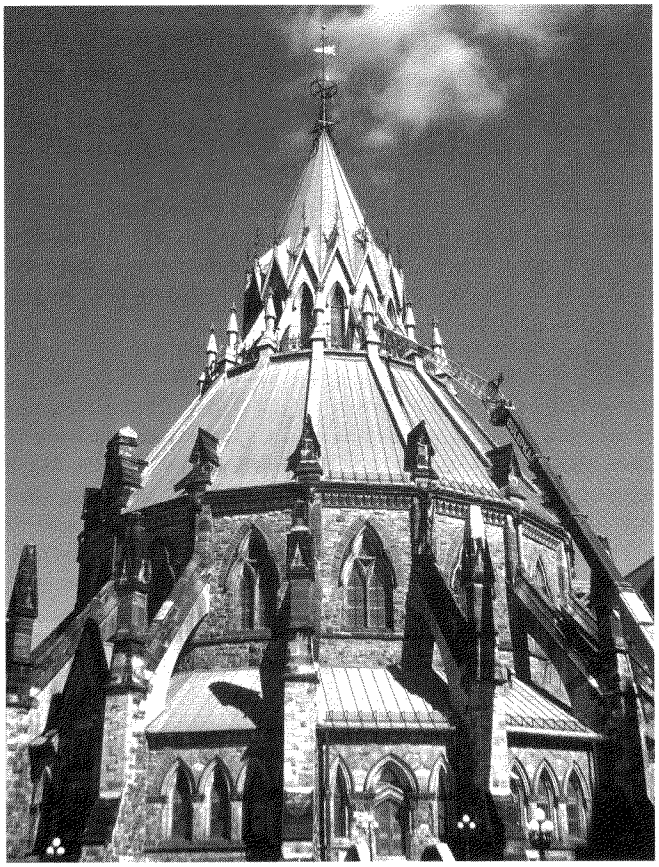

Figure 1. Exterior of the Library of Parliament, Ottawa.

Heritage guidelines

The many alterations the building had undergone made determining an appropriate conservation philosophy and strategy very challenging. The *FHBRO Code of Practice* (Stovel 1995), a document incorporating international principles and philosophies of conservation, was used to guide the team in developing treatment options. Another key document, the *Design Guidelines* prepared by the Heritage Conservation Program, Public Works and Government Services Canada, provided a preliminary assessment of the existing conditions and heritage attributes.

The *FHBRO Code of Practice* recommends the use of eight criteria for the evaluation of heritage buildings:

1. Minimum intervention.
2. Treating each case as a unique situation.
3. Balancing the principles of caution, honesty, and fit in relation to the most important values of the building.
4. Using the principle of caution in interventions respectful of heritage character, particularly when dealing with material values.
5. Using the principle of honesty, in particular when dealing with formal or design values, to ensure preservation of the visual coherence of a significant form or stage in the evolution of a building.
6. Using the principles of fit/compatibility to harmonize proportions, colour, texture, forms, materials, or structural characteristics of added elements, when dealing with contextual values.
7. Interdisciplinary collaboration.
8. Research prior to intervention.

Historic documents provided limited evidence to identify the major, discrete phases of intervention. Many of these were recognizable by virtue of their departure from the original heritage character, design, and/or fabric, but some treatments were not readily identifiable. Although alterations in character, design, and in some cases fabric could be located by visual inspection, the lack of written treatment records (either because they were non-existent or untraceable) rendered the treatment history speculative at best. It was necessary, therefore, to undertake extensive research into the identification of the building materials prior to developing a conservation strategy. The Canadian Conservation Institute (CCI) was commissioned to sample and analyse the interior and exterior elements to provide the foundation of the treatment design.

Analysis

As part of the condition survey and documentation of both the interior and exterior of the Library of Parliament, a series of samples representing an overview of the building materials was taken. The sample size was quite small to ensure minimal damage was done to the structure during testing. The samples were then analysed by the Analytical Research Laboratory at CCI in order to identify and characterize the materials. The following techniques were employed in this study: Fourier transform infrared spectroscopy; X-ray diffraction; scanning electron microscopy and X-ray microanalysis; light microscopy; and metallography (details on the analytical procedures are given in Appendix 1). This survey was not intended to point out specific structural defects present in the building but instead to (a) identify the composition of the materials presently incorporated into the building fabric, (b) differentiate between materials of original historic importance and those added in later, renovation campaigns, and (c) through examination and assessment of condition, determine the viability of materials in present use. This information was intended to provide a benchmark or condition report, and serve as the basis for the development of treatment protocols.

Interior elements

Thirty-nine samples were taken from various objects in the interior of the Library. These included the grillwork of the railings, the fire doors, the gas light fixtures, several other metal fixtures, the wooden handrails, and the coatings on a number of objects including the wall panels and various features of the stair tower. [The stair tower was isolated

from the rest of the interior of the Library and had undergone far less restoration; as such it was a fine example of the original building materials even though its condition was poor because of its exposure to an uncontrolled environment.] The analytical results were particularly valuable in assessing the material composition and condition of the

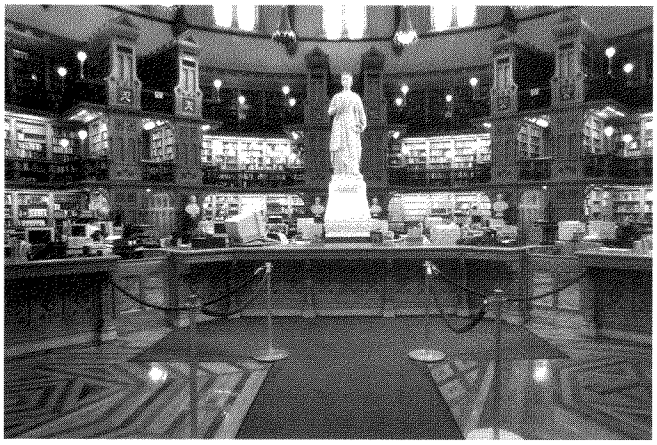

Figure 2. Overall interior view of the Library of Parliament.

Figure 3. Fire doors to the Library of Parliament which date prior to 1916.

painted fire doors, the painted balcony railings, the finishes on the pine wall panels, the composition and coatings on the brass light fixtures, and the material condition of the stair tower.

Analysis showed that the fire doors were coated with a thick polyurethane varnish. The stratigraphy and composition of the paint layers, down to the primer, were documented. No original paint remained in the areas examined. The first white layer that was present over the red lead-based primer contained the rutile form of titanium white and anhydrite (calcium sulphate), a pigment mixture that was first used in about 1940 (Laver 1997).

The grillwork of the railings in the Reading Room was composed of wrought iron, the decorative flowers of the grillwork were white cast iron, and the corner posts of the grill railing were grey cast iron. Two layers of black paint were present on most of the samples from the grillwork, both layers being alkyd-based paints. The presence of the alkyd medium in the paint indicated that the black paints could not have been not applied before 1933, the year alkyds were patented (Golding 1959). A brown paint was visible in one area on one of the iron balls of the decorative grillwork where the black paint was chipped away. This brown paint, composed of hematite, lead white, a trace of lead carbonate, and probably a drying oil medium, had been applied over a thick white paint layer and a grey paint layer, and two layers of varnish were present over the brown paint. This layer is present only intermittently, but it indicates that there is a possibility of polychromy in the interior and that the choice of black for the railings was a later decision.

The metal from the 'bronze' gas light fixture was identified as brass, and the decorative elements were of very similar composition. Analysis revealed that the lamp was solid brass (it had the same composition throughout its thickness) rather than plate. A clear acrylic lacquer had

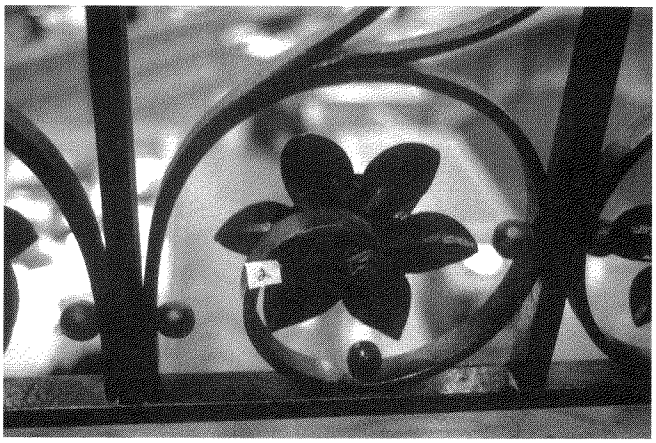

Figure 4. Close-up of the interior railings of the Library of Parliament.

been applied to the gas light fixtures; this confirmed that the cause of the black streaking was differential corrosion.

In the stair tower, two samples from the railing (an element of the detail and a decorative leaf) and the door at the top of the tower were determined to be wrought iron, and the series of paint layers on the iron railings were analysed. The upper black paint on several samples was an alkyd-based paint. It had been applied to a green-brown paint composed primarily of Prussian blue, lead white, barium sulphate, kaolin, and calcium carbonate in a drying oil medium. A grey paint layer, which contained materials contemporaneous with those in the green-brown layer, was present beneath it. The grey and green paint layers dated prior to the current black alkyd paint and were representative of the earlier coloured paint layers on these railings. Iron corrosion products, including lepidocrocite and goethite, were present under the paint layers on several samples from the railings.

Exterior elements

Seventy-two samples were taken from the exterior of the Library of Parliament, including metal samples, corrosion samples, coating samples, and efflorescence products. Twenty-five of the samples were chosen for analysis in this study. This set of samples included roofing material, the decorative metalwork, and the coatings applied to the exterior metalwork. The analytical results were particularly valuable in determining the original finish and the current finish on the iron ornamentation, determining the effect previous treatments had had on the exterior ironwork, and assessing the current condition of the roof.

Figure 5. The roof and ornamental ironwork on the exterior of the Library of Parliament.

Remnants of at least three painting campaigns were present on samples from the weathervane, possibly because its remote location made cleaning prior to repainting very difficult. The first coating over the metal was magnetite. The next coating was a red lead, chrome orange, and oil primer, a popular choice for outdoor protective coatings in the late 19th century (Matero 1994). This was followed by a black paint. Two visually similar brown layers were present over the black paint. The weathervane was the only location where this series of layers was observed (see Figure 6). One of these layers contained zinc phosphate hydrate, a component found in several commercial rust converters.

The same three top layers (two grey/black titanium white and alkyd-based layers applied over a red priming layer containing an alkyd paint with zinc yellow, kaolin, and hematite) were present on all the samples from the lantern roof. These were the most recent applications of paint and primer on the exterior ironwork, and indicated an extensive campaign to refinish the exterior metalwork. Oral history dated this at 1983.

The metal elements of the weathervane, gablet finials, lantern roof railing, and possibly the fleur-de-lis window grills had most likely been treated using the Bower-Barff process[1] (Matero 1994; Goodway 1993) to produce a compact layer of magnetite on the surface. This corrosion-resistant surface coating was one of the most interesting and technologically significant features identified through

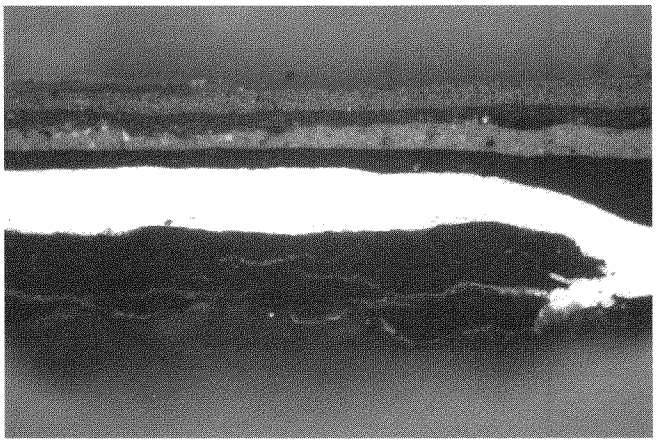

Figure 6. Cross section of the remaining paint layers from the weathervane of the Library of Parliament.

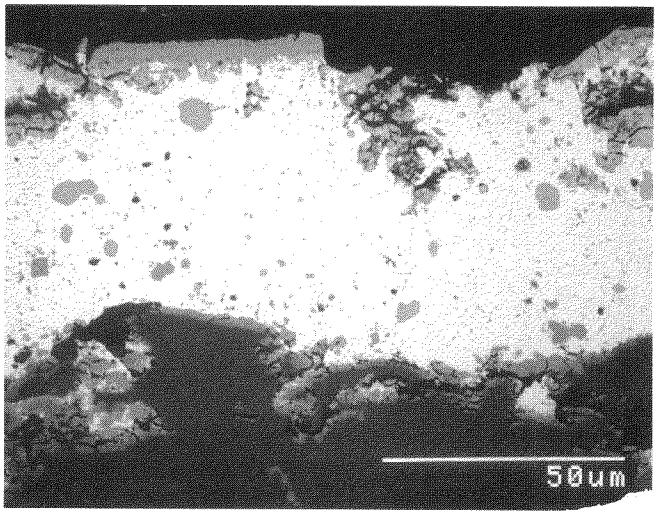

Figure 7. Backscattered electron micrograph of a cross section of the terne-coated copper sheet used on the roof of the Library of Parliament.

analysis; with further research it may help to identify the source of the iron used on the Library. Microscopic examination showed that in places there was corrosion within this layer and that it was no longer a uniform protective coating. No evidence of compact magnetite layers was observed on the stairwell roof cresting (which was thought to be the earliest example of exterior metalwork remaining). In most of the iron ornamentation on the roof, the two most recently applied paint and primer layers were directly over clean bare metal. This made it impossible to determine the original finish.

Analysis of samples from the roof determined that the 'lead-coated' copper was in fact a terne-coated[2] copper sheet (Zahner 1995; Merriman 1965; Gayle et al. 1980). The tin layer between the copper and the lead alloy was easily observed in the roof sample from the Library (see Figure 7), but whether this was intentional or not is another matter. Oral history indicated that the lead coating was 'put on at the shop' and no mention was made of a decision regarding a 'terne' coating.

Having established the present composition of the lantern roof sheathing, it may be of interest to note that it replaced galvanized iron (Higgins 1994; Heritage Conservation Program 1996) which had been painted to look like stone. The terne-coated copper pinnacle finials replaced cast lead finials. These two changes in building fabric were part of the 1954 renovations.

Visually, the roof appeared to be in an advanced state of deterioration. The analysis of the roofing material confirmed this and led to an increased understanding of the deterioration of the terne-coated copper roofing. In two of the three samples examined no lead alloy was left on the surface: the surface of one of these samples was covered with the corrosion products brochantite (a copper sulphate compound) and cuprite, and the second sample revealed large pits (up to 70 µm deep). The sample that still had a lead alloy layer (up to 70 µm thick) was undergoing severe pitting as well as corrosion which was occurring within the lead alloy layer itself and at the copper – lead alloy interface. Industry standards in the literature recommend that this material be coated on installation with an organic sealant, peened or painted to decrease its microscopic porosity (Lead Industries Association, Inc.). Devising a treatment to preserve significant architectural features composed of this material and showing signs of differential and galvanic corrosion will be very challenging.

Conservation strategy

Anecdotal evidence from tradespeople who have worked on the building over the last 30 years proved to be an invaluable source of information that clarified treatment chronology and materials, and the results of the analysis confirmed some of this oral history. This knowledge will assist in distinguishing between original fabric and later treatments so that the risk of compromising heritage fabric can be reduced.

For example, analysis revealed the presence of a layer of magnetite on some of the wrought iron elements, but examination showed that this layer was neither compact nor consistent. There was also evidence of sandblasting, a process that likely removed the bulk of the magnetite layer from the surfaces of the metal. Workmen reported that many elements had been taken to the shop and sandblasted. If the magnetite layer had been intact, the treatment protocol would have been directed at preserving the original magnetite layer on the metal surfaces. However, with this layer significantly damaged or removed, other treatment options should be considered. Analysis also identified a variety of iron metals used on the interior railings. Treatment should therefore be designed to incorporate a cleaning program that will suit or benefit each of the metals and their individual characteristics.

As a second example, the analysis of the paint on the fire doors showed that no original paint remained although earlier visual examination had suggested otherwise. The absence of original or early paint layers on the door leads to a different conservation approach than would have been taken if the paint layers were original.

The two most important aspects of the value of the Library of Parliament are its utility as a working library and its celebratory nature as one of the longest surviving and unique examples of Canada's federal architectural style. Keeping in mind the Federal Heritage Buildings Review Office

guidelines and the results of this analysis, three main options have emerged for consideration.

1. The first option advocates that the Library of Parliament be conserved in its present form; it recognizes the heritage value in the most recent alterations to the building and recommends that they be conserved. This strategy promotes uniformity with the other buildings on Parliament Hill, but possibly obscures the important attributes of the building's uniqueness by making it conform with the existing ensemble.
2. A second option portrays the Library of Parliament as it was during the period from 1889 to 1952, the state in which it existed for the longest period. This strategy recognizes the uniqueness of the building throughout its history prior to the 1950's renovations and acknowledges the fact that it always distinguished itself from the other buildings on Parliament Hill.
3. The third option seeks to embrace the character and design that was intended to reflect the High-Victorian Gothic-Revival style of the original. This strategy recognizes that the principal discernable interest and value of the building resides in its exemplary architectural design, motivating the reinstatement of lost character-defining attributes and original design integrity.

The analysis undertaken as part of the condition survey will assist in evaluating the material performance of previous treatments and therefore help to determine whether or not elements of these treatments should be retained. When assessing conservation activities and their impact on heritage character, it is critical that they be recognized for what they are (i.e. treatments). When a treatment application has failed or has compromised the original character, design, or material integrity of the structure, it may need to be removed and a new treatment considered and implemented. The retention or removal of an intervention or conservation treatment should be treated with greater flexibility than the rigours applied to the preservation of original fabric. Previously executed treatments must be assessed for their appropriateness and condition on a myriad of levels to determine their success and impact on heritage character, design, and fabric. The awareness and acceptance of this premise will allow for a range of treatment options that will best serve the heritage character of all historic structures and, in particular, the Library of Parliament.

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Endnotes

1. The Bower-Barff process is used to protect metal surfaces from corrosion in outdoor environments; it produces a hard wear-resistant skin of varying thickness that ranges from brown to black to blue black. The process was developed in the late 1870's to produce magnetite on the surface of iron by treating it with superheated steam at 1200°F for 6–7 h. [Magnetite is harder than iron, is not as easily scratched or abraded, and is unaffected by moist atmosphere.] As the process evolved, carbon monoxide and air were used in place of the original superheated steam to produce the magnetite surface, which was so coherent that corrosion usually occurred only if the surface was broached. The process gave good coating results with cast iron, but was more difficult to apply to wrought iron and polished steel. Although paint was still the favoured coating for exterior ironwork at the end of the 19th century, the Bower-Barff process was also frequently used.

2. Terne, a tin alloy of lead, is used to coat steel, copper, and other metals and has a composition of approximately 12–20% tin (Merriman 1965; Zahner 1995). In terne-coated metals the tin in the alloy wets the metal, allowing the formation of a metallurgical bond between the substrate metal and the lead (Lead Industries Association, Inc.).

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Appendix 1: Analytical techniques

Cross sections were prepared by embedding the samples in polyester casting resin for paint samples, or epoxy or polyester resin for metal samples. The sections were then ground and polished using standard methods.

Qualitative X-ray microanalysis was undertaken using an Hitachi S-530 scanning electron microscope (SEM) equipped with a Tracor Xray X-ray detector and a Noran Instruments Voyager II X-ray microanalysis system. Using this technique, elemental analysis of small volumes, down to a few cubic micrometres, can be obtained for chemical elements from sodium (Na) to uranium (U) with a sensitivity of about 1%.

Quantitative analysis of the copper-alloy metal samples was undertaken by X-ray microanalysis. The SEM was operated at an accelerating voltage of 20 kV. Noran Voyager II standardless analysis software with a Proza correction routine was used for the analysis of the samples. The results were checked against standard reference materials. The relative error for elements present at concentrations greater than 5% is ±3%, and for elements present at concentrations less than 5% the relative error is ±20%.

X-ray diffraction was undertaken to identify the major crystalline compounds present using a Rigaku RTP 300 RC rotating anode generator with a cobalt target operated at 45 kV and 160 mA. The samples were run using either a D/Max-B diffractometer or a PSPC microdiffractometer. The microdiffraction samples were mounted on the end of a glass fibre with silicone grease.

For Fourier transform infrared spectroscopy, a portion of the sample was mounted in a diamond anvil microsample cell. It was analysed using either a Bomem MB-100 spectrometer or, for smaller samples, a Spectra-Tech IR-Plan Research microscope interfaced to a Bomem MB-120 spectrometer.

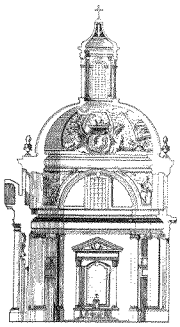
Selected paint samples were mounted in Cargille Meltmount for examination by polarized light microscopy using a Leica DMRX microscope.

Résumé

L'examen et l'analyse des éléments décoratifs intérieurs et extérieurs de la Bibliothèque du Parlement

L'édifice du Centre de la Colline du Parlement (conçu en 1859) a été détruit par le feu la nuit du 3 février 1916. La Bibliothèque du Parlement, complétée en 1877, était encore debout après cet incendie et sa structure originale était intacte jusqu'à ce qu'un autre incendie ne se déclare dans la coupole en 1952. Ce sinistre a entraîné des modifications importantes au cours des quatre années subséquentes, et celles-ci ont affecté la structure, le dessin et le caractère patrimonial de l'édifice.

Cet article décrit l'examen et l'analyse de l'état de conservation récent des caractéristiques architecturales et des revêtements intérieur et extérieur de la Bibliothèque du Parlement. Le but de cet examen et de cette analyse était de documenter et de caractériser les matériaux utilisés tant lors de la construction originale que lors des rénovations subséquentes. L'étude a établi les données de référence pour les matériaux utilisés et leur état actuel, ce qui sera d'une grande utilité lors de l'élaboration des protocoles de traitement.



Non-destructive Examination of the Distemper and Oil-based Paintings in an 18th-Century Decorated Interior

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Abstract

This paper discusses the examination of the painted and decorated interior in *Synvisstua*, a little log building that was originally a guest house situated in Narjordet, Østerdalen, Norway. The building was dismantled in 1934, moved 320 km south to the open-air museum Glomdalsmuseet in Elverum, and re-erected there in 1935. The main room's monochrome and decorative distemper paintings (from 1744) are among the oldest dated paintings in Norway. The original paintings have been partly painted over with distemper and linseed-oil paint.

The main purpose of this project was to determine which parts of the decorative paintings were original and which parts were secondary additions. Based on the results of the project, earlier structural alterations to the building have been outlined, an attribution to a certain artist has been suggested, and a method of conservation treatment has been recommended. Using non-destructive examination methods, large parts of the original decorations (which had been painted over) have now been recorded.

Introduction

This paper discusses the examination of the painted interior of a small log building, *Synvisstua*, at an open-air museum. The work was carried out as part of an interdisciplinary project.[1]

Synvisstua is a one-room log building with an additional entrance room in planked timber framework at one end. The overall size of the building is approximately 7.4 m long by 5.65 m wide. The log-built part is a square room, each side being approximately 5.65 m. This is the main living room, and contains the decorative paintings. Today the building is heated by an open fireplace.

The building originates from a farm called *Synvisgård* at Narjordet in Os municipality, Nord-Østerdalen in Norway.[2] At the farm, *Synvisstua* was connected to the back of a larger log-built dwelling. The entrance to the house was through a sleeping-room in the main building. *Synvisstua* was described in 1934, when removed from the farm, as being "in a bad state of preservation, with severe rotting of the sills." The damaged sills were apparently not replaced when it was re-erected at the museum, as the present building is approximately 10–15 cm lower than the original.

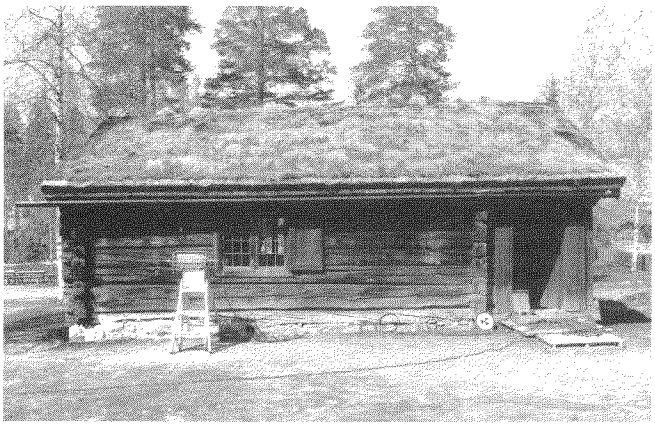


Figure 1. Synvisstua *seen from the south, with the X-ray unit ready for exposure. Photo: Brænne.*

I carried out a preliminary examination of the building in 1995 to investigate the state of preservation of the building and the decorative painting, and to present suggestions for conservation and repair. My main conclusion was that a thorough examination of the entire building and decorations would be necessary before any treatment could be carried out. Among other findings, this preliminary examination showed that large portions of the earliest paintings might have been painted over, and that parts of the distemper painting were in a relatively bad state of preservation.

The main objective of this project was to provide the information on the building and paintings order that would be necessary for proper conservation work to be carried out. The aims of the project were to obtain as much knowledge of the building as possible, to evaluate the building in a wider context, and to try to identify the artist or artists responsible for the painted decorations.

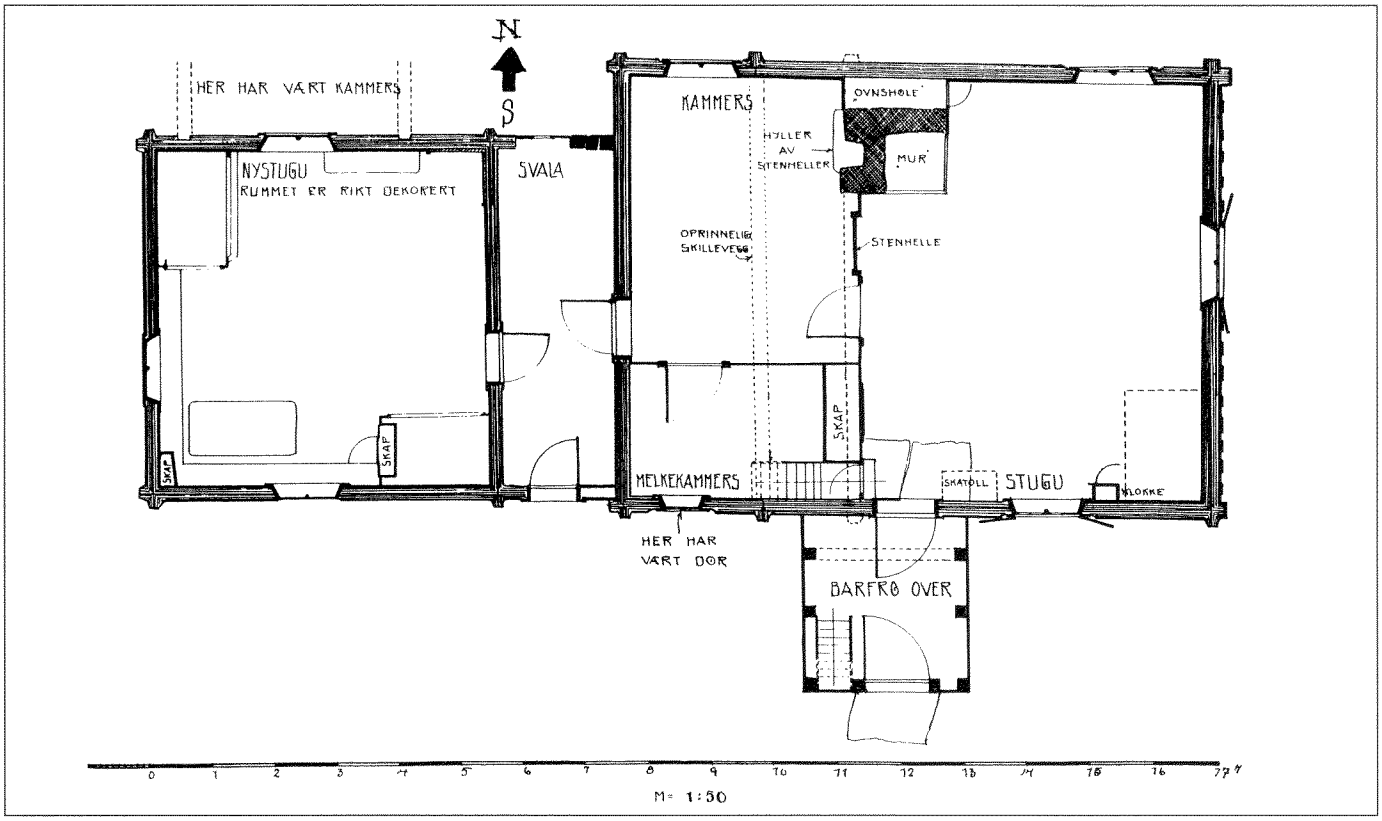


Figure 2. Ground plan from 1933, when the buildings still occupied their original sites on the farm. To the left is Synvisstua, *with the entrance room to the right. The log-built dwelling to the right was left on the farm. When* Synvisstua *was dismantled, the log wall in the dwelling that formed* Synvisstua*'s outer wall was replaced with pine and spruce deals.*

Important dates in the building's history

1727. Construction of the log-built part. Timber dated by dendrochronology.[3]
1744. Execution of the first decorative painting, according to contemporary inscriptions.
1807. Latest date inscribed in the decorations. Probably the year when repainting and overpainting of parts of the original decorations took place, along with refurbishment of the interior.
1934. Building dismantled and transported approximately 320 km.
1935. Re-erection at Glomdalsmuseet. Retouching of damages to the decorative paint layers.
1974. Cleaning, conservation, and retouching of the decorative paint layers.

Description of the main room and the decorative paintings

Construction and inventory
The ceiling and walls were panelled with planed pine and spruce deals which provided an even surface for the paint. There were windows in the south, west, and north walls. The timber on the outside showed traces of two generations of earlier, smaller windows. Secondary timbers under the window in the north wall showed that there was once a door in the space now occupied by the window. The entrance door was of an 18th-century type and was placed in the eastern wall. There was an open fireplace (probably a reconstruction of an earlier fireplace) in the northeastern corner. The inventory was to a great extent typical of the region, with beds and benches along the walls, cupboards, and a long solid table in front of the windows. The floor was of pine planks with mortise and tenon joints.

Monochrome and decorative painting
On the evidence of the inscription on the southern wall, which includes the date 1744, art historians have considered the visible distemper-painted decorations in the room to be mostly the originals. In Norway, decorative painting in wooden buildings can be from as early as the 13th century. However, the first paintings in *Synvisstua* (from 1744) are among the oldest that are actually dated. Attribution to an artist has been discussed for a long time. Many names have been suggested, among them the building's owner in the 1740's (Sønvis Jensen) and Swedish artist Eric Wallin (who painted a church in the neighbouring valley in 1745).

Oil-based colours
The oil-based colours were assumed to represent overpainting done in 1807. The floor was marbled in a variety of

blue colours. The whole room had a dado (approximately 55 cm high) painted to give the appearance of mahogany, and the beds, benches, and table were painted in the same way. The cupboard in the corner was decorated with inscriptions and flowers, and the door was decorated with an imitation of walnut on the frame and fantasy trees on the panel.

Distemper painting

All the painting over the dado and on the ceiling was done in a distemper technique. The entire background was painted as a rough imitation of a blue-and-white woven textile. On the north and south walls, as if standing on top of the dado, were several large vases with flowers.[4] On the western end wall, to the right of the window, was a similar vase; to the left of the window was a soldier in uniform playing a flute. On the eastern end wall was another soldier in uniform holding a gun and raising his sabre, with an inscription beside him proclaiming that he will protect the house. Running the whole way around the room at the top of the longitudinal walls and at the same height across the gable walls was a border with text; the text consisted partly of family members' initials and dates of birth and death, and partly of quotations from the Holy Bible. On the southern gable were two pillars flanked by tendrils; in the middle stood a young and an old man on either side of a tree, with an inscription beside the old man that contained words of wisdom to the young man. Similar pillars and tendrils were on the northern gable; in the middle part was a stag, with a biblical text beside it. All the letters in the inscriptions in the room were of a type used in the second half of the 18th century. Several circular, semi-circular, and floral designs forming a symmetrical and regular pattern were on the ceiling. Not only pleasant to look at, the decorations were meant to tell stories. This was not a common feature in Norway, but was used on the other side of the border, i.e. in Sweden, in the 18th and 19th centuries.

Figure 3. Distemper and oil-based decorative paintings on the southern part of the west wall, before conservation. Photo: Sjur Fedje.Hedmarksmuseet.

Figure 4. Distemper and oil-based decorative paintings on the middle part of the east wall and the door, before conservation. Photo: Sjur Fedje.Hedmarksmuseet.

Pigments used

All the pigments appeared to be of the type used commonly in Norway in the 1740's, so no analyses have been carried out to make certain identification. In all probability the following pigments were present: chalk, white lead, red ochre, red iron oxide, cinnabar, red lead, yellow ochre, brown ochre, indigo?, Prussian blue?, raw sienna, burnt sienna, raw umber, boneblack, lampblack, and gold leaf.

Examination methods

Two main types of examination methods were used: non-destructive examination methods, and methods that required intervention in the structure. The following discussion concerns itself chiefly with the former.

Non-destructive examination methods

a) Naked-eye inspection in normal light and

b) Inspection in normal light using a magnifying glass and portable binocular microscopes — A lot of information about alterations in the construction, furnishing, paint, and decorations was recorded by inspecting the room thoroughly. Negative traces in the paint layers revealed that the building was approximately 10 cm lower than it had been originally. It was also possible to establish that important elements of the original construction, such as two supporting beams between the end walls and a supporting beam between the south and north walls, had been removed. Remains of the original moulding around the door opening in the north wall were still in situ. The bed in the southeastern corner was a secondary addition. The open fireplace was new, and a free reconstruction at that. The windows had been replaced. Through lacunas in the paint, it was possible to observe that there must have been earlier decorations under at least parts of the current paint layer. The latter had been painted partly over the original, and partly up to the edge of the original.

c) X-ray photos taken with portable X-ray equipment[5] — All necessary precautions against radiation injuries were taken during the preheating of the unit and the subsequent exposures. The X-ray tube was placed outside the building, with the tube facing the wall. The distance from tube to film plane was approximately 80 cm. The X-ray film was affixed directly to the painted and decorated surface of the inner wall. The thickness of the timber wall varied between 12 and 20 cm, and the inner deals were approximately 2.2 cm thick; the X-rays were capable of penetrating wood with a thickness ranging from approximately 14 to 23 cm. The X-ray unit had a fixed setting of 5 mA; based on previous experience, exposures of 70 and 80 kV were chosen, and exposure times were 5.5 and 6.5 min. Three exposures were taken.

Norwegian decorative distemper painting of the 17th to 19th centuries did not commonly make use of highly dense pigments such as white lead, cinnabar, and red lead (pigments that leave significant marks on X-ray film). The white pigment is almost without exception made of chalk, and the red colours are usually red ochres or red iron oxides (pigments that do not show up on the film). Because of this, the exposures were not expected to yield results.

All the exposures were a bit overexposed which, in the light of previous experience with this technique, was surprising. A fresh set of exposures will be taken with shorter exposure time to see if better results can be obtained. Two of the exposures showed nothing of interest. The third exposure was taken on the right-hand side of the window marked WA on the plan. This showed parts of a volute painted on the inner deals alongside the window mouldings. As there was no white in the original painted decoration, it seemed most likely that the volute was painted with dense pigments like red lead or cinnabar, and this was confirmed by analysis of the cross sections. The form of the volute's design was very unlike those known from the 18th century in Norway.

It is possible that the application of other feasible non-destructive examination methods could yield results at least comparable to anything that X-radiography provided.

d) Examination of the paint layers using ultraviolet (UV) light[6] — The room was made totally dark by taping black plastic over the windows. The lamps were then switched on, and were left on for 30 min to obtain maximum fluorescence in the paint layers and painted decorations. The surface was then inspected through yellow UV protection glasses. In addition, a small portable UV lamp with a built-in magnifying glass was used for close-up inspection of details.

Examination in UV light largely confirmed the observations made in normal light with the naked eye and with the help of binoculars. It was clear that large portions of the surfaces had been painted over. The unusual thing about the paint and decorations in *Synvisstua* was that the usual difference in fluorescence between the old paint and the later additions was present only to a minor degree. The later additions and overpainting, and the retouches done in 1935, were easily recognizable. So, too, were the retouches and parts treated in connection with conservation work in 1974. Generally speaking, most of the surfaces gave off an uneven and flashy fluorescence. After about 1 h, large patches of the underlying paint also started to fluoresce, intensifying the flickering effect. As a result it was almost impossible to obtain any distinct observations that could enable differentiation of the original paint and decorations from the later additions.

A most unusual effect occurred in one part of the room. The painted-over (and therefore invisible) original inscription on the west wall gradually became more and more visible. After about 90 min, most of the original text was legible. This phenomenon is not at all common when UV fluorescence occurs on a painted surface. The explanation may be that the overpainting was carried out using the same water-soluble distemper binding media as the original decoration. When the new paint was added, the binding media in the original paint partly dissolved and became mixed with the new layer. If, as indeed seems to have been the case, the binding media in the original inscription's black letters were weaker than those in the monochrome background, the pigments and the binding media in the letters would have soaked into the monochrome overpaint, leaving a discoloration not visible in normal light, but visible during UV fluorescence. This phenomenon was observed only on the west wall, though there may have been concealed original inscriptions in other parts of the room.

e) Examination using an infrared (IR) converter and a black-and-white monitor[7] — An attempt was made to make direct prints of the images recorded on the monitor, but the quality was not satisfactory. Instead it was decided to photograph the most important observations directly from the monitor, using normal black-and-white panchromatic film, and slides. This method of documentation often gives diffuse pictures, but in this case the quality was mostly good enough to carry out examination and evaluation of the original, painted-over decorations.

Two different types of recording were used. Areas painted over in oil-based technique were examined directly. These parts yielded good images of the original (no longer visible) decorations. Areas originally painted in distemper technique and painted over in distemper gave either very weak or no images whatsoever. To make the original decorations visible in IR light, we considered trying to alter the refractive index of the distemper overpaint. As the distemper paint layers would be easily dissolved and destroyed in solvents containing water, tests were made by spraying the surface with a mist of small amounts of pure alcohol, which was applied only to the limited area that

was to be examined. The alcohol made the overpaint moist for approximately 30 s to 1 min. When the alcohol had completely evaporated (after about 1.5–2 min) there were no signs of alteration or damage to the paint layers. The technique proved to give very good results for those parts of the walls painted in distemper technique. The original decorations were visible for approximately 1 min, and could be examined and recorded.

Examination with the IR converter brought to light a great deal of information about the room's original decorations. It revealed that large parts of today's decorations were secondary additions or overpaintings. The original painted decoration under the 'mahogany' dado was a very characteristic drapery of 17th-century style. Beside the window mouldings were painted volutes and spearpoint-like designs. Similar designs had not been observed in Norway previously, but can be found in a church in Sweden.[8] The dado under the north window had the characteristic drapery painting, but this cannot have constituted the original decoration here, according to the following pieces of evidence. The window mouldings of the north window went all the way down to the floor, and the walls beside the mouldings were painted with continuous volutes all the way to the floor, which indicates that the opening must originally have been made for a door instead of a window.

All the inscriptions were painted over and some had been slightly altered. Thanks to the finding of an original dated inscription, we had a reliable dating to 1744. The original texts were more comprehensive, and contained more quotations from the Holy Bible. The letters were in a 17th-century type of calligraphy, and were similar to those in the texts found in Sollia Church.[9] The vases with flowers had the same form originally, but were painted with greater confidence. The original furniture was painted to resemble walnut, and the 18th-century floor had been left unpainted.

Methods requiring intervention in the structure

f) Sampling and examination of cross sections through the paint layers — Due to the bad state of preservation of parts of the paint layers, samples could be taken from areas where the paint was flaking. Fifteen samples were taken and examined.

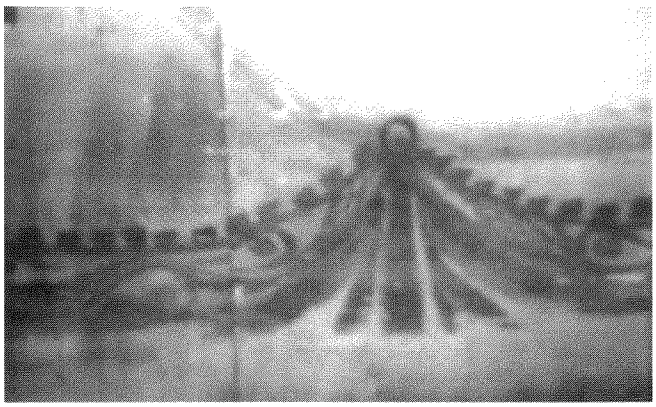


Figure 5. South wall. Original painted distemper decoration. Image of 17th- or early-18th-century drapery or wall hangings. Infrared image, photographed directly from the monitor. Photo: Brænne.

Figure 6. East wall. Inscriptions from 1744 and 1807. Original distemper paint text is grey, later distemper overpainting is black. Infrared image, photographed directly from the monitor. Photo: Brænne.

Examination revealed the structure of the paint layers, and the techniques used in the execution of both the original painting and the overpainting. The cross sections showed that the entire room was originally painted and decorated in distemper technique on a uniform, white distemper background.

g) Cleaning of the painted surfaces — No results were obtained.

h) Uncovering of small areas of secondary paint layers using solvents and scalpels — It was possible to observe traces of the original decoration in lacunas in the overpainting on the ceiling. However it was not possible to record traces of the design of the original decorative paint using UV or IR equipment. In connection with the first period of conservation work, in August 1999, it was decided to remove parts of the overpainting on the ceiling, where conservation would be impossible. This work brought to light parts of the original distemper floral decorations.

Conclusions

The main conclusions of the examinations were as follows: the non-destructive examination methods proved very valuable in providing new knowledge of the building and the painted decorations; the building had been partly reconstructed; the original main entrance was probably located in the north wall; a useful method for non-destructive IR investigation of painted-over distemper paint was developed.

The examinations proved that only parts of the original painted decorations remained. Those original paintings that were still visible comprised the two soldiers, the young

man and the old man, the tendrils, and the four pillars. As one of the examination methods made it possible to read an original dated inscription, the original painting can probably be attributed to artist Eric Wallin. The technique and the pattern of the later repaintings corresponded to the paintings done by artist Sønvis Olsen Holemoen, who was well known in the district, and who was also responsible for the decoration of six rooms in a neighbouring farm in 1822. This included the background on the walls, the ceiling, the dado, all the visible inscriptions, the vases with flowers, the furniture, and the floor.

Acknowledgements

The author thanks English language consultant Rory Dunlop, NIKU.

Endnotes

1. Participants in the project:
   Initiative and co-ordination — head of conservation, conservator Vigdis Vingelsgaard, Hedmarksmuseet.
   Part 1. Dendrochronological dating of the log building — carpenter/engineer Jan Michael Stornes, NIKU.
   Part 2. Colour analyses, building history investigations, examination of painting techniques and materials, and evaluation of the state of preservation — Jon Brænne, NIKU.
   Part 3. Interpretation of the building history and evaluation of the building in relation to similar buildings — chief curator Steinar Sørensen, Glomdalsmuseet.
   Part 4. Art-historical interpretation of the decorations, and suggestions for their attribution to known artists — chief curator, Dr. ing. Ingeborg Reitan, Drammen Museum.

   At the time this paper was written, Parts 1 and 2 had been completed, and Parts 3 and 4 were in progress. The field-work for Part 2 was carried out from May 26 to 30, 1997, with control visits in May and June 1998 and August 1999.

2. For further descriptions of the building, see:
   Brænne, J. "Museumsbygninger i Hedmark Fylke. Undersøkelser og evalueringer." *NIKU Oppdragsmelding* 52 (1997), pp. 21–36.

   Meyer, J. *Fortidskunst i Norges Bygder. Østerdalen I.* Kristiania, 1918, pp. 32–34, ill. pl.VIII.

   Skirbrek, H. *Hus og Tun*. Glomdalsmuseet, 1963, pp. 72–89.

3. Stornes, J.M. *Synvisstua, dendrokronologisk datering*. NIKU report, 1997.

4. The pattern is probably from the book *The Treatise of Japanning and Varnishing* (Oxford, 1688).

5. Equipment used: portable X-ray unit, Balteau Baltospot, type BL 100/5 with Beryllium window, film size 30 x 40 cm.

6. Equipment used: two large UV lamps with six tubes in each, tube type Philips TLD 18 W/08 D6.

7. Equipment used: Grundig Electronic IR Converter SN 76, 50/60 Hz 22W, Kodak Wratten IR 87C filter; Sony Video Graphic Printer UP-850.

8. Artist Eric Wallin and his son, Nils Wallin, painted Särna Church with similar designs in 1771. Särna Church is located in Sweden, approximately 210 km from the original location of *Synvisstua*.
   See also:
   Swan, O. *Särna gamla kyrka*. In Särna – Idre 300år. Falun, 1945, pp. 221–246, ill.

9. Sollia Church is a log church, erected in 1744, located 160 km south of the original location of *Synvisstua*. The interior is completely decorated with distemper paintings, with inscriptions written in 1745. The work is signed by Eric Wallin.

Résumé

Examen non destructif des peintures à la détrempe et à l'huile d'un intérieur décoré du XVIII^e siècle

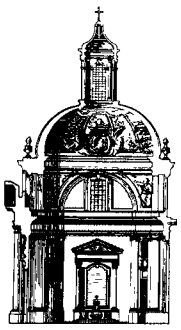
Ce document traite de l'examen de l'intérieur peint et décoré de Synvisstua, un petit bâtiment en rondins ayant servi à l'origine de maison d'invité, situé à Narjordet, Østerdalen, en Norvège. En 1934, le bâtiment a été démantelé, puis déplacé à 320 km vers le sud, jusqu'au musée en plein air de Glomdalsmuseet, à Elverum, où il a été rebâti en 1935. Les peintures à la détrempe monochromes décoratives de la pièce principale (1744) comptent parmi les plus anciennes de Norvège. Les peintures originales ont été en partie recouvertes de peinture à la détrempe et à l'huile de lin.

Le projet visait principalement à distinguer les parties des peintures décoratives qui étaient d'origine de celles qui avaient été ajoutées plus tard. Le projet a permis de déceler des modifications structurales antérieures au bâtiment, de suggérer l'attribution des oeuvres à un artiste et de recommander un traitement de conservation. Une bonne partie du décor d'origine (recouvert de peinture) a pu être documentée grâce à des méthodes d'examen non destructives.

2

Project Planning: Teams and Partners

Planification de projet : Équipes et partenaires



Major Projects and Historic Houses: Lessons Learned at English Heritage

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Abstract

This paper discusses the key collections management issues that arise during a major historic house project using two examples at English Heritage: *Down House* and *Eltham Palace*. These issues stem from a lack of understanding by project management about collections management and its role in risk reduction. It has been found that a conservator and curator working in partnership can be effective in influencing decisions and addressing the issues; therefore both should be employed full-time for the duration of any major restoration project.

Introduction

A major restoration project can be the most dramatic event that occurs in the life of an historic house and its collections. Mitigating the risks to the interiors and collections from building works is dependent on a successful partnership between the conservator and curator, who must work together to influence decisions throughout the life of the project.

Any major project affects the normal management and maintenance of an historic house, with decisions suddenly being made based on deadlines, an injection of money, personalities, and relationships. The 'success' of a project is often measured solely on whether it was on time and within budget, these short-term goals overshadowing the fact that the historic house is a unique asset (i.e. it provides public access to collections displayed in context).

Operating under the pressure of a major project can be a liberating experience for the conservator/curator partnership, one that can result in creative solutions, effective relationships, and a new respect from management. This paper concentrates on the key collections management issues associated with a major historic house restoration project, and highlights the pivotal role that conservators and curators have in the delivery of a successful 'on time and within budget' project.

Background

English Heritage is the government's advisor for the historic environment, and encompasses both the built heritage and its associated collections and archaeology. It owns and manages more than 400 historic sites and properties (135 of which hold collections) and also has a large grant-giving role supporting the preservation of listed buildings and archaeology.

English Heritage is divided into nine regions supported by central, management, policy, and strategic departments. Each region employs a small team of curators who are responsible for the care and presentation of the historic properties and collections in their region. The regional curators are guided by the central museums and collections department which includes the collections conservation team.

The major projects department, a central management team, was created in 1995 "to manage major restoration and development projects at EH and other sites" (*English Heritage Annual Report* 1995/96). Put another way, it makes sure projects are delivered on time and within budget. The department uses a government-developed project management system modified to meet the specific needs of historic house projects, although it is acknowledged that projects involving fragile interiors and collections add a new level of complexity not sufficiently covered by existing systems.

The major projects department runs a small permanent team of project directors who contract in external project management as required. Both external and internal English Heritage expertise is used to complete identified projects, with internal expertise being concentrated upon the curatorial, philosophical, interpretation, and conservation aspects. Allocation of funding to the collections management aspects of a project is minimal (which means that in-house staff are required and even expected to meet the shortfall) whereas building construction aspects are fully costed and externally resourced including environmental management systems. Funding for major historic house projects is available both internally and externally, the

main external funding source being the Heritage Lottery Fund.

The following two historic house restoration projects illustrate the key issues relating to collections management, and highlight successful solutions.

Down House

Charles Darwin lived and worked in *Down House* and the surrounding gardens from 1842 until his death in 1882. He wrote *On the Origin of Species by Means of Natural Selection* (1859) in the Old Study. Following the death of his wife Emma, the collections were dispersed and the interiors stripped. In 1929 the house reopened as The Darwin Memorial Museum with the re-created Old Study as its centrepiece. In the 1960's the main ground floor rooms were refurbished and the first floor was let as a flat. The collection of paintings, prints, books, documents, objects, and furniture amounts to more than 5000 items.

English Heritage took over responsibility for *Down House* from the Natural History Museum in April 1996, completing the major restoration project of the building and interiors in September 1997.

Project management
This was the first project handled by the major projects department that involved collections. They managed it on behalf of the London Region who, for regional management reasons, had no input during the project even though they would be responsible for operating and maintaining the property.

A predetermined budget linked to an existing business plan secured by the previous organization responsible for the property was adopted, and English Heritage top management insisted that the project be completed within 12 months. This budget and deadline both affected the way the project progressed.

The major projects department swung into action to set up the project organization structure. Key staff were selected to form the project board and teams, and a manager with construction experience was contracted to run the project. The collections were represented by the Director of Museums and Collections and the Senior Collections Conservator (it is interesting to note that the collections were not represented on the building design team). The building works were undertaken by the main contractor under the direction of the appointed architect and project management company.

In this environment of planning and action there was no time to define clearly the scope of the project and the individual responsibilities. These continued to be addressed throughout the project.

Issues and solutions
a) Relationships
The success of a project is dependent on excellent communication among all those involved; such interaction can only be built on trust and strong relationships. Project planning systems are simply a structured way of getting people to communicate so solutions can be found, quickly.

The conservator developed an excellent relationship with the project manager through clear simple communication outlining the needs of the collections in terms of cost and time. As a result, the conservator was given a certain degree of flexibility in managing the conservation budget, which ensured a fast procurement process and creative solutions. This degree of trust encouraged honest and frank discussions, which in turn allowed the best decisions to be made.

Collections issues were initially represented in both the collections conservation team and the interpretation/exhibition team, but early on in the project these teams combined to form a single collections team. The strong partnership that developed among the curator, conservator, and exhibition designer facilitated the successful delivery of the restored interiors and new exhibition in record time and with minimal risks to the collections. The tight deadline encouraged a clear separation of roles: the curatorial team worked on the display philosophy, planning the period room displays, purchasing fabrics and finishes, and liaising with the main contractor; the conservator dealt with auditing, packing, storage, access, conservation program, and installation management; and the designers developed the concepts for the first floor exhibition and managed the exhibition construction contract. Each of these roles became inclusive rather than exclusive, encouraging the essential discussion that led to suitable solutions.

Unfortunately the needs of the collections were not adequately represented on the building design team. This group was the domain of building construction experts (namely the architect, main contractor, engineers, and quantity surveyor). It was assumed by management that specifications alone would satisfy the needs of the collections and interiors. However, what a builder interprets to be adequate protection may be far removed from what is required to protect an historic interior. No matter how tight the building specifications are there is always room for interpretation, particularly when dealing with contractors who have no experience working on an historic house. Due to inadequate protection, the interiors at *Down House* became very damp during building works; this not only caused the historic panelling to crack once the heating was operational but also resulted in an infestation of book lice.

There was also no full-time representative on site to be responsible for the protection of the interiors. This lack of

a collections advisor on site or on the building design team resulted in inappropriate decisions being made. Radiators were located in places where large furniture was to be positioned, and fire sensors and security cameras were mounted in a manner that disturbed the overall interpretation of the period room and the fitting of the curtain poles.

However, a conservator was based on site prior to and during the installation stage. This meant that a good relationship was developed with the main contractor's site manager and quick decisions could be taken by the conservator to mitigate potential risks to the collections from construction-related problems. For example, the afternoon before the first delivery of furniture (including Emma Darwin's grand piano), the site manager indicated that the Drawing Room would not be ready due to problems associated with the refitting of a leak detection system. This informal on-site communication allowed the conservator to stop the delivery and re-assess the collections installation program.

Formal lines of communication are essential for controlling a major project. However, when an historic house is involved and the deadline draws closer, informal communication lines with site management and the building design team are also helpful in reducing the risk to the collections, keeping the overall project costs down, and meeting the all-important deadline.

b) Collections management

Early decisions concerning collections management and packing influenced the effective management of the collections program, saving time and money and reducing the risk of damage.

A 100% condition survey of the collections was undertaken before packing to gather basic information about each object, including a priority rating assigned in the context of the display philosophy and a condition score. This allowed the conservation program to be prioritized easily. Combining the two scores ensured that those objects of highest importance and poorest condition were included in the treatment program. The conservation database became an invaluable management tool influencing overall collections planning and budgets.

The collections were packed so that the items would be accessible for conservation, display, and exhibition planning. Objects were secured in custom-made open trays stacked into hired crates. This reduced handling and sped up display planning and installation.

The scope of the collections management component of the project was not fully realized due to a lack of understanding of the steps, time, and budget required to present and care for an historic house collection professionally. The major projects department assumed that this type of service would be provided in-house, so no budget was initially allocated. Through their full-time involvement, the in-house curator/conservator partnership was able to raise the profile of the collections component, building relationships that eventually started to influence decisions. This project illustrated the importance of fully costing the collections management side of a major project, and allocating the necessary resources.

Eltham Palace

"Eltham Palace is one of the few important medieval royal palaces in England to survive with substantial remains intact" (Turner 1999). A large private house adjoining the medieval Great Hall was built by Stephen and Virginia Courtauld in the 1930's. They left the house in 1944; the site was then occupied by army educational units until 1992.

The unique 1930's interiors reflect the ultramodern design taste of the period. Many of the largely intact interiors include the wooden inlaid and panelled walls lining the circular Entrance Hall, the Boudoir, the Library, and the Study. Other features such as fireplaces, doors, doorknobs, switches, and bathroom fittings have also survived. Technical features including electric fires, synchronous built-in clocks in most rooms, a loudspeaker system that could broadcast throughout the ground floor, an internal telephone exchange, and a centralized vacuum cleaner also remain largely intact. The Great Hall medieval furniture and the original interiors and fittings form the remaining original collections. The Courtauld's collection of furniture and art that originally filled the property has been dispersed around the world.

English Heritage took over management of the whole site in 1995. The restoration project continued from October 1997 to June 1999 and was partly funded by the Heritage Lottery Fund. The two aims of the project were to open the house, palace remains, and gardens to the public and to create a venue for conferences and commercial events. The 1930's interiors were re-created using replica furniture and soft furnishings combined with period furniture and antiques based on original photographic and documentary evidence.

Project management

The major projects department managed the work, again on behalf of the London Region, but this time members of the London Region team were included on the project teams. The architect, design team, and the project management company were selected and in due course the main contractor appointed. The site was the responsibility of the main contractor during the building works period. A completely different project team to that of *Down House* was assembled.

The main contractor worked to specifications approved by English Heritage, and subcontracted all the specialist site work including the conservation of the interiors. English Heritage limited the conservation tender list to qualified companies, and also checked the methods statements from the selected conservation companies.

The regional curator and the senior collections conservator looked out for the welfare of the collections and interiors on both the presentation and operational planning teams but not on the design and works team. The building works were again the domain of the construction professionals.

As before, site management focused on the building works issues with no appreciation for the potential risks posed to the interiors by poor protection and work practices.

Problems and solutions

The challenges affecting the curatorial and conservation aspects of the project stemmed largely from a general lack of appreciation of the importance and fragility of the original interiors. The relatively modern 1930's building was assumed to need minimal protection during building works and this made it difficult to argue for sufficient resources to protect and conserve the interiors in the short and long term (although in fact the wooden and inlaid walls were fragile and very susceptible to physical damage from contractors and an uncontrolled environment). It was again expected that the collections management aspects would be resourced through the in-house teams.

a) Relationships

In an attempt to overcome the type of communication problems that had been encountered during the *Down House* project, enormous teams were created that included all stakeholders. Unfortunately, the large size of the project teams and the formal lines of communication imposed by the project management only served to slow down decisions and hinder the development of effective working relationships.

Within this environment the conservator/curator partnership was successful in the following areas:

- securing a full-time curator paid by the project to co-ordinate the presentation program and address conservation issues associated with the building works and the future operation of the property (this post was supported by the English Heritage collections conservation team and the London Region curatorial team);
- convincing project management that the project curator must attend the design and works team monthly site meeting;
- securing a budget that partially covered the collections management activities (including storage of Great Hall furniture, an inventory of fixtures and fittings, and installation support).

The project curator (rightly so) placed a higher priority on the representation of the rooms than the conservation issues (namely site protection and installation planning). Consequently the original finishes suffered some damage due to poor supervision by site management, inadequate protection, and a lack of awareness by the builders of the importance of the interiors. These issues can only be addressed by a combination of precise specifications and the site presence of an 'aware' English Heritage representative (conservator/curator/house manager) working with the builders to ensure that standards assuring minimal damage to the interiors are in place. This project illustrates again that collections are most effectively represented by a partnership between the conservator and curator, and both posts must be full-time and funded by the project.

The project curator developed good relationships with the architect and clerk of works and site manager through her attendance at the site team meetings and site visits. The site visits identified key problems to do with inadequate protection and poor environmental conditions. These issues were slowly addressed through formal communication lines.

Despite the fact that the presentation team's budget represented only 13% of the total project costs, no flexibility was given to manage the budget. For cost control purposes, all individual purchases had to be approved by the project director. This arrangement slowed down procurement, strained relationships, and could potentially have delayed the opening date.

It was also difficult to convince project management that the planning and timing of collections management during the installation stage can only be predicted broadly. The inevitable overrun on building works means that planning tools like Gantt charts can never accurately predict the installation program. It is essential that the installation team has adequate resources to deal with delays and unpredictable issues that will arise during this intensive period.

b) Collections management and installation

It was only when the curator and conservator worked in partnership at the beginning and during the installation stage of the project that both the presentation and conservation issues were adequately addressed.

Although many of the original fixtures and fittings were intact, they were vulnerable to being damaged or even discarded by the builders. Therefore, an inventory was undertaken and noticeable labels were attached to items in order to raise their profile; these labels successfully protected the collections during the building works.

Environmental monitors were positioned in visible locations to check whether or not conditions in the vulnerable rooms were being controlled as agreed through selective heating and closing of doors and windows. A sign

explaining what the 'black box' did helped to highlight the importance of keeping the doors and windows closed.

A phased handover of the site became necessary to meet the opening date. The installation program had been under-resourced by the project largely due a lack of comprehension about the steps involved, with resources being allocated for delivery and installation of 'new' collections, objects, carpets, and curtains, but not for deep cleaning and dealing with the unpredictable conservation issues that always arise during installation. To overcome the potential risks to the interiors and still meet the opening date, two experienced conservation consultants and five contract cleaners were funded outside of the project. This meant that the site was thoroughly cleaned and the various conservation issues quickly and efficiently handled. [The design and works team did not appreciate that the stone floor in the Great Hall required specialist cleaning until the wooden floor was removed toward the end of the project. Addressing this issue through the existing management system would have affected the opening date and the budget. Fortunately, by this stage the collections installation team had developed a good understanding with the main contractor; this allowed the conservator contracted to help with the installation program to carry out the cleaning of the stone floor in time for the collections to be returned.]

Influencing decisions

How can conservators and curators influence decisions from the project initiation stage and beyond? This question reflects the 'service' status of these professions within the heritage community.

Following the projects already discussed, the collections conservation team at English Heritage commissioned a review into the role of collections conservation in major projects. This review outlined project-related issues and proposed a model for formalizing the involvement of the teams in a major project. It also highlighted the need for the collections conservation team to improve the communication of its role, aims, and services within English Heritage.

Circulation of the findings of this report initially raised awareness of the issues relating to collections and projects; however, a further agreement in the form of clear guidelines is required. These must spell out when and how the collections management components need to be represented so as to reduce the risk to the budget, timing, and the collections.

A combination of clear guidelines to which all parties agree is essential. This, combined with regular informal contact with the major projects department, should lead to the automatic involvement of the conservator and curator in the decision-making process.

Conclusions

When an historic property is the subject of a project, the professionals move in and collections management issues are often seen to be less important than the new roof. This imbalance is reflected in the unwillingness of management to invest in this side of the project (even though the cost in terms of the total budget is minuscule and the risk to the opening date is high). The conservator and curator are usually not involved until after the budgets are formalized, making it difficult to extract the resources necessary to manage the collections component of the project professionally. A strong partnership between the conservator and the curator is essential to change these attitudes. Clear communication in terms of cost and risk are required.

To complete the collections management side of an historic house project successfully, both a curator and a conservator must be employed full-time for the duration. This partnership will assure that the numerous issues and challenges that a major project presents will be addressed.

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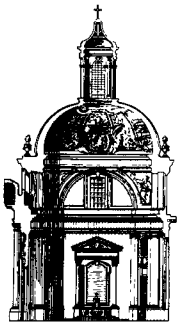
Résumé

Grands projets et maisons historiques : Leçons apprises à English Heritage

Cet article traite des grandes questions de gestion des collections qui surgissent lors d'un important projet concernant une maison historique, à l'aide de deux exemples traités par English Heritage : Down House et Eltham Palace. Ces problèmes sont causés parce que la direction d'ensemble du projet comprend mal la gestion des collections, et le rôle de cette gestion dans la réduction des risques. On a constaté qu'un restaurateur et un conservateur travaillant en partenariat peuvent réussir à influencer les décisions et à régler les problèmes; les deux devraient donc être employés à plein temps pour toute la durée d'un projet de restauration d'envergure.



The Commissioner's Residence in Dawson City, Yukon: A Multidisciplinary Restoration Project in a Northern Historic Site

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Abstract

The Commissioner's Residence in Dawson City, Yukon, was opened to the public by Prime Minister Jean Chrétien in August 1996 as part of the centennial celebration of the discovery of the Klondike. This paper describes the multidisciplinary restoration and historic furnishing of the building, which included architects, extant recorders, historians, archaeologists, curators, conservators, craftsmen, contractors, and many others, from all over Canada, working together over a period of 7 years. The planning and implementation of the project are explained, relating the contributions of all the specialists to conservation aspects of the project. The peculiar constraints of implementing such a complex project in a remote northern community are also discussed.

Introduction

The Commissioner's Residence is a nationally significant historic building in Dawson City, Yukon. It is an architectural statement of the extension of Canadian government administration into Yukon Territory. Its prominent location (on Front Street) and imposing facade (the result of a renovation completed in 1908) reinforced the roles of administration and social leadership exercised by the Commissioner, who was the top government official in the Yukon. Its strong presence in the community is reinforced by the landscaping and built features of the grounds surrounding the residence.

History of the building and its furnishings

The Commissioner's Residence was constructed after the heyday of the Klondike gold rush. Convinced that the mining of gold in the Klondike would not be a short-lived industry, the Canadian government invested significantly in infrastructure in the former Yukon capital. The Commissioner's Residence was one of six buildings constructed under the design and guidance of government architect Thomas W. Fuller, who later became the Dominion Architect for Canada. It was occupied by five different Commissioners between 1901 and 1916, after which it was unoccupied until 1950, when the Sisters of St. Anne used it as a home for elderly men and staff housing for nuns and teachers. Parks Canada acquired the building in 1970. A flood in May 1979 (when the Yukon River overflowed its banks and 80% of Dawson City was flooded) seriously damaged the parquet floor, finishes, and furniture housed within the building.

Planning of the restoration

The Commissioner's Residence had been identified as a major development node in management plans since the development of the Dawson Historical Complex National Historic Site commenced in earnest (around 1970). The first multidisciplinary team meeting to discuss the restoration and furnishing of the residence took place in April 1988; in attendance were curators, conservators, historians, an interpretation specialist, an architect, and an archaeologist.

The concept for the restoration evolved into a four-component project: the building was to be given fire protection (thus a sprinkler system was required); the grounds at the front of the building were to be landscaped to the appearance of 1915, and the area to the rear given a contemporary treatment; the interior main floor, main stairway, and second floor hall were to be restored, and the main floor furnished to period; and the building was to be used seasonally for presentation to the public.

Various investigations were scheduled early in the development of the project, including historical, architectural, curatorial, and archaeological investigations. This research was used to guide the development and implementation of the project and to make informed decisions as work progressed.

The project was managed using the Project Initiation and Planning System (PIPS). This proved to be a valuable tool to guide the project development and expenditure (in excess of CAN$1 million). A Program Evaluation Review Technique (PERT) chart was developed, and the project was subjected to critical path analysis which, in the early

stages of the planning, enabled us to identify key areas that needed to be addressed in order to complete the project on schedule.

Contemporary work

The first phase implemented in this project was the fire protection system. A dry sprinkler system was chosen because it would reduce the risk of water damage if frozen water pipes were to burst (it was too expensive to heat the structure throughout the year). The main supply valve and apparatus were placed in a small heated utility building located at the rear of the residence. The sprinkler system was camouflaged in the areas that were furnished and restored.

The installation of the sprinkler system continued through the winter of 1992–1993. Areas of the walls that were opened to permit the installation of the piping were carefully documented to ensure that the original wooden components could be accurately replaced. The installation of electrical service for lighting (110- and 220-V receptacles throughout the building) was planned at the same time to minimize the impact upon subsequent work in the project. During this phase of the project, the flood-damaged parquet floor was covered with plywood to protect it from the traffic associated with the installations.

The electrical needs were defined by requirements for service and maintenance of the furnished areas, provision of environmental control, and re-installation of the original lighting fixtures. These fixtures, with two exceptions, had survived intact within the building. They were removed and rewired to meet contemporary CSA requirements by a contractor in Victoria, British Columbia. This arrangement worked well, and the contractor was sensitive to our requirements for protecting the integrity of the original fixtures. The two missing fixtures were reproduced from a sample original fixture by a supplier in Portland, Oregon. These replicas are distinguishable from the originals under close examination, but are not obvious to a casual viewer.

Although it was necessary to provide electrical service to various areas of the building, it was also highly desirable to retain the authentic historic setting. We were able to hide the installed electrical receptacles discretely behind the baseboards in the furnished areas of the building. A design by the project architect that was perfected by a site craftsman resulted in small vertical sliding panels being cut into the baseboard to allow access to each receptacle.

Original electrical outlets and switches were left in place, but in a non-functioning state. The control of lighting in each of the rooms is now from a single panel located in the kitchen at the rear of the building.

Landscape design and work

The original landscaping had been lost after years of abandonment and modification. The surface surrounding the building was irregular and all fences, flowerbeds, and the flagpole had been removed decades before.

Archaeological investigations and historical research preceded the design of an appropriate landscape treatment for the grounds surrounding the residence. This research enabled us to identify the location and appearance of a number of features at the site, including fences, trellis, flowerbeds, walkways, and flagpole. However, we faced the dilemma of accommodating current visitor and site operational needs while still retaining the authentic layout. It was eventually decided to develop the grounds in front of the trellis, which flanked both sides of the residence toward the rear, as an historic reconstruction of the original layout from 1915.

Early documents and photographs were analysed, and the species of flowers historically planted in the beds were identified. These species were planted in the flowerbeds as part of the landscape restoration.

After exploring a number of options for providing wheelchair access to the interior of the building, we opted for a mechanical lift, installed at the rear of the verandah on the south side of the building. This location minimized the impact of these modifications on the original fabric and the historical appearance, as viewed from the main thoroughfare passing the front of the property.

Period restoration

The period restoration for the residence was subjected to the scrutiny of the Federal Heritage Buildings Review Office (FHBRO) to ensure that the interventions protected the heritage character of the building.

The strategy employed for the period restoration of the interior was to minimize the intrusion of modern features in the restored areas of the building. Interventions outside of these areas were also kept to a minimum. Intrusive details such as exit lights and fire extinguishers were excluded or located in undeveloped parts of the building. The repairs to damaged or missing finish details were designed to reduce replacement of original fabric to a minimum, and to minimize the extent of intervention on historic components.

The floor, as well as the lower wall detailing on the main floor walls, had been seriously harmed by flooding in 1979 (the floor, which consists of 10 000 small oak and mahogany tiles, and the subfloor were especially damaged). Through a careful process of discussion and testing, a means was developed to repair the damage.

After carefully recording the location of the tiles throughout the main floor, they were removed and each tile was numbered on the back. The tiles came off in squares consisting of eight tiles each, held together with a muslin backing. The backing and the water-soluble adhesive were removed, after which the tiles were soaked in water for 1 week. The water-laden tiles were then placed in a specially designed press and held under pressure for several days. The tiles responded by returning to and holding their original flat shape.

The original shiplap subfloor had undergone dimensional changes. It was screwed down and covered by a thin plywood layer, which was also screwed down. Although this was a seemingly coarse measure, the floor would have to bear considerable traffic and it had to be secure and capable of withstanding such use. The tiles were re-attached to a thin muslin backing and, using the previously numbered floor plan, were repositioned and nailed down using the original nail holes. The nails were countersunk and filler was applied to any voids in the surface, which was then sanded and given two coats of varnish. To date, the floor appears to have withstood the rigours of regular tours without showing any ill effects.

The selection of wallpapers began 2 years prior to their installation. Samples of original wallpapers found behind cupboards and mouldings provided good evidence of patterns and colours. Some patterns or close approximations were still available. In some cases, we decided to use similar, sympathetic patterns, where we could find them. Photogrammetric analysis of photographs of the main hall allowed the reconstruction of a wall and frieze pattern that could not be located in any historical document or contemporary catalogue. These patterns were reproduced for us with the cooperation of the craftsmen at Historic Fort Steele in British Columbia.

The wallpapers were applied to a muslin backing, which was stretched and applied to the walls and ceiling in the same way as the original coverings. The textile curator from our Winnipeg office located and sent us samples of varying weights of weave, from which we were able to select an appropriate match. After testing, our textile curator was able to advise us of the shrinkage properties of the material, which enabled us to fabricate wall and ceiling panels that would minimize the dimensional changes to which the fabric would be subjected.

Furnishing

Due to the unique circumstances surrounding the storage and care of the furniture after the residence was closed down in 1916, a large percentage of the original furniture had survived.

Working from a detailed and comprehensive curatorial furnishing plan for the building, we were able to select from our collections original objects for placement in the various rooms. Owing to the delicate or worn condition of some originals, these items were not used in the furnishing but were instead reproduced. Where the original pieces of furniture could not be found, replacements were either purchased or fabricated. Support in the acquisition of furnishings was provided by the textile and civilian curators from the Parks Canada Winnipeg office.

Another curator, working in our Calgary office, arranged for the reproduction of carpets throughout the main floor, as the originals were worn and would not resist the wear and tear of visitor traffic. Locating a manufacturer capable of producing adequate reproductions was a challenge. A firm in Montreal was able to reproduce one carpet pattern, a four-colour design from the Drawing Room and Reception Room, but the other pattern was too complex and required too many colours. Eventually, a manufacturer who had older equipment capable of reproducing the pattern was located in Thailand.

There was some risk involved in the reproduction of the carpets. One original that was sent to Montreal was partially disassembled to determine the method used in manufacture. Another of the original carpets was shipped to Thailand in order for the manufacturer to replicate the pattern. Fortunately, there were no negative consequences in either case.

Various furniture pieces were reproduced by craftsmen in Dawson City and Ottawa, as well as by contractors in Winnipeg. In all cases the craftsmen were able to work from photographs, and in some cases from original pieces of identical or like construction. All such work was catalogued and identified by special markings so that it could be distinguished from original pieces.

Framed prints and books were conserved in our conservation centre in Ottawa, and treatments were provided for artifacts acquired by purchase from Winnipeg. Due to the flood damage, many of the furniture pieces had both structural and cosmetic damage. Considerable consultation with furniture conservators from our Winnipeg office determined that the requirement for conservation treatment of the collection was extensive and would require considerable time and effort.

The treatment of the furniture was therefore initiated early in the project to ensure completion in a timely fashion. Extensive discussion was undertaken to determine how this work would be completed. The proposed methods of treatment were discussed at some length, and it was agreed to minimize the impact upon the furniture and utilize a treatment that would restore the existing finishes rather than remove and replace them. The furniture conservator for the Parks Canada regional office in Winnipeg visited the site for extended periods of time on two separate

occasions to work on the furniture with site staff and train them in the techniques at the same time.

Upholstered furniture was shipped to Winnipeg for treatment, and the original sofa was transferred to Ottawa to be conserved. At the time of disassembly, the original construction was analysed and this, combined with photographic evidence, enabled the fabrication of a matching reproduction armchair.

Discussion of conservation issues

There were a number of challenging conservation aspects to this project. Globally speaking, we grappled with the issue of conserving the authenticity of the building and its contents. Our aim was to achieve a satisfactory restoration in which the original materials, design, furnishings, and atmosphere were retained, while also minimizing physical and visual intrusions in this nationally significant structure.

Where possible, we retained original components of the building and installed the original furnishings. Modern intrusions such as exit lights, visible sprinkler heads, and contemporary services in the restored areas of the building were avoided wherever possible. If an artifact was too delicate or sensitive, we chose alternatives such as the use of reproductions which would protect the original yet maintain visual accuracy within the building.

Environmental control within the building was a problem. Early in the project we knew that the building would not be heated summer or winter. Data were collected for several years prior to the completion of the project in order to establish a baseline for conditions within the building. We learned that the typical ambient interior humidity levels were too high for museum standards, particularly in the winter. Therefore, several rooms on the main floor were given floor, wall, and ceiling insulation, a treatment normally applied to the exterior envelope. Within these areas, doors and windows are now covered with insulated inserts during the off-season, and humidistatically controlled portable heaters have been installed. This maintains the relative humidity levels and fluctuations within desired standards for conservation. Humidity levels have been monitored in the building since 1989, using both recording hygrothermographs and, more recently, electronic data loggers.

Light levels within the building were measured, and all windows in furnished rooms were covered with a UV-filtering plastic film. The light levels in the furnished areas are now well below acceptable museum standards, and the internal incandescent lighting is very low. In the evenings, blinds are drawn throughout the building to keep light out during non-operating hours. In Dawson there is constant daylight for 3 months in the summer, so reduction of exposure to daylight is critical. In the winter, the insulated inserts placed in all of the exterior window openings serve to minimize the exposure to the shortened hours of winter daylight.

To reduce dust levels within the building, visitors are asked to either remove their shoes before entering the residence or cover their footware with surgical slippers. It is felt that, in addition to the reduction of dust and cleaning problems within the building, this practice conveys a strong message to visitors about the importance and value of this site to Canadians. Visitors are carefully guided through the building in small groups to control the potential damage from mishandling or theft.

As part of the completion of the project, a regular program of inspection and maintenance is now followed, and preparations are made at the end of the season to prepare the building and the collection for winter storage.

During the implementation of the project, we found the extreme distances and isolation to be a challenge. A small number of furniture pieces suffered cosmetic and structural damage in transit, most notably the breaking of a leg of the music cabinet from the Drawing Room. Fortunately, all of the damage was repairable on site, thanks, in part, to the training that the staff received during the implementation of the project. The total percentage of damage to objects in transit was small, but is an area of concern for anyone who has to ship artifacts long distances over rough roads. Many of the smaller artifacts were shipped in robust plywood shipping crates, with an apparent reduction in the occurrence of damage to the contents in transit.

Working with artifacts in extreme cold conditions can also be a challenge. We received or shipped more than one truckload of material when temperatures of -30°C prevailed. Not only does the cold affect the objects directly, it affects the ability of staff to handle the objects. With stiffened, mittened hands, the handling of each object becomes a challenge.

A good relationship with a contractor was essential for good conservation practice. We found ourselves dealing with conscientious people who shared a natural concern for the well-being of the objects with which they had been entrusted. On more than one occasion, I was contacted by a contractor with questions about the effect their work might have on an irreplaceable artifact. After discussing such matters, damage to irreplaceable objects could be averted. I suggest that personal contact and frank discussion of conservation values to establish a level of confidence and communication with any potential contractor is essential in any kind of purchased service.

Conclusions

Many things went well for this project, and many of them could be usefully applied on similar projects.

1. Detailed planning in the early stages ensured that conservation had a clearly defined role from the outset. Having a good plan from the beginning of the project and sticking to it ensured success.

2. Roles and responsibilities were clearly defined from the outset of the project. As a consequence, everyone proceeded to perform their component of the work with confidence.

3. The surviving integrity of both the building and the collections enabled a highly accurate restoration. Many clues which answered questions about how things looked and where they were positioned were found throughout the residence.

4. Extensive public records, published information, and photographs provided a documentary foundation to this project and ensured a high level of historical accuracy.

5. The project was extended over a 7-year time frame. This removed the time pressure that sometimes favours undesirable courses of action and increases costs.

6. During the course of the project, we were able to make use of the extreme cold of winter to complete certain types of work. Our craftsmen, for instance, undertook certain shop-related projects that couldn't be completed during the busy summer operational season.

7. There was a strong spirit of respect and enthusiasm for the project. Staff became very engaged in their aspect of the work, and there was a high level of collaboration among all members of the large team of employees who worked on this project.

8. Training in furniture conservation was provided as a component of this project. This enabled the involvement of craftsmen on site, completion of conservation work on site for several pieces of furniture, and an assurance of additional skill in our staff in dealing with future maintenance requirements at the site.

9. We established good personal communication with many of our contractors. This enabled those who were not normally involved in restoration projects of this sort to contribute to the success of the project.

I have not addressed many of the more detailed conservation issues such as specific treatments and materials employed; I speak as a project manager for an undertaking that cost more than CAN$1 million and involved many disciplines over a period of 7 years. One of the important things I brought to the project, as team leader, was the integration of conservation values into every aspect of planning and implementation. Thanks to the contributions of many people, this project was successfully completed on schedule and under budget.

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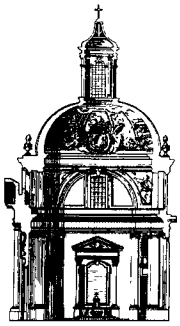
Résumé

La résidence du commissaire à Dawson City, au Yukon : Un projet de restauration multidisciplinaire d'un lieu historique nordique

La résidence du commissaire, à Dawson City, au Yukon, a été ouverte au public par le premier ministre Jean Chrétien au mois d'août 1996, dans le cadre de la célébration du centenaire de la découverte du Klondike. Cet article décrit la restauration multidisciplinaire et l'ameublement historique du bâtiment, ce qui a demandé la participation d'architectes, d'enregistreurs de bâtiments historiques, d'historiens, d'archéologues, de conservateurs, de restaurateurs, d'artisans, d'entrepreneurs, et bien d'autres, de partout au Canada, travaillant ensemble sur une période de sept ans. La planification et la mise en œuvre du projet sont expliquées, en détaillant les contributions de tous les spécialistes aux aspects de conservation du projet. Les contraintes particulières de l'exécution d'un projet aussi complexe dans une communauté nordique éloignée sont également traitées.



The Restoration, Preservation, and Reinterpretation of the Steamboat Ticonderoga

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Abstract

The 1906 Lake Champlain steamboat *Ticonderoga* recently underwent an extensive 5½-year restoration. As the last remaining side-wheel steamboat of its type, the 67-m (220-ft.) *Ticonderoga* (now in permanent dry dock at the Shelburne Museum in northern Vermont) was declared a National Historic Landmark in 1963. This paper discusses the restoration and conservation guidelines and treatments used during this project. The demands of the restoration project necessitated extensive background information, including physical evidence discovered through sampling surface coatings and structural details, archival (written and photographic) evidence, and oral histories (people who worked and traveled on the *Ticonderoga*). The findings of this research guided decisions regarding the significant structural restoration work for the preservation and treatment of interior elements. A careful examination of archival records reflecting the 1920's era of operation led to the determination of a specific date for reinterpretation — October 3, 1923; it is this period that is reflected in the refurnished historic interior, exhibitions, publications, and programming. This paper concludes with a discussion of how the collaboration and interdependence of the Shelburne Museum's educators, curators, conservators, and preservation shipwrights contributed to accuracy and success in preserving the steamboat's interior.

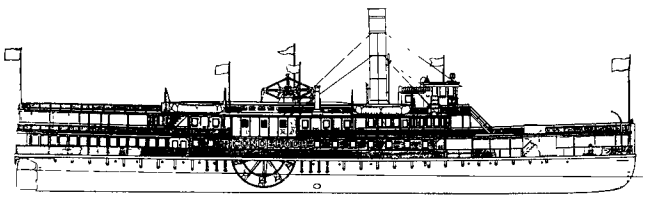


Figure 1. Profile drawing of the Ticonderoga.

When the Delaware and Hudson Railroad, through their subsidiary the Champlain Transportation Company, built the *Ticonderoga* in 1906, they expected that (as with all their previous side-wheel steamers) this gleaming new boat would last perhaps 25–30 years. Little did they realize that not only would this be the last in a long line of 29 steamers built for Lake Champlain, but it would steam its way through nearly 5 decades of active use and another 45 years in permanent dry dock. In 1937, with declining passenger and cargo transport following the Great Depression, the railroad divested its interest in the lake steamers. But the *Ticonderoga* held on through new ownership. Through the late 1930's and 1940's the vessel served primarily as an excursion boat, with her new owner finding many ways to increase revenues and keep the operation profitable: he mounted a neon showboat sign atop the turtle deck, added slot machines, converted the dining room into a dance floor and covered over the stairs to the galley to increase dancing room, and expanded the existing bar and added others. These were hard times for a vessel already considered a relic of the steam era and well beyond its expected usefulness.

Despite the deteriorating condition and the changing times, the *Ticonderoga* somehow (perhaps miraculously) survived any significant alterations to its original structure. Most turn-of-the-century vessels had by this age been added to the scrap heap or undergone major reconfigurations of their engines, superstructures, and interiors. This was especially the case for those that had operated through both World Wars and the resulting technological advances. When the *Ticonderoga* was moved overland to the Shelburne Museum grounds in 1955, the ship unfortunately lost the crew that not only operated but also maintained it continuously. Being a very complex structure, the vessel required continual care and maintenance. While the Shelburne Museum undertook its preservation responsibilities with the utmost diligence, the ship was forced to compete with 37 other historic structures for very limited maintenance resources. By the early 1990's the museum was faced with losing a vessel that had far exceeded its anticipated useful life span. Under the threat of closing the exhibit, the Shelbourne Museum had to choose between hiring naval architects to record the lines and structural details on paper before the steamboat was completely lost or finding funding for a massive and thorough preservation, restoration, and reinterpretation project. Fortunately in 1992 local philanthropists J. Warren and Lois McClure initiated a gift that helped see the 5½-year restoration

project through to completion as well as establish a restricted endowment for perpetual care and maintenance of this National Historic Landmark.

Restoration and preservation guidelines for the project followed the *Standards For Historic Vessel Preservation Projects* as determined by the United States Secretary of the Interior, whose objective is stated as:

> *Identifying, retaining, and preserving to the greatest extent possible original or historic fabric, as well as material, elements, features, and form that are important in defining the historic character of the vessel.*[1]

These guidelines were adopted into three practical options (in order of preference):

1. Consolidation and conservation of original materials should take precedence over replacement whenever it (a) does not affect the structural integrity of the vessel, (b) does not significantly increase the rate of material degradation to the consolidated piece or surrounding material (as compared to new material replacement), and (c) is economically feasible.
2. Repair and replacement with new similar material should be localized to the degraded or affected area whenever structurally and economically possible.
3. Repair with new dissimilar material should only be considered when (a) original material is unavailable in today's marketplace, (b) there are significant health/safety concerns with the original material, or (c) the new material substitute provides a significant improvement in material longevity and maintenance. However, a new material and its application must be chosen to replicate as closely as possible the original surface appearance and be reversible.

   Using modern, long-lasting, low maintenance protective coatings where substantially improved protection and reduced maintenance will add to the life of the vessel, so long as the new finish is reversible, and matches the original in color, texture, and appearance.[2]

One would expect that a vessel less than 100 years old, existing in the time of photography and film, and being part of a museum's collection for nearly 50 years, would have a vast archival collection of documents and photographs. But this was not the case for the *Ticonderoga*. Although we did have a number of the logbooks and inspection reports covering the daily runs of the boat, they did little to inform us of structural and operational details. There were virtually no records of repairs or routine maintenance until the Shelburne Museum's ownership, and even this later record was sketchy. We did have partial drawings of the hull and deck plans from 1905 but we know the vessel was not built or configured exactly as drawn. Our photographic collection of the *Ticonderoga*, although numbering nearly 200, had only <u>one</u> early interior image (a 1923 photo of the dining room). So from the outset we knew that an extensive research project was necessary if we were to preserve the historic record accurately in both the physical structure and reinterpretation.

We started by compiling and cataloging all the existing material at the museum. Requests and searches for any information in the local and regional libraries were initiated. One document discovered in Special Collections at the University of Vermont proved invaluable in the reinterpretation of the exhibit (this was an inventory of the purchases used to build and furnish the *Ticonderoga*, written and compiled by the then general manager of the Champlain Transportation Company). Press releases were submitted to area newspapers informing the communities around the lake that we needed photographs, written material, and, very importantly, oral histories of the *Ticonderoga* and its operation. Visitors to the Shelburne Museum, especially those that came onboard the vessel during the restoration (we kept much of it open throughout the project), were solicited for information pertaining to the *Ticonderoga*'s history. And last, the structure itself provided us with physical evidence that guided many of the restoration decisions and details.

Considering the size and scope of the project, I will cite just a few examples of how these findings helped direct restoration work for the preservation of interior elements.

In 1962, Electra Havemeyer Webb altered two adjacent interior rooms aboard the *Ticonderoga* in order to reinterpret the new larger space as a bridal suite/stateroom. The founder of the Shelburne Museum often used the boat to exhibit her collection of maritime prints and furniture, but not necessarily to represent the original structure and fabric of the vessel accurately.

Several findings in the archival record as well as some physical evidence pointed to a completely different configuration for this area. The 1905 deck plan showed two rooms, one a baggage room and the other the captain's room. Although there was no museum record of the original configuration and use prior to the change, a number of physical clues strongly supported the architect's plan.

1. Two doors entered the space.
2. Both doors had plugged screw mounting holes exactly matching fastener holes in two brass nameplates, one engraved as BAGGAGE ROOM and the other as CAPTAIN. Both of these were located on doors of other spaces on the boat.
3. Overhead moulding treatments for trimming out the deck beams abruptly changed along the original wall location. This was further evidenced from paint buildup lines indicating the location of the wall header/junction with the overhead decking.
4. The light fixtures and switches were different: in the baggage area they were of a utility grade but they were of a fancier style in the captain's room.

5. All staterooms aboard the *Ticonderoga* had a corner sink cabinet that was fitted to an outboard corner of the room. As the outboard sides of a vessel are curved, the junction of the dividing walls oriented athwartship (perpendicular to the longitudinal centre line) and the outer wall was either an acute or obtuse angle, which changed as one moved along the length of the vessel. When the two rooms were altered to make one, the original corner cabinet (fitted for the captain's room) was moved forward to the resulting new corner. This change in location necessitated an alteration to its corner angle fit, which was apparent under close examination of the cabinet's construction.
6. Finally, within the baggage room area there were built-up paint lines showing the exact location of shelving for the purpose of storing baggage and belongings.

With this array of collaborating findings, the restoration and preservation of these particular interiors was fairly straightforward. Examination of other existing dividing walls provided accurate information for replication of the missing wall and its sill and header details. Fortunately we were able to preserve and expose a portion of the original faux finish in the captain's room. The white topcoats of paint were separating at their junction with the shellac sealer layer applied over the wood grain finish. With careful chipping using razor scrapers and scalpels, most of the original coating on the curved wall panels and door was exposed and preserved. Other surfaces, along the exterior wall, were lost to previous repairs or deterioration. Deck-to-deck Douglas Fir tongue-and-groove wainscotting was exactly replicated and installed. These new surfaces in the captain's room, including the replaced dividing wall, were wood-grained using two oil-based coat layers and one top grain coat to match the original in colour and style. The baggage room was painted gray to match the paint sampling. Objects used for the finished re-installation were dictated by the document *Inventory of Purchases for the Construction of the Steamer Ticonderoga* found in the University of Vermont's Special Collection. Although we had no original furniture for the captain's room, this document informed us that we needed a brass bed, desk, bureau, chair, spittoon, chamber pot, etc. Replication of archival material such as the current logbook, correspondence, newspaper, and licenses added the finishing touches.

Early photographs often provide the most definitive evidence of a vessel's historic structure. Our appeal to area residents for early photos of the *Ticonderoga* paid off when Cynthia Coxen of Windsor, Vermont, sent us a collection of more than a dozen photographs that her parents had taken in 1909 on their honeymoon aboard the *Ticonderoga*. This was just 3 years after the steamer was launched.

They took a number of images of each other standing in different locations around the turtle deck. This is a structure atop the hurricane or upper deck with a clearstorey

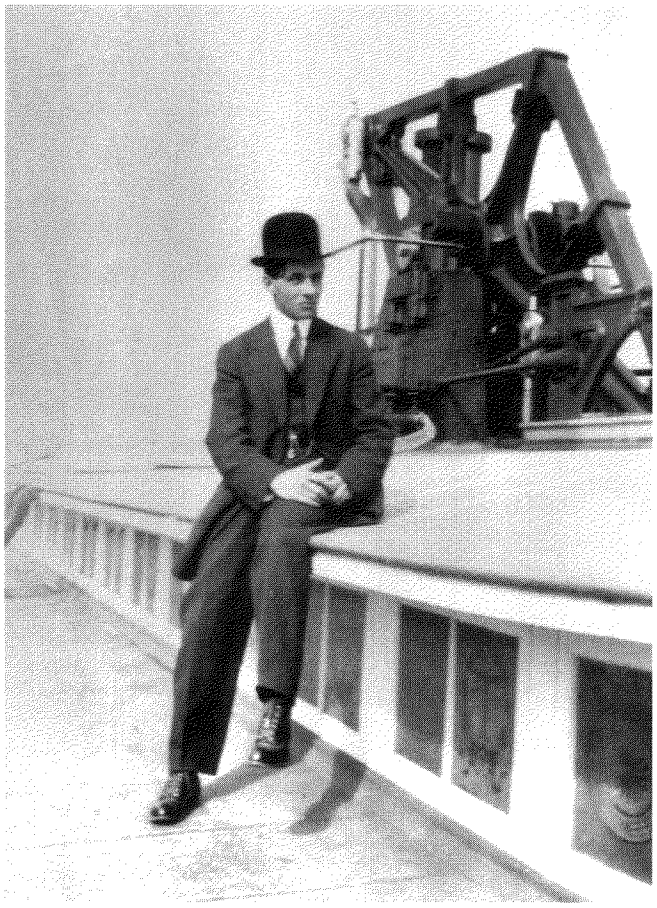


Figure 2. Charles Cole seated on the turtle dome on the hurricane deck during his honeymoon, September 1909 (4.20.4-636).

of 44 windows, two panes each (88 pieces of glass), that provides elegant natural lighting to the stateroom interior hallway below. At the start of the project it was assumed that the pattern on these panes was one of a double acid etched 'T' within a wreath. There were three other patterns represented in the windows when we started, but in no particular order. Because of their randomness it was believed that they were simply replacements when the 'T' pattern panes were broken. However under close scrutiny of the historic photos it was revealed that the principal pattern for each window was for the left pane (as viewed from the exterior) to be the circular wheel cut pattern and the right was the etched 'T' within the wreath pattern. The photos also showed that in several symmetrical locations around this clearstorey other etched patterns were used. For example, the aft centre window had in the left pane a 'V' within the wreath and a 'fleur-de-lis' pattern in the right pane. It is probable that these patterns came from salvaged glass from an earlier steamer, the *Vermont II*.

We found that sampling surface coatings, especially those that may have been partially exposed to the weather, did not always provide conclusive findings about the original treatment. The *Ticonderoga* name board prominently

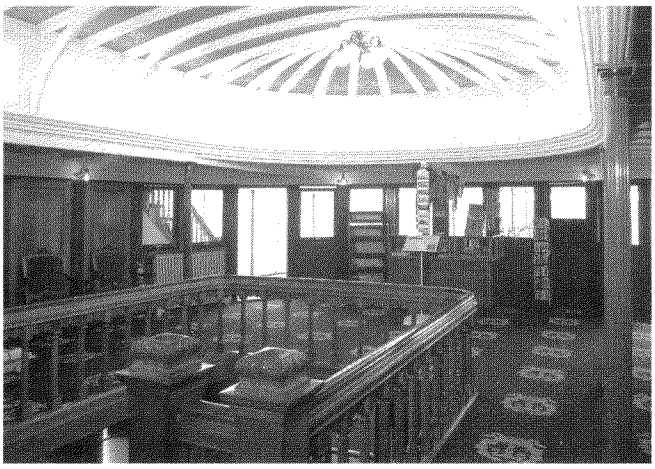


Figure 3. Restored stateroom hallway, and interior turtle dome, September 1998.

located on the forward exterior curved panels of the pilot house should, by tradition, have gilded lettering on a black background. Museum conservators conducted thorough paint sampling and analysis to find any possible traces of gilding, including traces of metal leaf or gold size. Samples were taken from down in the 'valleys' of the carving as well as from areas that were better protected and partially hidden. Even after examination under a low-powered binocular microscope (6–60x), no traces of any original gilding were found. It became apparent, however, that the carving had been stripped almost to bare wood at least once, as there were occasional traces of a beige layer in the most recessed areas only. The decision to regild the sign despite the lack of physical evidence was made after obtaining an oral history account from former captain Martin Fisher in Florida (the last pilot of the *Ticonderoga* in the late 1940's and early 1950's). He recalled repainting the name board one winter when it needed it, but he could not afford the gold leaf. He also recalled that the black background was painted with a flat black sand textured paint that we also re-created.

The next deck below the stateroom hallway also had what we suspected to be a gilded treatment for an overhead detail moulding. Along the upper edges of the wooden girder beams, and the bottom edge of the interior perimeter crown moulding, was a detail moulding of an 'egg and dart' pattern. This we also believed to be originally gilded with gold leaf as it had a topcoat of yellow/gold-toned paint from the mid 1980's. However, like the pilot house name board, extensive paint sampling revealed no evidence of size or metal leaf. When making structural repairs to the overhead deck we exposed about 5 cm of this 'egg and dart' that had been overlaid by other moulding during the original construction. This hidden undisturbed area clearly showed original gilding. Museum conservators and volunteers removed, stripped, repaired, and applied a pigmented primer coat (Burnished sealer, ROLCO Labs) to more than 590 m (1900 lineal ft.) of this moulding. Once dry, the primer coat was lightly abraded with a fine wire brush to increase adhesion for the 12-h Charbonnel gold size. The gilding was completed using a 22.75-karat Monarch, dark gold leaf from Sepp Leaf Products Inc., New York.

Perhaps the most significant and difficult decision affecting both the historic fabric and long-term preservation of the heritage interior of the *Ticonderoga* was the choice of material for the weather decks. As this historic vessel is completely exposed throughout the year to the northern Vermont climate, the weather decks (those areas that receive the full impact of the sun, wind, acidic rain, and snow plus about 150 000 visitors per year) are a hugely important element in protecting not only the *Ticonderoga*'s superstructure and riveted steel hull, but also the elaborate interiors of the three deck levels. The choices for the restoration of these badly deteriorated and leaking structures were to utilize a similar material and method approach, or dissimilar 'modern' method and material. The similar material approach would be for 53-cm (21-in.) #6 canvas duck to be laid, bedded, tacked, and painted in the original manner providing a watertight surface over the structural tongue-and-groove decking. On the steamers of the 19th and 20th centuries, canvas decks were the best means of providing a lightweight, watertight structure for the upper decks. Typically this canvas treatment was, depending on exposure to wear and strain, viable for about 10–20 years. The last time the *Ticonderoga*'s hurricane or top deck canvas had been replaced was in 1980. Within 5–6 years this application was leaking so badly that as many as 50 buckets were placed in the interior staterooms and hallways to catch the drips. Consequently the temporary and expedient measure of overlaying this canvas with aluminum roofing flashing was employed. Although this layer did a good job of keeping the rain and snowmelt out, it created a new, perhaps more severe problem of trapping condensed moisture between layers of deck structure. When the surface temperature of the aluminum dropped to or below the dew point, moisture from a structure already laden with a high relative humidity condensed on the underside of this metal, accelerating the deterioration of the wooden deck structure. This not only made these weather decks unsafe, but seriously impacted the integrity of the boat's interior and furnishings.

Confronted with the facts that (a) fully exposed canvas decks have a relatively short lifetime when considering the museum's obligation in preserving for future generations this National Historic Landmark, (b) replacement of about 900 m^2 of canvas every decade or so would be by far the most costly maintenance procedure once the restoration project was complete, and (c) a failing deck (as with the roof of any building) has a very serious impact on the rest of the structure's integrity, it was necessary for conservators and restoration shipwrights to explore other possibilities for the deck repair. We looked into the use of modern materials and proven methods. One common in the wooden boat building industry is the use of epoxy laminating and

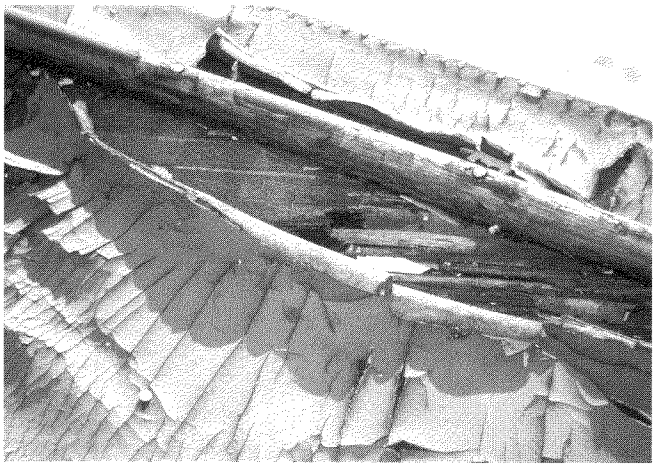


Figure 4. Deteriorated deck canvas/hurricane deck, 1993.

Figure 5. Turtle dome windows and deck with aluminum roofing flashing, 1993.

composite systems. This method typically utilizes a synthetic fabric such as Dynel or Xynole (open-weave polyester) saturated with epoxy resins, and applied in such a manner as to leave prominent the fabric's weave or texture. When painted, this application resembles closely that of a new, traditionally laid and painted canvas deck. The early examples of this application from about 1970 are still providing a strong watertight deck surface with a traditional appearance.

From a preservation and historically authentic point of view this was the least desirable restoration option, but the most desirable in terms of longevity and future maintenance. Our decision depended on how heavily one weighed the preservation of method and material with its impact on the vessel's structure and interior as well as the museum's long-term financial ability to maintain this treatment, with that of compromising original type material and method in order to preserve better the other 85% of structure and interior, thus minimizing maintenance costs. We chose the latter primarily because of the *Ticonderoga*'s full exposure to the weather and its impact on long-term preservation and maintenance issues.

Fortunately we had the benefit of retaining and preserving some original 1906 deck canvas that existed on the aft promenade deck. This area of 185 m^2 in the stern of the *Ticonderoga* is open to the sides, but protected overhead by the hurricane deck above. Due to its exposure to the weather on the sides only, just about 30% of the outboard area needed extensive restoration. This area had undergone several past repairs, and was a patchwork of re-canvasings. Our restoration included extensive repair to the deck's structure and the application of new 53-cm (21-in.) #6 canvas duck with traditional methods. The other 70% or central area was in such good condition that we were able to leave intact the original 1906 canvas! This was remarkable due to the fact that we knew of three to four previous re-canvasings of the rest of the *Ticonderoga*'s weather decks.

Through the comparison of these two methods we have had the opportunity to educate our visitors about the challenges that face open-air historic house and maritime museums. Not only are we housing collections within a collection of historic structures in which climate control is very difficult, but we must also preserve the structures themselves.

Prior to 1993, when a visitor walked on board the *Ticonderoga* the main story told was of how, in 1955, this massive 809-t (892-ton) vessel came 2 miles overland to the Shelburne Museum grounds. The label copy was there just to name the different parts of the boat. In order to bring new life to the exhibit we needed to 'people it', i.e. make it seem as though the crew had just stepped off the boat or out of their quarters, leaving their current activity in full view.

To accomplish this, a specific date was established for the reinterpretation of the *Ticonderoga*. With nearly complete

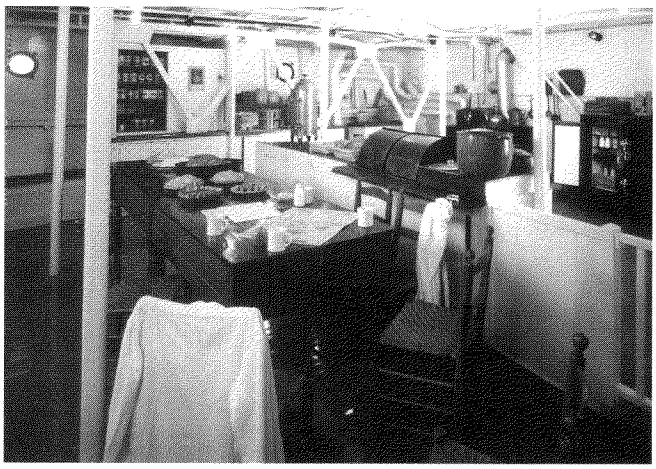


Figure 6. Re-installed galley, September 1998.

records of the boat's operation during the early 1920's, plus the date of our only interior photograph as 1923, and the fact that the Champlain Transportation Company's books would never again show such profit, the education and curatorial staff established a reinterpretation date of October 3, 1923. This date then guided the specific props to be used, from actual vehicles of the period to reproduction periodicals, newspapers, postcards, clothing, candy bars, gum, soda, galley and pantry supplies, apple barrels, and much more. We also established three principal themes to guide the objectives of the reinterpretation: (a) to illustrate the steamboat experience of both passengers and crew on Lake Champlain from 1915 to 1925 during the heyday of the steamboat era in northern New York and Vermont, with an exhibit focus on the year 1923, (b) to reveal the importance of steam power to the expansion of travel, tourism, and commerce on and around Lake Champlain, and (c) to tell the unique story of the last steamboat of her kind.

The success of this project depended on the collaboration of nearly all of the museum's departments, including the preservation ship carpenters, conservators, educators, curators, and administrators. The information gathered from the physical evidence by the carpenters led to the accurate preservation and, in some cases, re-creation of the historic interior. This guided the reinterpretation by providing the curators with physical detail accuracy. The research and oral histories gathered in turn helped all involved, including new programming, publications, reinterpretation, label copy, and, of course, the physical preservation and restoration of the steamboat's heritage interior. The end result has assured the preservation into the next century of the *Ticonderoga*'s history, structure, and the experience of being onboard a Lake Champlain steamboat.

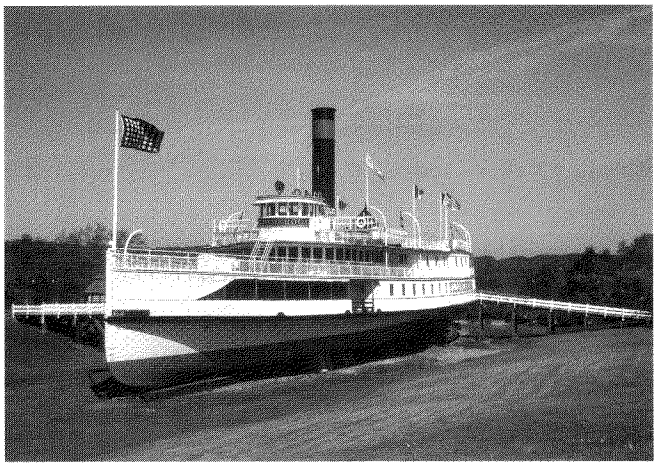


Figure 7. Side-wheeler Ticonderoga, *Shelburne Museum, September 1998.*

Endnotes

1. United States Secretary of the Interior. *Standards for Historic Vessel Preservation Projects*. United States Department of the Interior, National Park Service, National Maritime Initiative, p. 79.

2. Ibid., p. 82.

Résumé

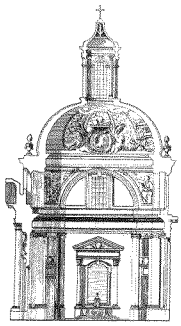
La restauration, la préservation et la réinterprétation du vapeur Ticonderoga

Le vapeur Ticonderoga, *lancé sur le lac Champlain en 1906, a récemment fait l'objet d'une restauration étendue qui a duré cinq ans et demi. Dernier vapeur à roues latérales de ce type qui subsiste, le* Ticonderoga *de 67 m (220 pi) se trouve maintenant en cale sèche permanente au Shelburne Museum, dans le nord du Vermont. Il a été déclaré monument historique national en 1963. Cet article traite des lignes directrices de restauration et de conservation et des traitements utilisés au cours du projet. La restauration a nécessité la collecte de nombreux renseignements de base, y compris les données sur les matériaux découverts par l'échantillonnage des revêtements et des détails structuraux, des documents d'archives (écrits et photographiques), et des éléments d'histoire orale (recueillis auprès de personnes qui ont travaillé et voyagé sur le* Ticonderoga). *Les résultats de ces recherches ont orienté les décisions prises pour les travaux importants de restauration structurelle visant la préservation et le traitement d'éléments intérieurs. Un examen attentif des archives ayant trait à la période d'exploitation des années 1920 a conduit à déterminer une date précise de réinterprétation, soit le 3 octobre 1923; c'est à cette période que correspondent l'intérieur historique remeublé, les expositions, les publications et la programmation. Cet article se termine par une discussion de l'importance de la collaboration et de l'interdépendance des éducateurs, des conservateurs, des restaurateurs et des charpentiers de marine spécialisés en préservation dans l'exactitude et le succès de la préservation de l'intérieur du vapeur.*

3

Treatment Approaches: Walls and Ceilings

Méthodes de traitement : Murs et plafonds



Marble Conservation at the Dominion Public Building, Hamilton, Ontario

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Abstract

This paper discusses the conservation treatment of marble cladding on the walls of the great postal hall of the Dominion Public Building in Hamilton. The original bond between the marble cladding and its terra cotta backup wall had been plaster of Paris adhesive. Scanning the surface with a miniature but high-powered radar antenna that had recently been developed provided conservators with a map showing the precise location, shape, and size of every patch of plaster adhesive. This non-destructive investigative technique made it possible to repair the bond where it had failed (either between the marble and plaster of Paris or between the plaster of Paris and terra cotta, or both) with very little disruption to the original building fabric. Also discussed is the additional mechanical connection that was established as a backup to the adhesive for each marble slab.

Modern Classicism became the preferred mode for urban federal architecture during the 1930's. The Dominion Public Building (by Hutton and Souter Architects, erected in Hamilton by the federal government between 1935 and 1937), was one of the "...large 'dominion buildings' that were built in many cities across the country to accommodate government offices, using funds released under the Public Works Construction Act."[1]

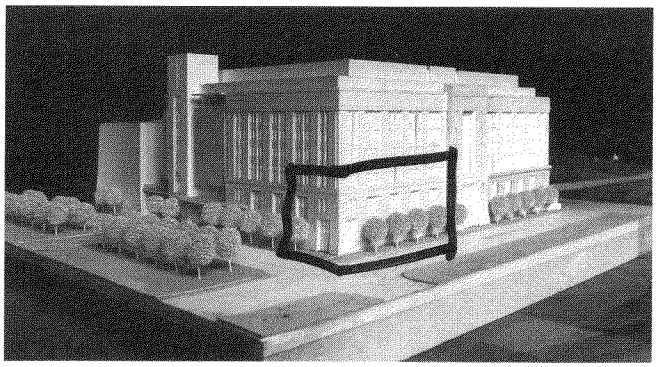


Figure 1. Architects' Model DPB 1935. Subject room marked.

The building housed the central post office, customs' officialdom, and all other federal government offices in the city of Hamilton until the 1980's, when it was declared redundant and sold to the Ontario Realty Corporation. On their behalf, Norr Partnership Architects thoroughly renovated the building between 1997 and 1999, and added considerable space. UMA Engineering and Martin Weaver Conservation Consultant were engaged to assess the building and report on the requirements from a conservation perspective. The original building envelope, the great postal hall, and the main elevator lobby were preserved in this adaptive re-use scheme. The building is currently used as Provincial Courts.

Description of subject rooms as found

The postal hall was a long, narrow room with a proportionately high ceiling. One side wall was pierced by large high windows to the street, while the other was lined with bronze-framed wickets used for the dispensing of stamps and other over-the-counter postal services. Three great electric chandeliers hung from the coffered plaster ceiling. Massive glass-topped bronze desks were provided for the convenience of patrons wishing to address letters. There was a large ceramic-tiled map of the young Dominion of Canada above the stamp windows. Two marble-tiled telephone booths were provided for public use. In all, it was a room designed to impress and engender confidence.

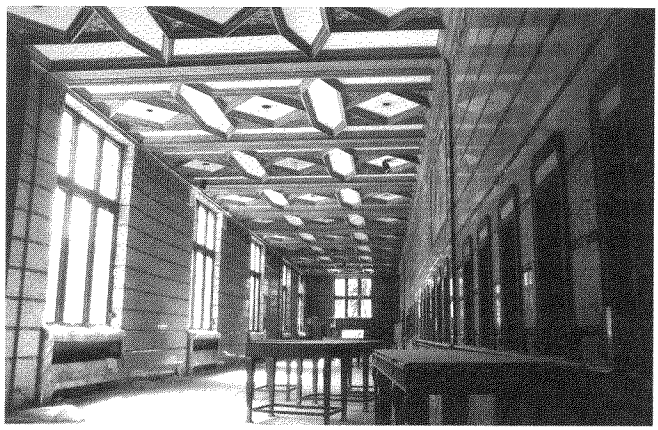


Figure 2. Postal hall of the Dominion Public Building is clad floor-to-ceiling in marble.

The postal hall and the adjoining elevator lobby were both tiled from floor to ceiling with marble panels. Intended to simulate ashlar, the panels were 38 cm (15 in.) high and were cut randomly up to 1.3 m (52 in.) in length. A 5-cm-high (2-in.) contrasting second marble type (to simulate the mortar joint) divided the larger courses. This material was of random length, up to 2.4 m (8 ft.). The actual grout joint between marble tiles was always less than 0.5 cm ($^3/_{16}$ in.).

The problem

In 1996, Martin Weaver was asked to form an opinion about the condition and stability of the marble cladding. The survey was necessary because:

a) there had been greatly increased vibration from truck traffic along two facing streets;
b) large swings in humidity and temperature in the building during the heating season had caused great stress on the type of connection used in the 1930's installation;[2]
c) there had recently been a significant increase in vibration within the building structure caused by the use of a motorized track-driven front-end loader and other demolition equipment on the floor above the subject rooms during the demolition phase of the current renovations.[3]

From temporary scaffolding, Weaver thoroughly sounded each of the 1200 panels for the quality of its connection to its substrate and mapped the results on his as-found notes. He concluded that the connection of a very substantial percentage of the slabs had suffered at least somewhat over time, and most decidedly over the recent past (during renovation and demolition and during the 5-year period when the building was closed to the public and minimally maintained).

In his "Preliminary Report and Recommendations for the Stabilization and Conservation of Limestone Exterior Masonry and Interior Marblework and Decorative Finishes of the New Provincial Courthouse in the Old Dominion Building, Hamilton, Ontario" (dated July 28, 1995), Weaver made the following recommendations:

> *For the consolidation/re-attachment of the marblework I recommend a method which was developed for "blind injection" for the consolidation and conservation of decorative plasterwork. The method was fist* (sic) *invented by Morgan Phillips, an architectural conservator now living in New York State* (now deceased). *Working subsequently on the conservation problems of Quebec's National Assembly building with Professor Ian Hodkinson at Queen's University, I developed an improved version of the formula using acrylic resins and a strange material called fluid petroleum coke.*
>
> *The new formula was successfully applied for the conservation of the very large plaster ceiling of the Salon Bleu of the National Assembly Building in Quebec. The specifications for the complete operation are given below.*
>
> *The work must be meticulously carried out and I would recommend that it be done by a conservator... or a conservation firm that has experience of the technique - such as Rod Stewart of Port Hope, Ontario.*

For more information, see also *The Conservation of the Ceiling of the Legislative Assembly Chamber of the National Assembly of the Province of Quebec, Canada* (a paper by Ian S. Hodkinson and Martin E. Weaver that was given to the 1980 Conference of the International Institute for Conservation, Vienna, Austria).

Clearly there needed to be a conservation plan applied to the marble cladding in any part of the building where it was to be retained. Historic Plaster Conservation Services (HPCS) was asked to develop and execute the marble conservation plan.

Objectives

The mandate of HPCS in this project was to devise a cost-effective and minimally intrusive method of achieving secure adhesion of the marble to its terra cotta speed-block substrate. The method had to meet the following objectives:

a) adhesion was to be achieved without the removal of the marble;
b) consolidation of the many broken stones in the band courses and elsewhere was to be achieved and verified with the stones in situ;
c) verification that the adhesion met the standard requirements was to be carried out as the work progressed.

The requirement to develop a program that would not require the removal of panels meant that a non-destructive investigation technique was required to explore the quality of the inner connections within the wall system.

Description of wall system

A 38-cm by 1.3-m (15- by 52-in.) block in the postal hall was typically connected with up to eight patches of plaster of Paris and two copper wires, one at each end.

In some cases the blocks had been set in place with the surplus plaster of Paris trimmed off the edges where it squeezed out (this had been accomplished by laying up the wall one block at a time, so to speak).

In other cases a line of blocks had been prepared and the squeezed-out surplus plaster of Paris left in place to serve as adhesive for the next adjoining block. This would have required very fast well-organized work to keep ahead of

the fast-setting plaster of Paris. Unfortunately this method of laying a line of blocks seldom provided a strong bond.

Additional security had been provided by mechanically fastening each block to the substrate. The system consisted of malleable copper wire, cast with plaster of Paris into slots in the edges of the marble. These wires were then bonded to the terra cotta surface with more plaster of Paris during installation.

Given that the general failures of the adhesive were seen just as often at the terra cotta/plaster matrix as at the marble/plaster matrix, it was assumed that many or most of these mechanical connections had failed.

Excelsior, which had arrived on site as a packing material for the marble slabs, had sometimes been used as a filler material in the space between the marble and terra cotta. The intention seems to have been to prevent the plaster of Paris from slumping or indeed falling to the floor when the production line block laying was attempted. No excelsior was found in areas where blocks had been laid up individually and trimmed of excess plaster of Paris. The porous and dry nature of the excelsior probably had a speed-up effect on the plaster of Paris, further contributing to its poor bond.

There were four different conditions of attachment (detachment) present throughout the site:
a) marble was attached securely to plaster of Paris, and plaster of Paris was attached securely to terra cotta (this is the ideal situation as built);
b) marble was attached to plaster of Paris but plaster of Paris was detached from terra cotta;
c) marble was detached from plaster of Paris but plaster of Paris was securely attached to terra cotta;
d) plaster of Paris was detached from both marble and terra cotta (in this case the plaster of Paris was usually held in place only by friction of its two outside surfaces).

There could be all or any combination of the four detachment conditions described above on any given block. In addition, it was assumed that a large proportion of the mechanical fastening had failed.

The root causes of failure

1. The marble work in the postal hall took place long after the rough interior speed-block partitions had been erected. Therefore, an accumulation of construction dust built up on the interior partition walls between the time they were built and the time they were tiled.

2. The marble slabs arrived from Italy by ship in wooden crates packed in excelsior. The polishing rouge (the final polishing medium that gives the final smooth glossy finish to a stone) is customarily not removed at the polishing works; rather it is left on the stone as a protection against other contaminants and dust.

3. These two conditions (i.e. dust on the substrate and rouge on the marble surface) require that the work site have a large free-flowing supply of clean water for rinsing and cleaning stones and substrate prior to installation.

4. In the 1930's, the marble trades in Hamilton were dominated by the Italian immigrant community that had established itself there after the turn of the century. Scots immigrants who had preceded them in the previous century dominated construction management and masonry trades. It is unlikely that there would have been many bilingual Scots/Italian foremen and trades workers at the time this building was erected because in Hamilton (as elsewhere in the Dominion) these immigrant communities remained cultural solitudes in isolation. Communication perforce was not easy on the site.

5. Picture, if you can, pails of freezing cold water being delivered to men working on rickety scaffolding for the purpose of giving the marble slabs a final rinse. The subject stone would be stood up on end and wiped from top to bottom with a soaking wet rag. [Imagine doing this in winter in a virtually unheated building!] It is likely the top of the slab would get the best rinse while the bottom would be very much less 'clean'. Now imagine the same right-handed worker performing the same action repeatedly (consistency is an essential element of good trade practice) with each stone along a particular lift of slabs. The result is that along any given line of individually laid slabs, the right-hand sides typically had far better attachment than the left-hand sides. [And this is exactly what we observed.]

6. To give this picture some rhythm, now imagine the delivery to the work station of 'about-to-set-up' plaster of Paris adhesive setting the pace of work. It is not surprising that bonding became inferior as we rose from the floor as this was further from the mixing point of the plaster of Paris. [This was also observed.]

7. In the locations we could inspect because slabs had been removed, failure between marble and plaster invariably involved polishing rouge left on the marble surface and not integrated into the plaster adhesive. Similarly, at the terra cotta surface the contaminant was construction dust.

Therefore, any in situ re-attachment would have to consolidate these two contaminants into the adhesive system.

Simulated mortar joints

The dark brown bands that simulated mortar joints in the postal hall (reported to be of *rosso antico* marble) were extremely fragile. Fissures and cracks were plainly evident in any given section. The material, which is of uniform dimension throughout the hall, had simply been cut to length from a random-length inventory brought to the site on wooden frames similar to geological core sample frames. If this material was dislodged from its present setting, a great percentage of it would crumble and suffer irreparable damage. These bands were typically bonded along their entire length with plaster of Paris, much of which had failed. Sounding was not necessary to establish that much of the body of this marble had also failed. In addition, it was clearly evident that most if not all of it would be lost if it was removed from its present location in any normal construction site manner.

Therefore, an in situ conservation method using a medium that would be suitable for the consolidation of fractured marble was needed.

Non-destructive investigation (NDI)

Sounding with a rubber mallet is a time-honoured method for identifying the existence of fractures within structures, but precision (finding the exact location of fractures) requires techniques beyond the sensitivity of sounding.

Three NDI approaches were explored[4] for this project: impact echo, ultrasound, and ground penetrating radar.

Impact echo and ultrasound were both able to tell us something about the conditions within the wall. Unfortunately, however, they only gave information about the immediate location of the test and they both required that the test subject, in this case the marble wall cladding, be smeared with petroleum jelly for better pickup by the transducers they use to gather data. Either of these systems would have been far too expensive and would have put the marble surface in some danger when removing the jelly.

Ground penetrating radar (GPR) was the third option. GPR has been widely used with large-sized antennas for the investigation of concrete slabs, roadbeds, and even graveyards, but it is the miniaturization of radar antennas by a Canadian company (Geophysics GPR International Inc.) that made this technique useful. The important development here is that the 1-GHz radar antenna is about the size of a videocassette. This antenna is ideal for walls, typically requiring high resolution and a shallow depth of penetration.[5]

A technician passes the radar antenna along the wall surface and in so doing generates a real-time representation of the interference the radio frequency meets as it penetrates the wall and returns to the antenna. This interference is displayed on a monitor, and the collected data are analysed. The technician then interprets the wave patterns as locations of adhesive behind the marble cladding and marks them on the wall surface with a water-soluble marking pen. With this information (the location and size of the adhesive plaster patches behind the surface) the task then becomes one of devising a good means of addressing the conditions found.

Consistency of trades is a pleasure to appreciate

After a few days of scanning, interpreting, and marking patches on the wall surface, patterns began to appear and a consistency of approach became evident. [An uncanny feeling of being in the presence of the long ago deceased worker laying up this marble is all part of the appreciation of workmanship. Clearly a skilled worker had taken a consistent approach to the same task performed under the same circumstances repeatedly over time. These workers would have understood innately, as we do in the late 20th century, that repetition enhances productivity.] We

Figure 3. Technician passes 1-GHz antenna across the wall surface.

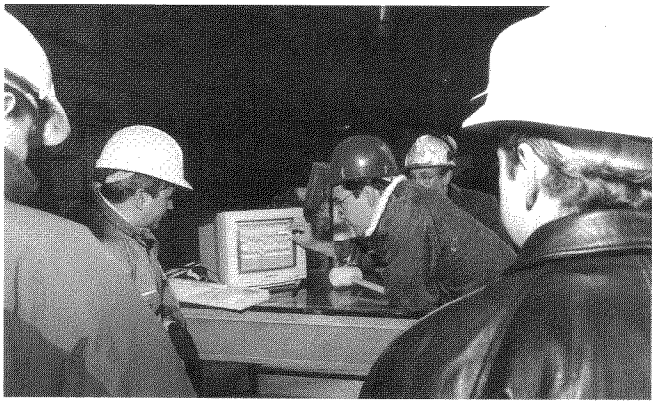


Figure 4. Data are collected and displayed on a monitor for interpretation. With practice, a technician can interpret the wave patterns.

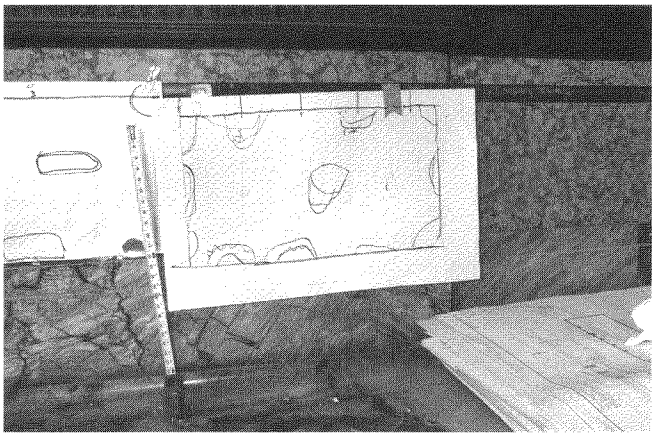


Figure 5. In our blind test, the technician made these marks on newsprint taped to the marble surface.

Figure 6. Once the test indicated that the procedure located the plaster adhesive patches with 90% accuracy, the survey continued.

found that most long slabs had three patches along the top edge, one on each end (over the wires), and one or two along the bottom edge. Any plaster in the middle seemed to have been put in at random and was of little consequence. It was probably placed there to cut down on possible vibration of longer slabs.

This observation did not lead us to cease the scanning exercise. In fact, it became even more interesting when the technician started marking locations inconsistent with the previously observed pattern.

What were we to make of a series of slabs along a line that seemed to have a consistent stream of plaster of Paris on all four sides but that vibrated 'to beat the band' when sounded? The answer, as it turned out, was the skilled tradesman's worst nightmare—speed-up.

In some locations where the opportunity presented itself, the decision had been taken to lay up a long line of slabs simultaneously. Cardboard shims had been placed along the top edge of previously laid slabs over a 6.1-m (20-ft.) section of wall. About-to-be-laid slabs had been washed down and leaned from the scaffold planks against the previously laid up marble. A line had been chalked along the future top edge of marble, and great splashes of plaster of Paris trawled onto the substrate along the line and along the top edge of the previously laid slabs. The slabs had been set in place one after another, then adjusted for final fit and shim thickness.

The problem inherent in this approach would have appeared when the final setting and end shimming were attempted. The workers would have placed 6.1 m (20 ft.) of slabs and then returned to the first one to fine-tune its location. But any movement after the immediate freeze that occurs when plaster of Paris is applied to a dry, dusty surface would have caused immediate and undetectable reduction in the quality of its bond.

In many cases where this line approach was taken, the only adhesive that was actually working was the incidental surplus that got squeezed into place with the setting of the next adjacent slab. The fine-tuning had disturbed the intended adhesive at the critical time of setting up.

[It is pure speculation on my part, but I wonder how site conflicts, trade practice differences (the line technique is perfectly acceptable and common in masonry applications), and inter-trade/cultural rivalry might have contributed to this problem.]

By sounding the wall in the precise known locations of adhesive, we could determine if a break in this specific adhesion had occurred. If it had, we were left to determine if the break was between the plaster and marble, or between the plaster and terra cotta, or both.

To do this, we drilled a 0.3-cm ($^1/_8$-in.) hole through the grout joint to the depth of the marble (i.e. just to the plaster surface). This could be determined by checking the drill bit for plaster dust. If the break had occurred between the marble and plaster, we were now intersecting it. Into this hole we gently pumped a wash of methanol using a lab

Figure 7. Methanol rinse being applied.

squeeze bottle. This rinsed out or dislodged any polishing rouge on the face of the marble. If the material streamed back out of the hole as quickly as it was delivered, we determined that there was probably no void to be found at this depth in this location. Several attempts were made along the grout line at this depth before it was considered sound. Because we knew that there had been a rattle here when this spot was sounded, we therefore could conclude that the break was to be found at the next level (i.e. between the plaster and the terra cotta).

In the case that the methanol was absorbed freely into a void (and this was readily noticeable with some experience), we concluded that we had discovered a break at the connection between the marble and the plaster. The treatment for this type of break is described below.

1. Continue to rinse the void with methanol until all the plaster face is wet and the contaminating rouge is dislodged or loosened. Some material may appear in the grout joint immediately below the subject location and this could be the result of saturation of the plaster or of the methanol wash simply running around the plaster at the surface. Experience indicated that when the material ran out immediately it was from surface run-off, whereas if run-out occurred after continued application there had been penetration. The total volume of methanol required for a typical treatment should not exceed 227 mL (8 oz.). [Note here that methanol has no harmful effects on the plaster of Paris and evaporates cleanly from it, but water as a wash agent would have a detrimental effect.][6]

2. Using the same tools, inject a dilute (20%) methanol/Rhoplex solution and observe its absorption. If the pre-wetting has been successful, the Rhoplex will be delivered throughout the break; it will consolidate the contaminant rouge and create the necessary bond. Repeat the injection twice, using 50% and then 100% Rhoplex. [A word about adhesives: The material selected for repairing the bonds addressed in this project is Rohm and Haas Rhoplex MC76. Rhoplex is a pure acrylic emulsion that can be diluted with methanol, thickened both chemically and with fillers. It is thixotropic (which means we can cause it to enter very fine spaces), non-toxic, water-soluble, and removable with toluene even when fully coalesced.][7]

3. Mark the spot for testing.

4. After a treatment is carried out at the first level (marble/plaster), let it coalesce and then re-sound the connection to determine if treatment at the second level (plaster/terra cotta) is necessary. [Suppose that the first break has been treated, coalescence has occurred, and re-sounding indicates continued vibration; we must therefore conclude that the break is between both materials and the plaster of Paris.]

5. Using the same hole, drill in the grout line through the plaster to the surface of the terra cotta and treat it in the same manner as the first break. The contaminant found here and either rinsed away or contained is general construction site dust that should have been washed off the substrate at the time of the installation.

7. Inspect after coalescence by sounding and pull testing.

Using this method, HPCS treated several thousand damaged plaster adhesive locations and successfully established a sound reconnection between the marble cladding and its substrate.

Mechanical fastening

It is always advisable when connecting heavy things to walls and ceilings in public spaces to provide a mechanical connection in addition to whatever adhesive might be present.

In the case of the marble cladding, the original mechanical adhesive was wholly inadequate because it only connected the marble to the face of the terra cotta with the same

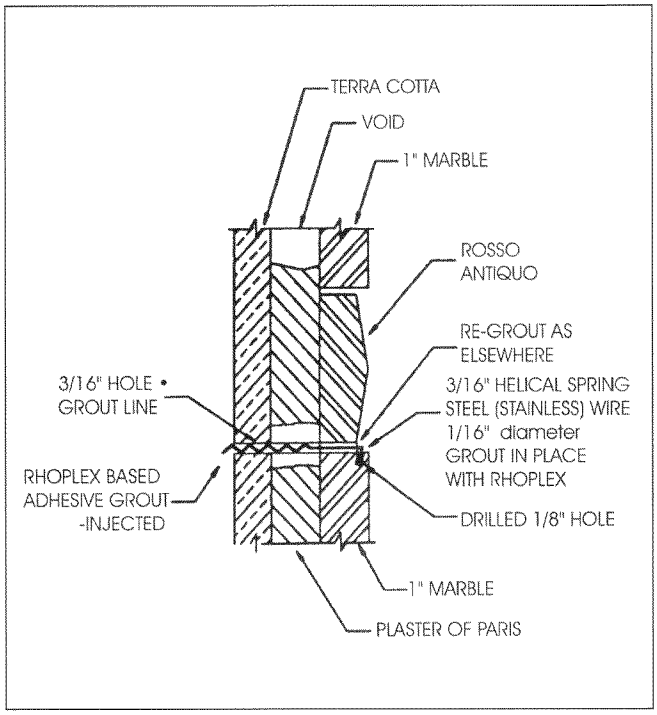


Figure 8. Cross section of marble cladding and wall showing mechanical connection.

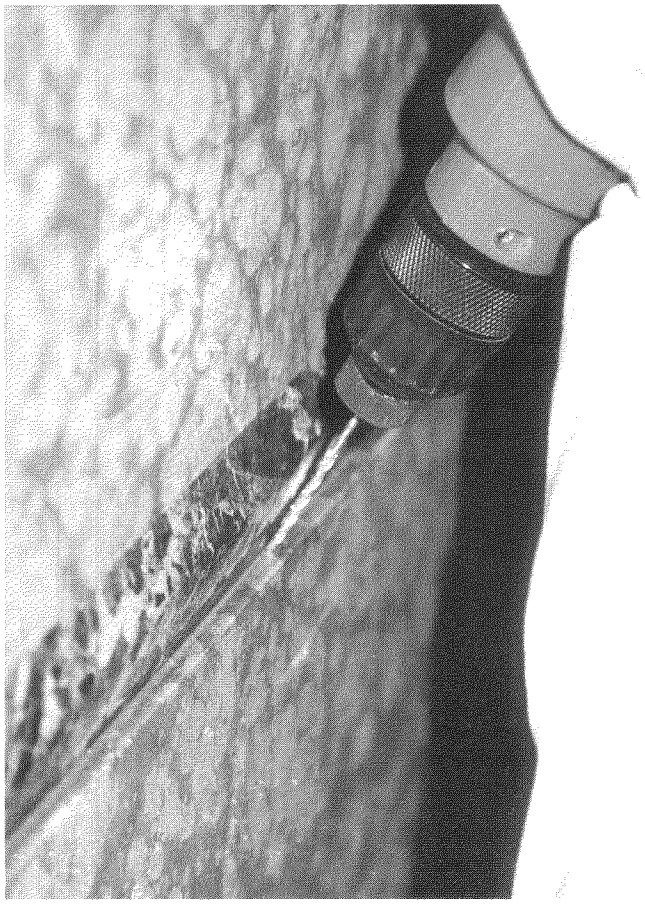


Figure 9. A 0.08-cm (1/32-in.) hole drilled at 45° to accept the tail of the mechanical fastener.

plaster of Paris adhesive that had already been seen to fail in so many locations. It was determined that three wire fasteners per average tile would be required.

Our approach was to drill three 0.5-cm (3/16-in.) holes through the grout into or through the terra cotta. Along the top edge, two holes were located 15 cm (6 in.) from each end of each tile. Along the bottom edge, one hole was drilled in the centre of each slab. Some of these holes went through plaster and some went through a void (between the marble and terra cotta) and on into the terra cotta.

A second set of holes, 0.08 cm (1/32 in.) in diameter, was drilled 1.25 cm (1/2 in.) deep at a 45° angle into the edge of the tile in line with each of these holes. A custom-made helical stainless steal wire spring with a long straight tail was inserted into these holes.[8] The tail end was site cut to length and sharply bent for insertion.

The end of the helix was filled with plasticine to prevent the adhesive from running out. The hole was pre-wetted with methanol, a 50% Rhoplex/methanol mixture, and then, while still wet, injected with a filled adhesive[9] down the centre.

These fasteners were very discreet once placed, but occasionally a glint of reflection from the stainless wire was noticed. This was hidden with a dab of grout-coloured acrylic paint applied with a toothpick. Three thousand such fasteners were used on the project.

Testing

Full coalescence of Rhoplex MC 76 takes place within 30 days. Testing was carried out using a suction device (the type used for carrying sheets of glass) and a mechanical spring scale. More than 91 kg (200 lbs.)

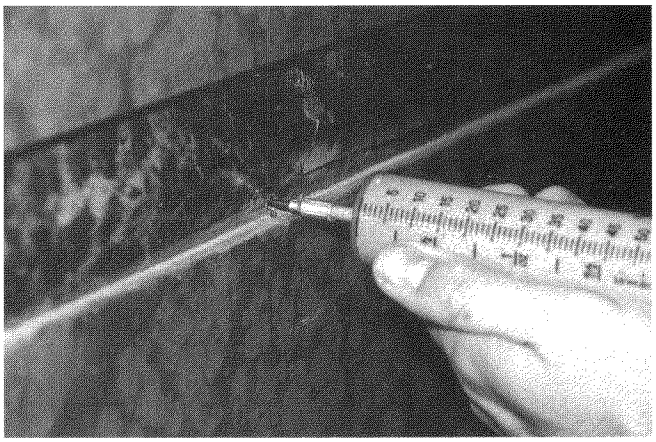


Figure 10. A filled adhesive is applied by injection through the centre of the helix to bond the stainless to the terra cotta. Once set, the straight end is fitted into the angle hole and a drop of Rhoplex placed to hold it.

Figure 11. Stainless helical spring is inserted. Note the tail is formed to fit the hole being drilled in Figure 9.

pull was applied to 20 randomly selected locations in the hall. None failed.

For interest sake, the same test was applied to a section of marble cladding that had been removed and re-applied using modern purpose-made construction adhesives over a similar terra cotta tile base. Adhesion failed at 22.7 kg (50 lbs.) pull.

Conclusions

1. Ground penetrating radar is a useful technique for determining conditions within some complex wall structures.

2. Detached marble cladding can be preserved in historic buildings in situ with minimal intervention.[10]

Endnotes

1. Kalman, H. *A History of Canadian Architecture Vol. 2.* Toronto: Oxford University Press, 1994, 760 pp.

2. Despite what is often claimed and intended by building custodial staff and their managers, buildings are very seldom maintained at an even and suitable temperature/humidity condition during prolonged periods of vacancy. Without the occupant to complain when the environment changes radically, the custodian has little notification that extremes are even occurring. In the Dominion Public Building case, the temperature of the wall near the ceiling could easily have dropped below freezing without the monitoring device at floor level registering the change.

3. Until one sees and feels such demolition activity first hand, it is hard to believe that it would ever be permitted inside a building that is being preserved in part for its architectural significance. It is as if the left hand doesn't know or agree with what the right hand is doing.

4. Hamilton is a centre of heavy industry in Ontario and as such is the home of the Non Destructive Examination Institute of Canada; Managing Director Doug Marshal kindly assisted HPCS by setting up trials of both impact echo and ultrasonic examination systems.

5. Senior Geophysicist Milan Situm of Geophysics GPR International Inc. carried out mapping of the plaster adhesive behind the marble tiles. Georadar uses a radar technology to obtain a continuous profile of the subsurface. The basic principle is to send an electromagnetic impulse into the surface. This pulse will travel through the material and reflect off boundaries of differing dielectric constants. A reflected pulse returns to the surface and is recorded by a receiver. Typical examples of boundaries include air/water; water/earth; earth/metal; and differing earth materials. Using that company's unique hand-held antenna connected to a computer he was able to record scanned transmission data directly on the marble surface.

6. Methanol is a WHMIS Class B-2 flammable liquid, and a WHMIS Class D 1-A Very Toxic substance. Safety precautions include protective clothing, air quality management, and fire prevention. Refer to the Material Safety Data Sheet available from any supplier before use.

7. Morgan Phillips discusses Rhoplex as a consolidant in *APT Bulletin* XII, 2 (1980), p. 37.

8. Custom springs for this application were fabricated by Bohne Spring, 60 Coronet Road, Toronto, Ontario.

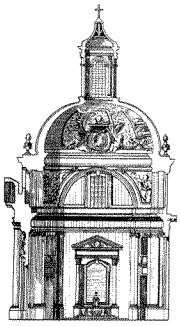
9. The filled adhesive used was a mixture of Rhoplex, lime, micro-balloons, and fluid petroleum coke, thickened to a gel state with Acrysol ASE 60.

10. Historic Plaster Conservation Services Limited Web site (www.historicplaster.com) contains further information about this project.

Résumé

Restauration des marbres à l'édifice public Dominion, à Hamilton, en Ontario

Cet article examine le traitement de conservation du revêtement de marbre sur les murs de la grande salle postale de l'édifice public Dominion à Hamilton. Le liant d'origine entre le revêtement de marbre et le mur de support en terra-cotta était un adhésif au plâtre de Paris. Le balayage de la surface avec une antenne radar miniature mais très puissante, récemment mise au point, a fourni aux restaurateurs une carte montrant l'emplacement précis, la forme et la dimension de chaque plaque d'adhésif au plâtre. Cette technique de repérage non destructive a permis de réparer le liant là où il avait cédé (soit entre le marbre et le plâtre de Paris, soit entre le plâtre de Paris et la terra-cotta, ou les deux), avec très peu de perturbations de l'édifice même. Une fixation mécanique supplémentaire mise en place comme système de réserve pour chacune des plaques de marbre est également expliquée.



Repairs to the Ceiling of the Blue Room, Holme Lacy, *Hereford, UK*

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Abstract

Holme Lacy is a Grade 1 listed house built in 1674, presently run as a hotel. When cracks were noticed in the ceiling of the 17th-century decorative plasterwork where one of the main tie beams had fractured, the proposed treatment involved inserting steel bars set in resin into the beam. Although controversial and not condoned by certain parties (including me), the other beams underwent the same treatment.

Following the acceptance of specifications and a method statement from Herbert Read Ltd., a laser levelling device was used to monitor movement, and the ceiling and beams were propped to minimize vibration and collapse. The ceiling itself was tied back and repaired.

The wisdom of using non-conservation specialists to inspect and specify work for historic structures is questioned. In this case, because of the manner in which the initial investigation was carried out, the actual reason for the beam failure was not discovered before work was started. This information would have substantially minimized the level of intervention.

Holme Lacy

Holme Lacy is a Grade 1 listed country house built in 1674 by Anthony Deane for John, Second Viscount Scudamore. It is believed to incorporate portions of an earlier building on the same site. The 17th-century building consisted of a main central block with cross wings at the north and south ends. The Saloon (now the Blue Room) was the major room of the house. The building was substantially altered and added to by William Atkinson (1828–1831) and by Sir Robert Lucas-Tooth (in the early 20th century). Built of brick, it is faced with local red sandstone (Hereford stone) ashlar with limestone (Bathstone) dressings. The roofs are covered by slate (Welsh and Westmoreland) and are hipped.

The house is notable for the quantity and quality of its wood carving by Grinling Gibbons. This work was the subject of Herbert Read Ltd.'s first involvement with this building (when extensive restoration work and recarving to these and the rare external carving by the same craftsman were undertaken).

The principal ground floor rooms in the south wings and central block have ornate 17th-century plastered ceilings. The Saloon (Blue Room) has the highest and most impressive ceiling which, above the cove, is original 17th-century work. Below is a frieze and pedimented doorways executed in the 19th century during the alterations to the house.

The Blue Room

This principal room of the 17th-century structure (formerly the Saloon) has undergone much remodelling since its construction, with the only discernibly original part being the plaster ceiling. The plaster ceilings in the house were restored in the 19th century by an Italian stuccatore named Bernasconi, a noticeable motif of his work being a daisy-like flower on a stem (a design that is apparent in the work of the Blue Room and could be an indicator of a large degree of intervention at that time).

The room itself is a double storey lit by three large windows with semicircle heads along the east wall. There are three windows above these on the exterior wall that do not open into the room, being blocked off by the coving.

The three entrances to the room, two of which use original openings, were all heavily embellished and pedimented in a classical manner during the 20th century.

The fireplace and walls between the windows have tall rococo-style mirrors, all of which are recent alterations. The original fire surround and overmantle were sumptuously decorated with Grinling Gibbons carvings.

Skirting, dado, and cornice are all enriched with acanthus-leaf and egg and dart moulding; the wall panels have applied mouldings surrounding them.

The ceiling itself is an elaborate affair that sits on deep coving above a recent frieze. This coving carries

Figure 1. Blue Room, circa 1900. Note the Grinling Gibbons overmantle and ornate plaster festoons, which are now missing. Photo: Country Life.

cartouches and crests of the Scudamore and Cecil families surrounded by branches of oak and laurel leaves. Where the coving meets the ceiling is a ridge that used to be festooned with free-hanging swags of leaves, fruit, and flowers, now sadly disappeared.

The rectangle of the ceiling has three main panels with segmented ends, and is banded by laurel and acanthus leaves and the aforementioned daisy-like flowers. The central panel has a large rosette, the end panels cartouches of coronets and branches. Smaller spandrel panels have naturalistic branches of leaves.

The design of the plasterwork and the depth of the work has the ceiling at different levels with large substructures forming the frames.

The decision-making process

Holme Lacy is let by the owner to Rank Warner Holidays UK (Rank) who operate it as a hotel. Their clientele is mainly people from middle age upwards, and therefore (due to the hotel management's perception of this demographic group's needs) the building has high levels of heating and low levels of humidity. This has caused a

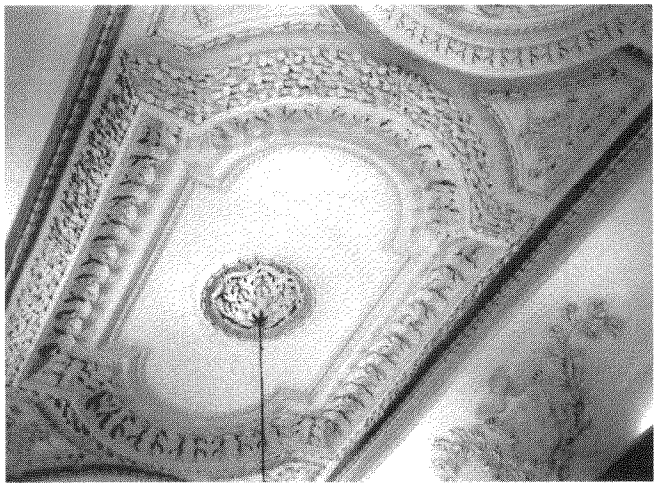

Figure 2. Ceiling of Blue Room, taken after completion of repair work. Photo: Chris Daniels.

large amount of change to the fabric and decoration of the buildings (we are now 4 months into a monitoring exercise using data loggers to record all the temperature and humidity levels continuously for 12 months in order to assess and perhaps resolve some solution) and is pertinent to this paper.

The Blue Room, used for special functions, is an important asset for the hotel. During one such occasion, a number of cracks were noticed in the ceiling. Owing to the fact that there is little or no maintenance to the hotel that is not essential, and to the lack of curiosity by the management and staff, nobody could be certain how fresh the cracks were.

Consulting structural engineers (used by the client for all their works whether new build, alteration, or repair) were called in to assess the situation. They immediately put the room out of use and provided a bird-cage scaffold to inspect the underside of the ceiling. To identify the nature of the deflection, a 350-mm-square piece of the plaster was removed from the radiation centre of the cracks; this material was put into a plastic carrier bag and discarded among the materials stored in the room during work.

It was discovered that the tie beam immediately above the cracking had developed a fracture approximately halfway along, and the subsequent settling had caused some minor cracking in the ceiling below. [It is important to note that while the cracks were undergoing repair towards the end of the project, the largest ones were found to have been repaired previously, probably within 10–15 years though there are no records of any such work.] The engineers also noted (with no small horror) that there was deflection of the other tie beams of up to 150 mm. To their modern thinking this indicated that the "main structural beams spanning the Blue Room have either failed or are

displaying severe structural distress" and "evidence of recent unexplained settlement." This conclusion (of the engineers) ignored the method of construction of these type of structures and the unmissable evidence of the ceiling's stability, and completely missed the major contributory factor for the failure of the beams.

The floorboards above the beams were lifted to gauge the extent of damage and a timber decay analysis company was called in to examine the timbers. Although all the correct procedures were used (such as Sibert decay probes), they did not open up the structure any further than the engineers had and this led once again to the major factor being missed.

All the findings indicated to the engineers that major intervention and repair work were necessary. Four options for this work were put forward to Rank and English Heritage:

1. replacement of four main beams with new oak beams;
2. strengthening of existing beams by plating;
3. formation of trusses, at beam locations, by utilizing main rafters and introducing new diagonal struts and ties;
4. formation of new structural 'overfloor' from which the existing ceiling structure could be suspended.

The method decided upon was a variation of #2: to reinforce the beams by the insertion of steel bars set in resin (a table of relative merits of each proposal was drawn up and unsurprisingly #2 scored joint lowest in terms of practicality and ease). This decision was fixed and immutable.

With the solution decided upon it was then deemed necessary to find a way to do this, within a budget and (most importantly to the client) a time limit. At this point Herbert Read Ltd. was called in to devise a method statement for the project, act as supervising officer, and carry out repair work to the the historic fabric.

Process of work

As it was going to be necessary to repair the network of cracks from above as well as below, their extent and location had to be mapped in order to locate them successfully. This would be virtually impossible to do by identifying the cracks from above as the space between the joists and beams had been completely filled with an expanding insulation material (Perlite) bonded onto chicken wire that had been nailed to the timber. It is interesting to note that this material is activated by the addition of moisture, that subsequently would be absorbed by the original structure, significantly altering its moisture content before drying out again. As there appears to be no record of when this was done there can be no comparison of states. Removing all the Perlite, to find the cracks, would have been too costly and taken too long. By setting up datum points in the corners of the room it was possible to record the position of all the cracks by triangulation using a laser measuring device. Transferring the datum points and measurements to a plan of the floor above, it was possible to locate and clear only those areas necessary.

The next priority was to afford the ceiling some support while all the work was carried out. This entailed upgrading the bird-cage scaffold in order to take the possible extra load of the ceiling. Once this was done adjustable jacks were inserted at points that coincided with the tie beams as well as possibly precarious areas of the plasterwork. The supports to the beams were inserted through the plaster by coring a 75-mm-diameter plug directly to the beam and then placing an oak plug of the same diameter and suitable length from the jack to the beam (so there was no pressure on the plaster). The plaster was 'soft-propped' by using a cushion of expanding foam on top of the jack (this meant the plaster was fully supported with no pressure exerted).

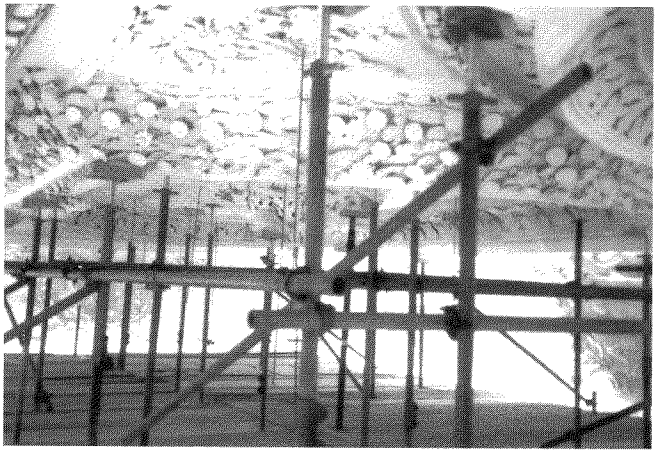

Figure 3. Propping system in place prior to work commencing. Photo: Chris Daniels.

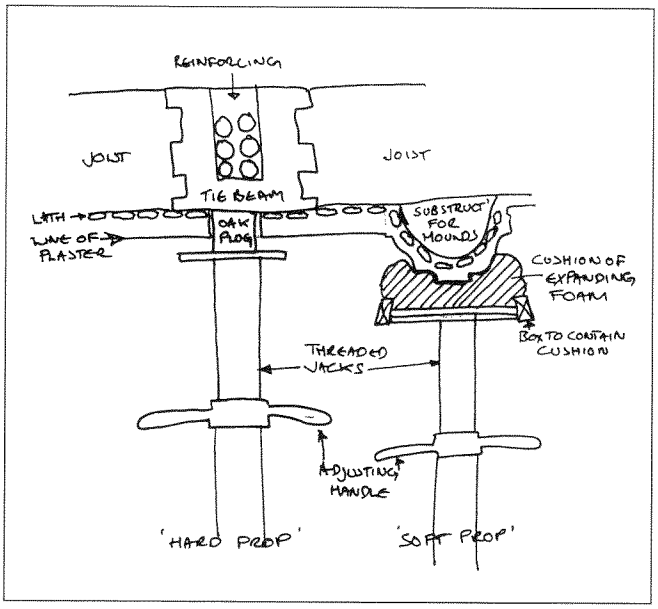

Figure 4. Propping design, showing hard and soft props.

Although this would be able to support the load, it was essential to monitor any movement that occurred when work was being carried out to the structure. This was accomplished by rigidly mounting a laser level to one corner of the coving, allowing it to traverse the space directly below the ceiling. Reference points were constructed from threaded bar and marker plates, set into the ceiling at sensible positions (as well as allowing line of sight to the laser — it was getting quite crowded at this point!) and adjusted to coincide with the laser beam striking a gradated plate that could be read easily to note any movement of the ceiling.

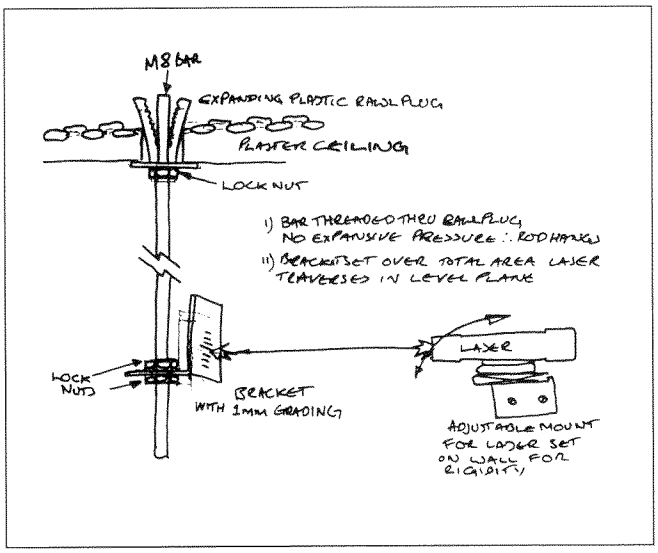

Figure 5. Laser monitoring system.

With the infrastructure in position it was possible to begin the work to the beams. The method was to form a channel in the centre of the beam from the top using a bespoke jig that allowed electric chainsaws to cut two slots at an exact depth along 6 m of the beam (it had been calculated by the engineers that it was not necessary to cut the whole 8-m length of the beam and so the metre under the eaves was left as is).

The timber between the beams was removed using chisels and chainsaws and all debris was cleared out. The fracture and all shakes were pinned where needed and filled with thixotropic epoxy resin Sikadur T36.

The channel in the beams was filled with 14 reinforcing mild steel rods, 32 mm in diameter, 6 m long. These were fixed into position using an epoxy resin grout Sikadur T36.

Figure 6. Chainsaw on jig showing partially cut slot in tie beam. Photo: Chris Daniels.

Figure 7. Junction of joists to tie beam showing straps and cleats added for extra rigidity. Also shown are the lugs through which structural ties, holding up plasterwork substructure, are secured and adjusted. Photo: Chris Daniels.

As all the beams had some degree of deflection, the steel rods could bend to follow the curve and the resin worked to fill the ends of the channels level with the top of the beam. Only one beam was worked on and without a centre at any one time so as not to weaken the ceiling too much. The lack of strength resulting from the beam being almost split in two was a major concern; it transpired though that as the structure was so stable there was no movement that could be attributed to the beams starting to fail.

Once the beams had been reinforced, straps and cleats were used to tie the joists to the tie beams, as shown in Figure 7.

During the treatment the ceiling had moved up and down (see Table 1) as weight was taken off by the removal of material and then as reinforcing was added. This movement did not result in any more damage to the structure or the plasterwork.

The next step was to secure the plasterwork. At first (during our initial survey) it appeared that as the heating levels had dried out the timber and plaster, subsequent shrinkage had caused cracking and symptoms that appeared to indicate the substructures were in danger of becoming detached and fractured; a system of ties was designed and inserted at imminent danger spots to prevent the perceived damage causing collapse. The same method of mapping the locations and extent of the cracks was utilized here to ensure accuracy and efficiency.

The problem of plaster detached from lath work is always to be considered when approaching work to this type of ceiling, and initial findings by those who undertook the first investigations indicated that this was happening. When we undertook the repair and reinforcing of the plaster, it was found that there was very little loss of attachment (by 'snots' being broken off or crumbling) and what loss there was had mainly been caused by overenthusiastic clearing away of the Perlite to look at the timber! The detached plaster was re-attached using a variation of the standard method, creating a basket attached to the joists used to support a layer of plaster that adhered to the original plaster. The method devised used expanded stainless steel sheet (Expamet) screwed to the joists on either side of the plaster that closely followed the contour of the back

Table 1
Laser level monitor readings of the height of the Blue Room ceiling, *Holme Lacy*, taken during repair work, August to September, 1998 (double readings were taken during beam strengthening)

Monitor point	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Date																			
25/08/98	3	2	4	2	3	3	3	2	1	2	4	3	3	2	3	1	1		
26/08/98	3	2	4	2	3	3	3	2	1	2	4	2	3	2	3	0	0		
27/08/98	3	2	4	3	3	3	3	2	1	2	2	3	3	2	3	0	0		
28/08/98	3	2	5	4	3	3	4	4	2	2	5	3	4	4	4	1	2	1	
01/09/98 am	4	2	4	4	3	3	3	4	2	3	0	3	5	4	4	1	2	1	0
01/09/98 pm	3	2	3	4	5	3	2	4	2	2	-1	2	4	4	4	2	2	1	0
02/09/98 am	3	2	3	4	2	3	2	4	2	2	0	2	4	4	4	2	2	1	0
02/09/98 pm	3	2	3	3	2	2	1	4	2	2	-1	2	3	3	3	2	1	0	0
03/09/98 am	3	2	3	3	2	3	2	4	2	2	-1	2	3	3	3	1	1	0	0
03/09/98 pm	2	2	3	3	2	2	1	4	2	2	-1	1	3	3	3	1	1	0	0
04/09/98	3	2	4	3	2	3	2	4	2	2	-1	2	3	3	3	1	2	1	0
07/09/98 am	2	2	2	3	1	2	1	3	1	1	-2	1	2	2	2	1	1	0	0
07/09/98 pm	2	2	2	2	1	2	1	3	1	0	-2	1	2	2	2	0	0	0	0
08/09/98 am	2	2	2	2	1	2	1	3	0	0	-2	0	2	2	2	0	0	0	0
08/09/98 pm	2	2	2	1	1	0	1	3	0	0	-2	0	2	2	2	0	0	0	0
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09/09/98 pm	2	1	2	2	1	1	1	3	0	0	-1	0	2	2	2	1	1	0	-1
10/09/98	2	1	3	2	1	1	1	3	0	0	-1	0	2	2	2	1	1	0	-1
11/09/98	3	2	4	3	2	1	2	3	1	1	-1	1	3	3	2	1	1	1	0
14/09/98	5	0	0	0	-1	-2	-3	1	0	-2	-4	-3	-1	-1	-1	0	-3	-3	-4
15/09/98	1	-1	-1	0	-2	-2	-2	1	0	-2	-5	-3	-1	-1	-2	0	-3	-3	-6
16/09/98 am	0	-1	-1	0	-3	-3	-4	1	-1	-3	-6	-4	-1	-1	-3	0	-3	-3	-5
16/09/98 pm	0	-1	-1	-1	-2	-2	-3	0	0	-2	-4	-3	-1	-1	-2	0	-3	-3	-5
17/09/98	0	-2	-3	-2	-2	-3	-4	0	-1	-4	-5	-3	-1	-1	-1	0	-3	-2	-5
18/09/98	0	-2	-2	-2	-3	-3	-4	0	0	-3	-5	-4	-2	-2	-3	0	-3	-4	-5
21/09/98	-1	-3	-4	-3	-5	-4	-6	0	-1	-5	-6	-6	-4	-4	-5	-1	-5	-5	-6
22/09/98	-1	-3	-4	-2	-5	-4	-6	0	-1	-5	-6	-6	-3	-3	-5	-1	-5	-5	-6
23/09/98	-1	-2	-3	-2	-4	-3	-5	0	0	-4	-5	-5	-3	-3	-4	0	-4	-4	-6
24/09/98	0	-3	-3	-2	-4	-3	-4	0	0	-4	-6	-5	-3	-3	-3	0	-4	-4	-6
25/09/98	-1	-3	-3	-3	-4	-5	-5	0	0	-5	-6	-6	-3	-3	-4	0	-4	-4	-6
28/09/98	-2	-4	-4	-4	-5	-6	-6	-1	-1	-5	-7	-7	-4	-4	-5	-1	-6	-5	-7
29/09/98	-1	-4	-4	-4	-5	-5	-6	-1	-1	-6	-7	-6	-4	-4	-4	-1			

Figure 8. Cleaning out material between joists. Note back of plaster (snots) pushed through lath and also substructure of central ceiling rose. Photo: Chris Daniels.

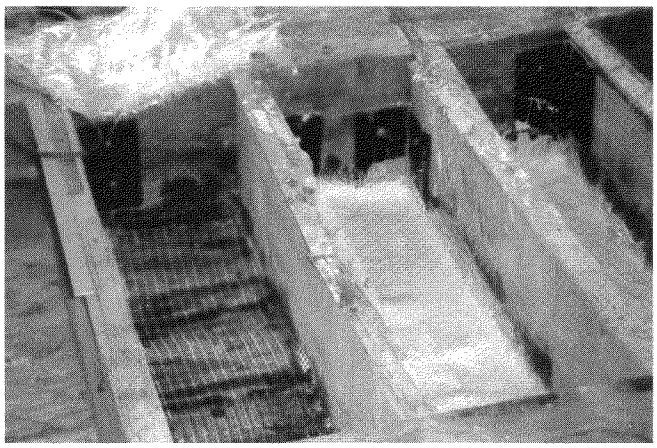

Figure 9. Re-attaching plaster to structure. Expamet shown in left bay, poured plaster in other bays. Note fibreglass mat on tie beam. Photo: Chris Daniels.

of the laths; plaster was poured through this to form a wet coat, and then woven glassfibre mat specifically designed to reinforce plaster was laid on and more plaster poured over and tamped in to ensure even coating of the whole area. Polymer modified plaster (Polycrystal) was used as it has been found to dry out at a slower rate than ordinary plaster, resisting the inevitable and weakening 'suck' (a useful attribute considering the extreme dryness of all the original materials). The resultant backing is much lighter and stronger than the usual hessian (welded stainless armature wire and plaster of Paris), and with its good retention of moisture did not impart sudden changes of moisture level to the surrounding materials.

Cracks were vacuumed out, rinsed, pre-wetted, then filled with a mixture of Polycrystal and plaster of Paris. All plug holes and larger areas of material (there were places where ornament was detaching or broken) were repaired on stainless steel armatures and filled with a mortar of the original material ground down and with Polycrystal as the matrix binder. The methods used here were attuned to the fact that there would be little time for looking after and tending materials that shrunk upon drying, or needed excessive moisture to slow the drying out.

Repairs were decorated and toned in with a water-based distemper paint.

The missing Perlite insulation was replaced with a fibre insulation (Rockwool), and the floorboards were re-laid (these had been marked prior to lifting, though some lifted during the primary survey had been misplaced) on new packing to smooth out the undulations of the floor, and fixed by screws rather than permanent nailing. The floor was then covered with 4-mm hardboard to minimize the incidence of raised board edges becoming a nuisance.

The room partitions and fixtures were re-created using studwork and plasterboard.

All propping was removed gradually in sweeps across the room to minimize sudden loading, all the while being monitored using the laser level.

Points to ponder

Throughout the ceiling structure there seemed to be very little incidence of biological decay factors; some laths and small areas of the main timbers were degraded, though not enough to affect structural integrity (the wood removed from the centre of the beams was in excellent condition and is of such quality that it is being utilized by Herbert Read Ltd. for repairs and new carving). This was notable when considering the conclusion of the primary inspections, and it is my opinion and also that of the conservation officers of the local council that the repair work need only have been carried out on the fractured beam.

When the partitions were being surveyed for removal it was noticed that the wall directly above the beam that had fractured was pinched top and bottom in an intriguing manner that warranted further investigation. Where the tie beams joined the eaves the sharp angle had been partitioned off to give a more room-like feel and to box in services; the space in-between the fractured beam and its neighbour had originally housed a fireplace with the stack running up through the eaves. This structure was a dormer with boarded and slated spandrels, the side nearest the fractured beam being completely boxed in with lath and plaster. Whereas all the other junctions of the rafter meeting the tie beams were exposed, this one was not and had not been uncovered at the primary investigation. An exploratory hole indicated that there was no timber where the rafter should have been, so it was necessary to open up the wall for further investigation. What was revealed was truly exceptional! The rafter had completely disappeared from where it sat on the tie beam to ceiling joist; 3 m of 300-mm-square oak had undergone attack and total disintegration by what appeared to be a *Donkiaspora gianta* form of wet rot. The extent coincided with the junction of the dormer spandrel and the mansard slope of the roof, where the slates had been nailed to the boarding with the omission of a lead flashing to line the valley. This had allowed water to leak directly onto the rafter, creating ideal warm and wet conditions for the subsequent rot.

The missing length of the rafter caused the not inconsiderable weight of the roof to be focused onto the joist which transferred the load through an upright in the partition wall to the middle of the beam. This coupled with the loss of upward thrust from the weight of the rafter exerting a leverage on the end of the tie beam meant that the beam was under excessive load and fractured on a weak point where a knot existed.

Figure 10. Extent of missing wood from rafter. Remnant of rafter resting against roof boarding. Note nail at right is 150 mm long and was used to attach joist to rafter. Photo: Chris Daniels.

Conclusions

The obvious conclusion is that through insufficient or substandard maintenance, a piece of lead flashing (costing no more than £5 and taking less than a day to install in an easily accessible area) was missing and thus ended up causing work of more than £55,000 to be undertaken.

The level of intervention (and cost) could have been substantially reduced if there had been a survey and recommendation undertaken by professional conservators working with the engineers from the very first rather than working to specifications based on preconceptions of those not familiar, and unhappy, with the seemingly non-standard conditions in which an historic structure can exist.

As mentioned previously, the whole interior environment of the building is being monitored for the next year and we hope the results will form the basis for a climate control system.

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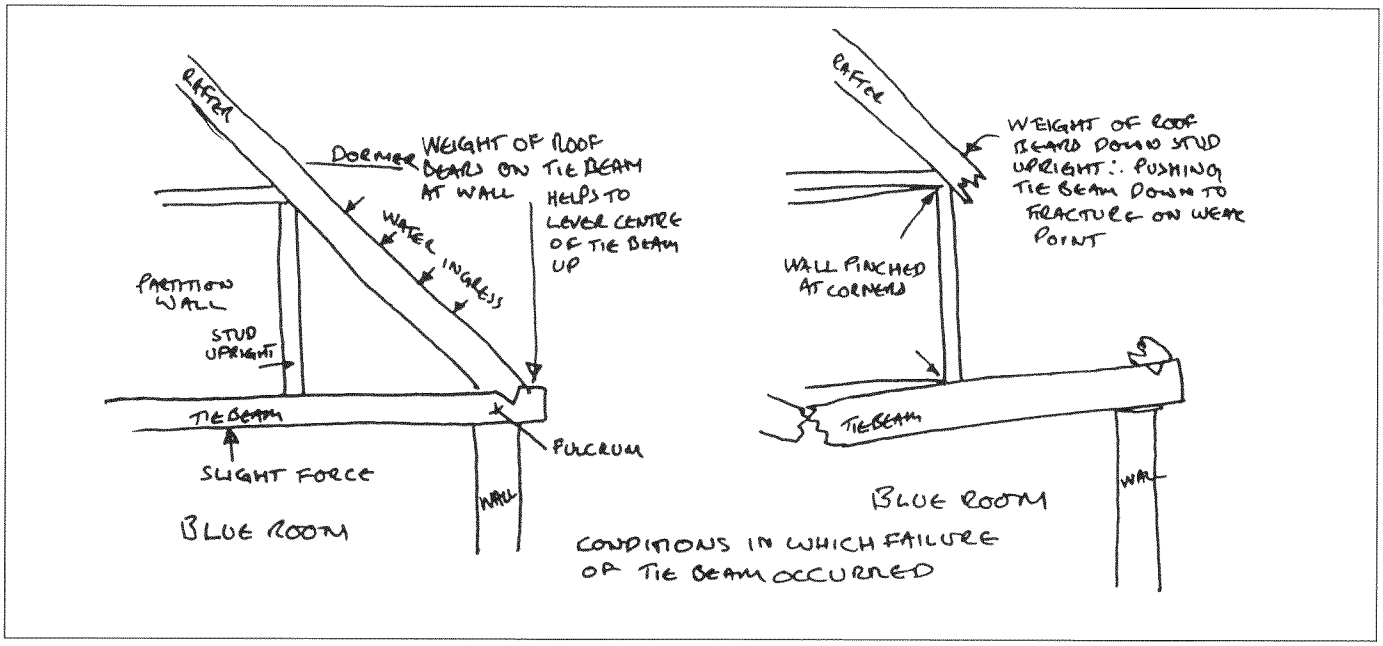

Figure 11. Factors causing fracture of tie beam.

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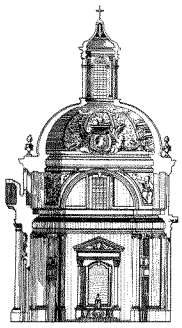
Résumé

Réparations au plafond du Blue Room, Holme Lacy, dans le Hereford (R.-U.)

Holme Lacy est une maison enregistrée de Classe 1 construite en 1674, qui est actuellement exploitée comme hôtel. Lorsqu'on a remarqué des fissures dans le plafond, dans le plâtre décoratif du XVII^e^ siècle là où l'une des principales entretoises avait cassé, le traitement proposé consistait en l'insertion de barres d'acier scellées dans la résine dans l'entretoise. Le traitement était controversé et désapprouvé par certains (parmi lesquels moi-même), mais il a été appliqué aussi aux autres entretoises.

Suite à l'acceptation des devis et d'un énoncé de méthodes de Herbert Read Ltd., un appareil de mise de niveau au laser a été utilisé pour surveiller les mouvements, et le plafond et les entretoises ont été étançonnées pour réduire au minimum les vibrations et éviter l'effondrement. Le plafond lui-même a été ancré et réparé.

La sagesse d'avoir recours à des spécialistes dans d'autres domaines que celui de la conservation pour inspecter les structures historiques et préciser les travaux à exécuter est mis en question. Dans ce cas-ci, à cause de la manière dont a été faite l'inspection initiale, la véritable raison du bris de l'entretoise n'a pas été décelée avant le début des travaux. Cette information aurait réduit de beaucoup le niveau d'intervention.



The Conservation of the Chinese House at Stowe

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Abstract

The Chinese House at *Stowe* was first mentioned in an early-18th-century account but its subsequent history was poorly documented until it was rediscovered in Ireland more than 200 years later in a neglected state. An extensive conservation program involving conservation of original timbers, replacement of rotten timbers, and reconstruction of the roof and floor, as well as the removal of 20th-century overpaint from the decorative surfaces and consolidation of the surviving 19th-century decorative scheme, was undertaken. The re-creation of the decorative scheme on two sides returned the house to its original appearance. Analysis of the paint layers, testing of suitable varnishes for the protection of the exterior, and monitoring of any colour changes by a spectrophotometer were important parts of the project.

Stowe, the former home of Sir Richard Temple and his descendants (the Dukes of Buckinghamshire), is renown for its magnificent gardens and architectural buildings of different styles. Despite the numerous alterations to the landscape many of the buildings have survived. One in particular has had a long torturous history and has only recently been returned to *Stowe*; this is the Chinese House. It was built in the early 18th century, removed from *Stowe* in 1750 to be re-erected on a neighbouring family estate (*Wotton*), and then transported to County Kildare, Ireland, in 1957. By this time its history had been forgotten; its rediscovery 20 years later was due to Dr. Patrick Conner, who identified it as having been at *Stowe*. The National Trust was able to purchase the house and return it to England for extensive restoration and conservation treatment before it was reinstated at *Stowe*.

The Chinese House is first mentioned in an anonymous account of 1738, where it was described by a visitor as "in the middle of an old Pond is a house built on piles, after the manner of the Chinese, odd and Pretty enough but as the form of their Buildings is so well known from Prints and other Descriptions, there is no Occasion to say more of it."[1] A second description (1742) is more informative as it recorded "it is a square building with 4 Lettices [i.e. lattice windows] and covered with cloth to preserve the lustre of the paintings; in a Chinese lady as if asleep, her hands covered by her gown... the outside of the house is painted in the taste of that nation by Mr. Slatea: the inside is India japann'ed work."[2] None of the early sources reveals who designed the Chinese House, but it is possible that it was the work of William Kent (the architect for a number of other garden buildings at *Stowe*). The exterior paintings are recorded as being by Francesco Sleter, a Venetian artist who was employed at *Stowe* to paint several interior rooms in the house and also a number of interiors of the garden buildings.[3]

The Chinese House has had a history of repainting and restoration, and none of the early painted designs on the interior or exterior is visible today. The first record of work was in 1779 (after it had been removed from *Stowe* and re-erected at *Wotton*) when an account mentions work undertaken by a pair of painters who spent 3 days each working "at the Chinese building."[4] The next recorded account of any restoration work was in 1937 when the paintings were restored by Percy Willats of Lenygon and Morant, a London decorating firm. There are no details concerning the restoration, but a 1949 photograph in *Country Life* shows its appearance at the time. In 1957, Major Michael Beaumont purchased the Chinese House and moved it to his Irish estate in County Kildare. At this time the exterior was certainly repainted (a comparison of its present appearance with the *Country Life* photographs shows a change in style). The faces of the Chinese figures were 'westernized' and the floral paintings acquired different types of flowers, but it is not known who undertook this restoration. The interior painted decoration was not touched by either the 1937 or the post-1957 restorations and there is no archival information about any earlier restorations.

The house was in a neglected state by the time the National Trust acquired it, having suffered extensive paint loss on two exterior walls (below the top Buddha and dragon panels which were in relatively good condition) as well as rot and insect damage to the wooden structure. The south side had been weathered back to the bare wood and less than half the paint survived on the west wall. Prior to dismantling the house, a condition report on the painted

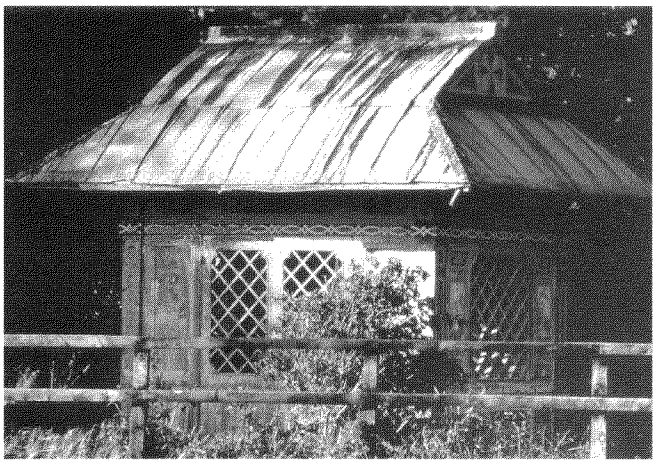


Figure 1. The Chinese House in Ireland. Photo: the National Trust.

surfaces was written and the exterior painted surfaces faced with BEVA 371 and tissue paper. Upon arrival in England, a condition report on the timber framework was commissioned so that the National Trust could develop a conservation methodology for the painted surfaces and the timber structure.

The house measured 3.8 m long by 2.8 m wide by 3.4 m high (roof excluded), and was constructed of exterior and interior softwood panels applied to an oak frame. The four sides of the house were joined with pegged mortise and tenon joints at the corners with the exterior corners being covered with softwood pilasters. Interior and exterior rails separated the decorated panels, and double doors on the north and south sides provided access into the house. The lower sections of the house and corner pilasters suffered from extensive rot including total loss of some sections, splitting of panels, and shrinkage cracks, and dado rails were partially detached from the framework. In some areas the panels were completely riddled with holes from insect attack. Previous repairs had used inappropriate materials which had caused further damage to the structure.

The painted surfaces presented an interesting dilemma as half of the exterior paint was missing and the other half was flaking, cupping, and delaminating between the various overpaints. In addition, the paint layer was poorly bound presenting a whitish appearance overall. The interior surfaces were in better condition although disfigured by water stains, blooming of the varnish, and vandalism. Stylistically, the interior and exterior decorations were of different dates, with the interior being from the early 19th century and the exterior from the mid 20th century.

The approach to the conservation treatment was discussed and formulated by National Trust staff including the Historic Buildings Representative for *Stowe*, the Architectural Historian, the Adviser on the Conservation of Painted Surfaces, the Advisers on Furniture and Wood, and the project Architect. Initially it was agreed that structural repairs would be undertaken to ensure stability and that the paint surfaces would be consolidated, surface cleaned, and varnished. In areas where either new wood was inserted or there was extensive paint loss, the wood would be primed and painted in a single unifying colour, and the roof and floor would be entirely replaced as they were in very poor condition.

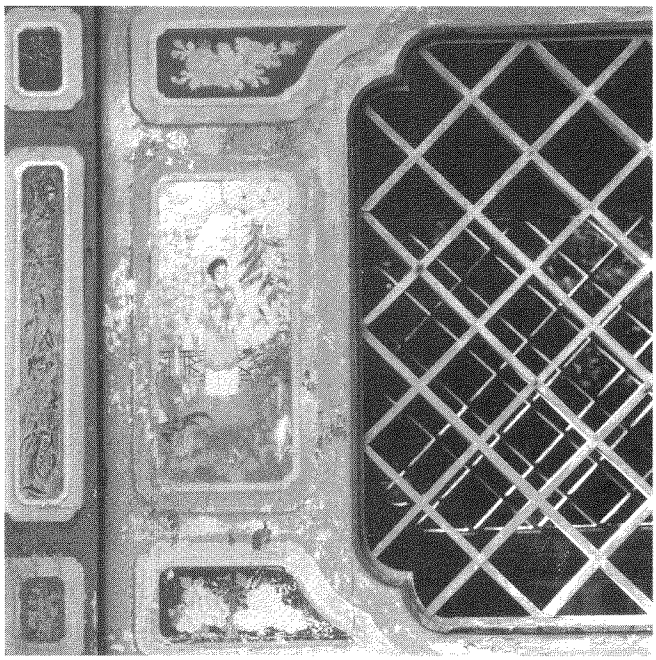


Figure 2. Exterior figurative panel. Photo: the National Trust.

Figure 3. Decorative panel on the interior. Photo: the National Trust.

However, as the project proceeded it became quite evident that a more detailed consideration and treatment of the painted decoration was required and this would alter the initial approach of minimal intervention. Consolidation was not wholly successful in the areas of severely cupped paint which had survived on the two badly weathered sides, and it was felt that they would continue to deteriorate in the outdoor environment. Where the post-1957 overpaint had flaked off, the underlying paint layers appeared to be in relatively good condition. In order to understand the paint history of the interior and exterior and to determine the extent to which the underlying areas were in good condition, paint analysis was undertaken.

The interior scheme appeared to consist of three distinct layers. The first layer was a warm green with narrow lines of black, yellow, and dull red as borders around decorative panels. All the rails were also green with some black bordering just below the ceiling. The second scheme involved repainting in a much darker and more intense blue-green colour (verdigris and green copper glazes) which was covered by a thick oil varnish. X-radiographs showed urn-like decorations in the centre of the panels which relate either to the first or second scheme. Certain areas (such as the edges of doors and the rails) were highlighted with gold metallic powder sprinkled onto the wet varnish, which was a classic japanning technique. This would have given an overall appearance of a japanned interior which coincided with the 1742 description. The final scheme involved a complete repainting with three separate undercoats to provide a lighter background to the decorative panels. The presence of chrome green in the decorative panels indicated a date after 1818 (the introduction date) and the use of Prussian blue coincided with this date, as Prussian blue was generally replaced by French ultramarine after 1828. At this point, the rails were painted bright red (vermilion) instead of warm green or black.

The exterior was more difficult to interpret primarily because it would have been more frequently repainted as well as scraped back. Small traces of the 18th-century scheme were found that indicated the presence of a warm green colour (as on the interior) as well as smalt. Smalt was an unusual choice for it simply would not have survived in the outdoor conditions and would have readily degraded to a greyish colour requiring frequent repainting. This may account for the painters' work at *Wotton* in 1779. The 1820 scheme was the first complete scheme that survived and it was similar to the interior decoration. Additional work was carried out in the late 19th century and included repainting and revarnishing. In 1937, Percy Willats repainted the exterior but appears to have followed the earlier 1820 and late-19th-century restorations. The exterior was repainted once again after 1957, this time in a very crude fashion.

With a clearer understanding of the paint history, it was decided to undertake cleaning tests to determine if it was possible to remove the post-1957 restorations on the decorative panels. The cleaning tests revealed that the underlying layer was in relatively good condition although it appeared that the surface had been scraped to remove loose paint. The paint surface appeared to be largely the 1820 restoration with the remains of some of the 1937 restoration, Percy Willats having retouched and reintegrated missing areas in the 1820 scheme.

The removal of the post-1957 and 1937 restorations reflected a major change to the initial conservation strategy, and this was to continue throughout the project as the appearance of the house changed with the removal of overpaint and the addition of replacement timber. The decisions were made by the original committee and reflected curatorial and conservation considerations. The overall philosophy was to create a unified, balanced appearance that would retain the 1820/late-19th-century structure in combination with surviving later additions in good condition, and would clearly indicate the new alterations. As part of this approach, the areas of severely cupped paint had to be reconsidered as it was felt that they would continue to deteriorate in the outdoor environment. The underlying timber was badly decayed as were some of the surrounding timbers. Bearing these factors in mind, it was agreed to remove two of the painted panel sections for archival reference and completely remove the remaining traces of paint.

The final and perhaps most difficult considerations were the appearance of the original paint layers after the removal of the overpaint and the treatment of the two sides of the house (below the Buddha panels) that would be devoid of any paint and combine old and new sections of wood. The original paint surfaces were in an abraded condition but there was sufficient detail to undertake retouching of some of the missing areas while leaving other areas less distinct. The two deteriorated sides presented a more difficult problem and although the original approach was to paint any new sections in a unifying colour, it was now felt that such a large area of one colour would be visually unsatisfactory. The three options were to (1) paint the background colour and painted borders but leave the decorative panels blank on the walls as copied from the original walls; (2) paint one wall as above but re-create the one wall section that was clearly visible in the 1949 *Country Life* photograph; or (3) paint the one wall from the 1949 photographs and re-create the final wall based on what was barely visible in the 1949 photograph combining it with figures and motifs from the original walls. The final option was chosen as it was felt that it would present a uniform appearance to the house while clearly distinguishing the 19th-century originals from the 20th-century re-creations.

The conservation treatment of the structural work and the initial consolidation of the painted surfaces were undertaken by John Hartley and Hugh Routh of Tankerdale Workshop. Prior to the structural work, the painted

surfaces were consolidated using Plextol D528 (an acrylic copolymer dispersion) which was selected for its suitability of application and stability in an outdoor environment. All rotten timber sections were treated for woodworm and consolidated with Bencon 20 (an epoxy resin). For those sections that were to be replaced, either pine timbers from salvaged 18th-century Baltic pine of similar grain and moisture content or English oak of similar grain and moisture content were used. Joints were glued with hot animal glue (where this would have been used originally) and new patches and splices were adhered with an epoxy resin, particularly in those areas susceptible to water penetration. In many areas, nails had been used to secure the structure and these were replaced with stainless steel screws, counter-bored below the surface and covered with soft-wood buttons. Panel joins were resecured and strengthened by beech 'biscuits' which were small sections of wood fitted into curved mortise-type sections. Small cracks were filled with pine inserts but larger cracks were left to be treated in situ if necessary once the house acclimatized to its outdoor environment.

As the copper roof and floor were to be replaced, Tankerdale worked with the architect to design the replacements. The roof presented an interesting problem as the existing roof had a convex shape whereas early-18th-century sketches of the roof showed both concave and convex sketches. As there was no firm evidence for the roof structure, it was decided to re-create the previous roof outline. Initially, the end gablets were to be preserved but closer examination revealed their fragile condition and confirmed that they were largely 19th- and 20th-century replacements. Thus they were retired to join the archive collection and new gablets were constructed.

Once the wooden structure had been conserved and restored, the entire house was transported to the studios of Alan Bush and Jonathan Berry for treatment of the painted surfaces. Various solvent gels and commercial paint strippers had been tested for the removal of the overpaint but none proved satisfactory, so scalpels were used to remove it. After removal, the surfaces were cleaned with a mixture of triammonium citrate, triethanolamine, isopropanol, and water, and further consolidation was undertaken.

The removal of overpaints was confined to the decorative panels as the borders and background areas had been continually repainted. Their surface condition varied and decisions regarding the extent of any new repainting or retouching were made on an individual basis and were influenced by the overall appearance of the painted surfaces in order to ensure an overall balance. The retouching of the decorative panels was undertaken in Paraloid B72 (an acrylic polymer) with dry pigments whereas the repainting of the surrounding surfaces and the two new wall sections was in a traditional lead-based oil paint. The use of lead-based oil paint as opposed to a modern synthetic paint was chosen on the basis that its visual appearance and its aging characteristics would be more in keeping with the lead-based paints in the 1820 scheme. In England, lead-based paints can only be used on Grade 1 or Grade 2* listed buildings so the necessary permits were obtained prior to use.

The interior of the house received only minimal treatment as the painted surfaces were largely intact and minor conservation treatment could rectify the disfiguration caused by blooming and the deterioration of the varnish layer. It was decided not to remove the varnish layer at this stage. The overall cost of the project was considerable and it was felt that the interior could be treated more fully at a later stage if additional funds became available. The conservation treatment included consolidation with Plextol D528, surface cleaning with deionized water, filling in losses due to vandalism, retouching in a neutral colour, and revarnishing with Paraloid B67 (an acrylic polymer). Where new sections of wood had been inserted, they were toned with a neutral colour and there was no attempt to re-create the missing design.

Although the interior painted surfaces were varnished, it was decided not to varnish the exterior in order to allow

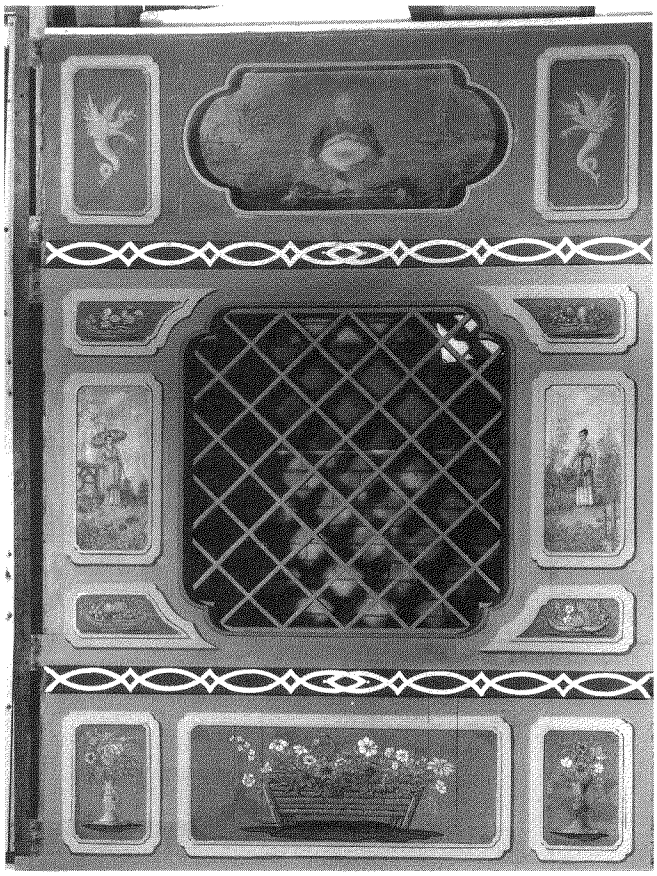


Figure 4. Conserved figurative and floral panels after removal of overpaints and retouching of losses. Photo: the National Trust, Ian Blatern photographer.

the lead paint to dry thoroughly over a 1-year period. During this time simple varnish trials were set to determine the most suitable and stable varnish for exterior use. A painted panel was prepared and coated with sections of different varnishes containing ultraviolet (UV) stabilizers and absorbers. The use of UV absorbers and stabilizers has been assessed for varnishes on indoor paintings but there has been very little work on their effectiveness for exterior varnishes. The following varnishes were tested: Paraloid B72, Paraloid B67, Paraloid B67/Regalrez (50/50), Ketone Resin N (a cyclohexanone), and Dammar. Samples of each contained the following additives: Tinuvin 292 and Tinuvin 328; Tinuvin 292 and Tinuvin 1130; Tinuvin 770 and Tinuvin 1130 (in each case, the former was the stabilizer and the latter the absorber). The sample board was exposed to the outdoor conditions for approximately 1 year. Surprisingly, all the varnishes showed little change but it was decided to use Paraloid B72 with Tinuvin 292 and 328, as Paraloid B72 is recognized as a very stable varnish and Tinuvin 292 and 328 have performed well in indoor situations. However, it is recognized that the additives will have a limited effect in outdoor conditions where the UV light levels are high.

In order to determine any colour change in the original as well as the newly applied lead paints, colour measurements

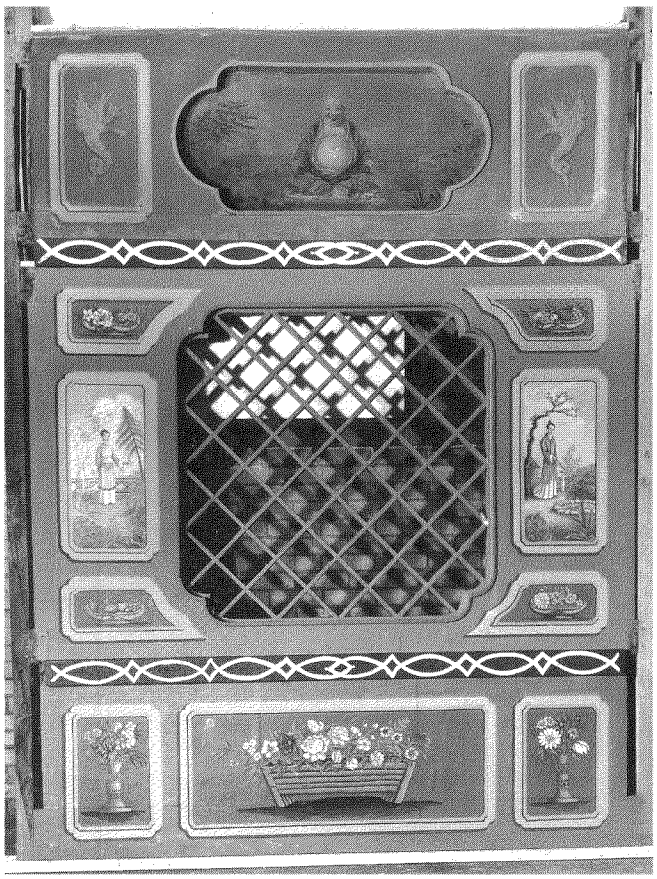


Figure 5. Re-created figurative and floral panels based on Country Life *photographs. Photo: the National Trust, Ian Blatern photographer.*

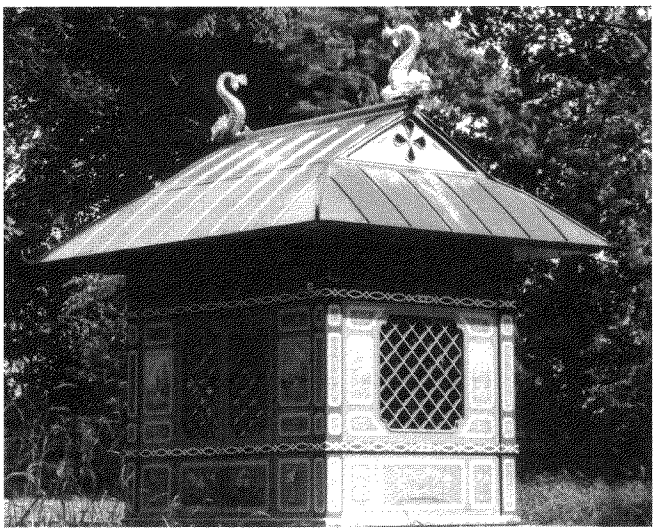


Figure 6. The Chinese House after conservation and restoration. Photo: the National Trust.

were taken using a Minolta Spectrophotometer CM508d. This method allows colour to be measured numerically and precisely, thus eliminating subjective perception and description. A year later, the locations were remeasured and it was noted that some colour shifts had occurred. While the colours had retained the same hue and dominant wavelength (i.e. what is commonly thought of as colour), they had become lighter and less saturated (particularly the greens). This may be due to the natural chalking effect of the lead paints and a visual observation of the surface certainly showed a desaturation or lightness of the colours which was most apparent in the greens (the dominant background colour). However, further measurements are planned after the house has been varnished and it will be interesting to see the results of these readings as the varnish will re-saturate the paint layers.

Although the Chinese House is now back at *Stowe*, the project is ongoing as we continue to monitor the colour changes and the stability of the varnish layer. The condition of the original paint and new paint will be checked yearly for signs of deterioration as will the structure of the house for signs of cracking or shrinkage of the timbers. In the winter months, the house is protected by waterproof curtains which are attached by hooks to the underside of the roof and retained by sunken fittings at ground level; this should reduce the rate of the deterioration that is an inevitable consequence of the English climate.

The original condition reports on the Chinese House were written in May 1993 and it was finally returned to *Stowe* in June 1998. Its slow rebirth from a completely neglected state to a conserved and restored house with 19th-century exterior and interior painted decorations and 20th-century re-creations was the result of the skill and sensitivity of the conservators. Although the original approach was modified

at various stages as the original structure was slowly uncovered, the guiding principle was always the integrity of the house and its materials and methods of construction. Where radical decisions were made such as the re-creation of the missing sides, lengthy discussions involving curatorial and conservation considerations preceded any final decision. The project proved to be a major undertaking for the National Trust which stemmed from the enthusiasm of the late Gervase Jackson-Stops, Architectural Historian for the National Trust, to see the Chinese House returned to the magnificent gardens of *Stowe*.

Acknowledgements

I thank the following people for their involvement in this project: Anthea Palmer (Historic Buildings Representative for Thames and Chiltern, the National Trust), Tim Knox (Architectural Historian for the National Trust), Linda Bullock (Assistant Adviser on Environmental Control for the National Trust), Andrew Bush (Regional Conservator for Thames and Chiltern, the National Trust), John Hartley and Hugh Routh (of Tankerdale Workshop), Alan Bush and Jonathan Berry (of Bush and Berry), Catherine Hassall (for paint analysis), and Fraser Brown (of Inskip and Jenkins, architects for the project).

Endnotes

1. George Clark, ed., *Descriptions of Lord Cobham's Gardens at Stowe (1700–1750)*, Buckinghamshire Record Society, 1990, no. 26, pp. 67–76, transcribed from a manuscript in the *Stowe* Collections at the Huntington Library, San Marino, California (Temple Manorial Papers, Box 8).
2. *Gentleman's Magazine*, vol. XII, June, July, and August, 1742, pp. 324, 380–382, 435–466.
3. Edward Croft-Murray, *Decorative Painting in England 1537–1837*, vol. II, 1970, pp. 277–279.
4. Huntington Library, *Stowe* Collection, STG Box 123 (*Wotton* estate accounts (repairs) 1760–1789), Bundle D/7.

Résumé

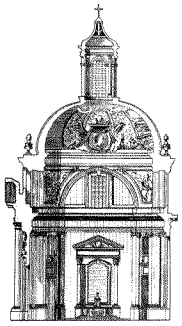
La conservation de la Maison chinoise de Stowe

La Maison chinoise de Stowe a été mentionnée pour la première fois dans un compte rendu du début du XVIII^e siècle, mais son histoire subséquente est mal documentée jusqu'à sa redécouverte, en Irlande, plus de 200 ans plus tard, dans un état très négligé. Un vaste programme de conservation, incluant la conservation des poutres d'origine, le remplacement des poutres pourries, et la reconstruction du toit et du plancher, ainsi que l'enlèvement du surpeint du XX^e siècle sur les surfaces décoratives et la consolidation de l'ensemble décoratif survivant du XIX^e siècle, a été entrepris. La recréation du plan décoratif de deux des côtés a redonné à la maison son apparence originale. L'analyse des couches picturales, la mise à l'essai de vernis appropriés pour la protection de l'extérieur, et la vérification de toute modification des couleurs à l'aide d'un spectrophotomètre constituaient des étapes importantes du projet.

4

Treatment Approaches: Wallpaper

Méthodes de traitement : Papier peint



The Effects of Conservation on the Appearance of Historic Wallpapers

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Abstract

The condition and appearance of historic wallpapers can be jeopardized by a number of factors, including the fragility of their materials, the vast areas they cover, and the wide range of conditions to which they are exposed. The development of their conservation as a specialty acknowledges that they are indeed worthy recipients of the extraordinary resources that can be necessary to allow high standards of treatment. This paper highlights five projects that illustrate the range of damage to which historic wallpapers can be subject, along with a variety of options for treatment. There is a particular focus on what constitutes the integrity of a room of historic wallpaper, and how the appearance of a room that is compromised by damage can be changed to highlight that integrity. Improvements in appearance should always be founded on improvements in condition being the paramount concern, with connoisseurship and craftsmanship directed to that end.

Introduction

Original wallpapers make an inestimable contribution to the credibility of historic interiors. They reflect the prevailing aesthetic sensibilities of an era and are often virtuoso demonstrations of design and technical achievement. Despite the printing of pattern and scenic wallpapers in large editions and the production of many hand-painted Chinese export works in multiple copies, many important designs survive in only a few locations worldwide. In this regard they achieve a singularity as graphic works analogous to that of rare masters' prints.

Historic wallpapers are particularly challenging subjects for conservation because of the fragile materials used in their manufacture, the vast surface areas subject to deterioration, and the imperative that such large projects be both manageable to fund and effective in improving condition and appearance. The development of their conservation into an area of specialty reflects an appreciation that the same standards of treatment brought to small fine art works can also be brought to large-scale decorative arts, and that historic wallpapers are worthy recipients of the resources that make possible a high level of attention. There already exists a large body of information about paper conservation in general and historic wallpaper conservation in particular, the types of damage to which they are subject, and the general procedures and options for treatment. The aim of this paper is more finite: to examine what constitutes the integrity of a room of historic wallpaper and how the appearance of a room compromised by damage can be changed to restore that integrity.

The larger context in which historic wallpapers are displayed contributes to a definition of their integrity. They may survive in original domestic or public installations, or in later structures and museum period rooms to which they have been transferred. The room may be one of many at a site that has original wallpapers or the only example. It may be a prominent public space, like a parlour or hallway, or a small intimate space such as a bedroom. Visitors may be permitted entry to the room for close inspection or confined to viewing from a doorway. Furnishings may be comprehensive and original, sparse, or from other venues or periods of interpretation. Surface finishes adjacent to the historic wallpaper may be original, simulated, obscured, or missing. And finally, the wallpaper may be compromised by damage that causes it to differ from its original appearance—damage that may or may not be reversible. In a broad sense, the integrity of historic wallpapers is a function of the texture they lend to an interior, their evidence as long-lived and genuine historic surfaces, and the associations they bring to an audience by their presence. In a more narrow and compelling explication, their integrity lies in them being exemplars and critical components of historically accurate design schemes, whether as grand centrepieces of attention or as humble backgrounds.

Historic wallpapers can suffer from numerous types of damage that compromise their legibility. Walls to which they were mounted may become insecure. Papers on which they were printed or painted may weaken as a result of the materials used in their manufacture, detach from the wall surface in large or small areas, or reveal planar distortions, tears, or losses. Design media may exhibit fading, cleavage, or loss from abrasion or insecure adhesion. Staining

may result from the aging of a paper, exposure, water damage, or the deposition of surface grime. Perhaps most disfiguring may be the well-intentioned but poorly executed efforts at repair, particularly the unfeeling applications of overpaint and the use of inappropriate adhesives. It is unusual not to have these conditions be apparent to some degree in a room of historic wallpaper. It often reflects an accommodation of the wallpaper to a structure and signifies that it is a longstanding component of an historic interior with a very specific and evolved identity, lending the wallpaper and the room something comparable to a patina. Conservation in these instances is addressed primarily at arresting damage that could become more problematic or unsightly, and expectations for a change in appearance are comparatively modest. However, when the variety and severity of damage are marked, and the security and legibility are endangered, the integrity of an historic wallpaper is compromised. In these instances a conservation project will be expected to accomplish more significant changes. There are a variety of possible outcomes that very much affect how a room of historic wallpaper will appear and be interpreted, as well as what resources will be necessary to achieve that outcome.

For complex projects it is crucial to emphasize that improvements in appearance must be based on improvements in condition, even if a compromised appearance is what instigated the review of treatment options. Although a change in condition is the primary focus, the procedures directed at a change in appearance (e.g. stain reduction, filling losses, and inpainting) must be integral to the treatment design. A conservation treatment can then be tailored to the capacity of an artifact to respond to the available procedures, with its success being very much determined by the connoisseurship and craftsmanship brought to its execution.

Outlined below are five projects in which the appearance of the historic wallpapers was markedly compromised by various conditions, including separation, loss or staining of the paper support, and loss of the design media. The treatment strategies are examined with regard to what options were available, how the changes in appearance were undertaken, and how the integrity of the historic wallpapers was addressed.

Hand-painted scenes after Giovanni Paolo Panini, English, circa 1765 Jeremiah Lee Mansion, Marblehead, Massachusetts

The grisaille designs were markedly compromised by enormous loss from abrasion and awkward efforts to disguise it by overpainting (as well as by tears and areas of separation that were mended and re-adhered to the plaster wall). The treatment was undertaken on site without removing the paintings, and focused largely on inpainting the countless small areas of loss (with watercolour) after removing as much of the water-soluble overpaint as possible and glazing what remained of it to harmonize with the surrounding original colour. It is important to note that inpainting was undertaken on the original surface of the paper. In fact, the paintings resembled enormous master drawings with painted frames and they were inpainted to clarify this interpretation. The intention was to restore the legibility of their design without jeopardizing the immediacy of expression that a drawing fosters. It was possible to locate copies of the 17th-century prints that served as models for their rendering, so a reference was available to clarify the composition in those few areas that didn't make themselves immediately apparent in the course of filling in the small losses between surviving patches of original design.

This project illustrates how fragile an image can be, particularly when it is as nuanced as a hand-painted one, and how the approach to inpainting should be directed by restraint. Leaving some evidence of the characteristic wear was intentional with the expectation that it would be

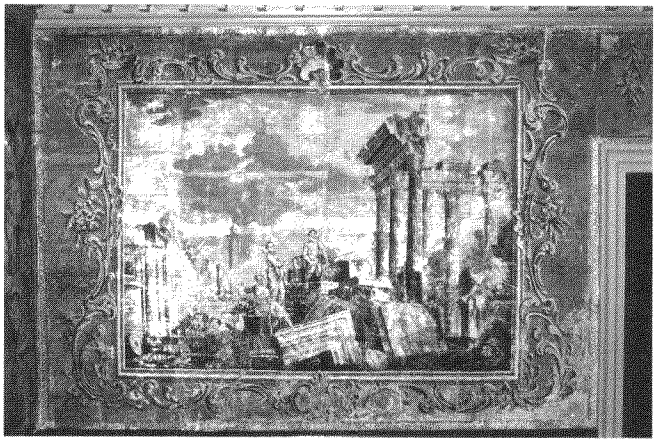

Figure 1. Hand-painted grisaille scene after Giovanni Paolo Panini, English, circa 1765, before treatment.

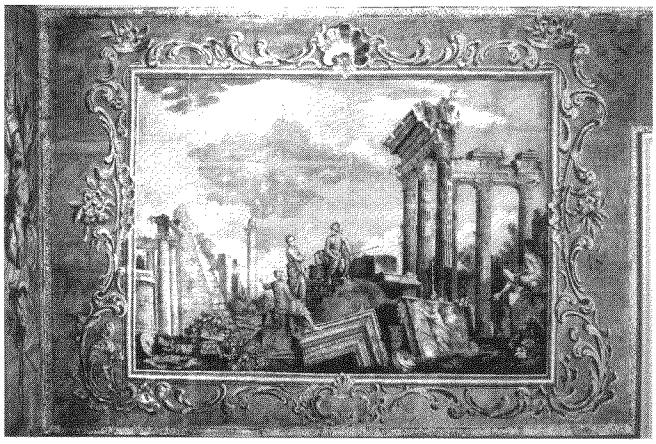

Figure 2. Grisaille scene, after treatment by inpainting.

subsumed by a more legible composition and sense of draftsmanship and be harmonious with the adjacent wainscotting and surrounding furnishings which were contemporary with the wallpapers.

'Landscape Figures' pattern wallpaper, French, circa 1815
Rosedale, Charlotte, North Carolina

Wallpaper survived in three second-floor bedrooms where it had been mounted onto interior walls made of vertical wooden planks. The exterior plaster walls of the bedrooms and all other rooms in which wallpapers had originally been mounted were bare (including a parlour with Adamesque mouldings). The condition of the surviving wallpaper was very compromised by widespread losses and tears that had resulted from being mounted directly to an uneven and acidic wooden surface, as well as by pronounced tidemarks, fading, and staining from exposure.

Although doing only local repairs for re-attachment was considered as an option to preserve the somewhat archaeological quality of the surface, it was decided to remove the wallpaper to facilitate its overall cleaning, reinforce it by lining, and re-adhere it securely to the plank walls. The wallpaper was painstakingly removed with steam and then washed to clean it, improve its strength, and facilitate lining. The Japanese paper used for lining was toned beforehand to match the general background colour of the wallpaper so that it could serve to fill the many losses at the same time that it reinforced the weakened and torn wallpaper. The wallpapers were then remounted to walls that had been prepared with fabric and Japanese paper beforehand to minimize the effect of the planks (as well as to facilitate removal in the future).

The toned lining paper was used to disguise the losses because the alternative of filling them with individually shaped pieces of paper was felt to be an unnecessary refinement and a significant additional expense. It was also felt that having the background be harmonious in colour served both to highlight what remained of the original wallpaper and to communicate what a surface completely covered in wallpapers that were unusual for the area would have looked like. Much attention was devoted to hiding the overlapping edges of the lining behind the original wallpapers so that the background would appear as seamless as possible. The coherence of the design was also significantly improved by cleaning, mending, and slightly inpainting the losses in the major design elements.

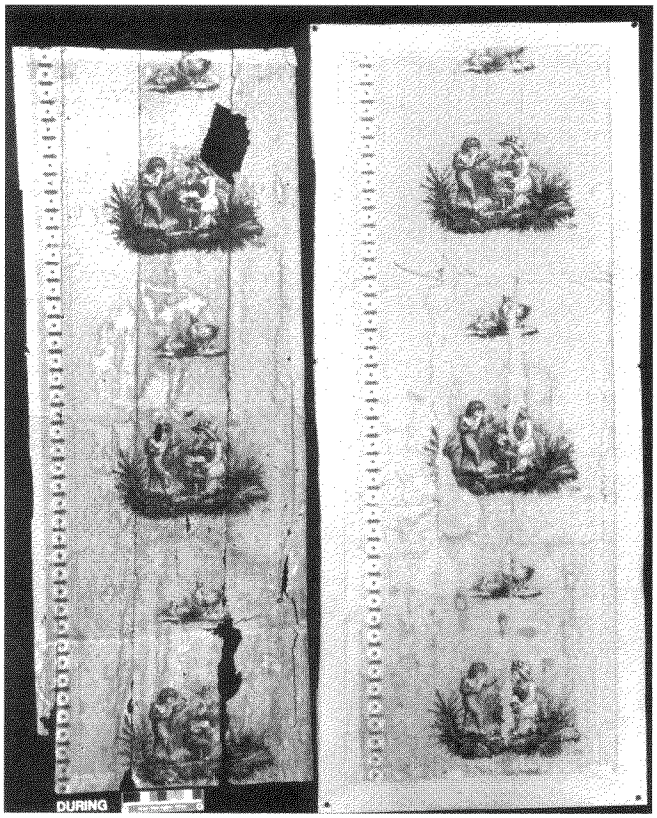

Figure 4. 'Landscape Figures' pattern wallpaper, during treatment (comparing a roll on the left that is untreated with a roll on the right that has been cleaned by washing and reinforced by lining with a toned Japanese paper).

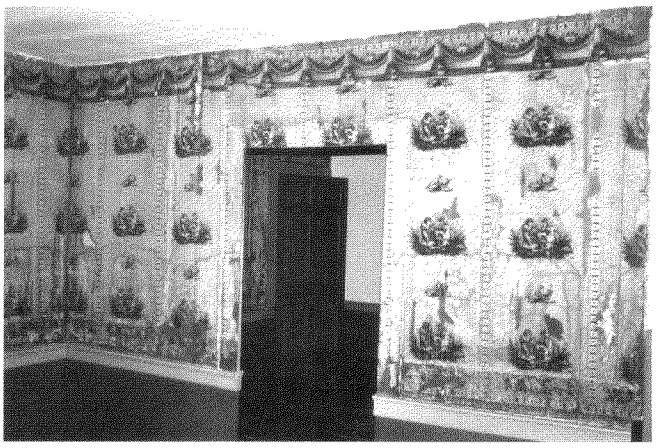

Figure 3. 'Landscape Figures' pattern wallpaper, French, circa 1815, Rosedale, *before treatment.*

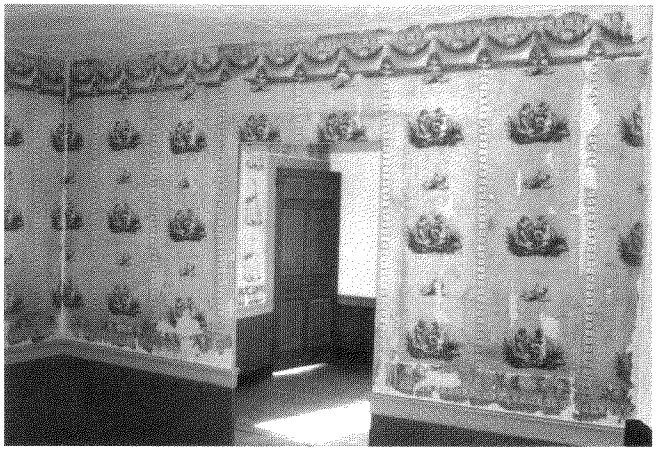

Figure 5. 'Landscape Figures' pattern wallpaper, after treatment.

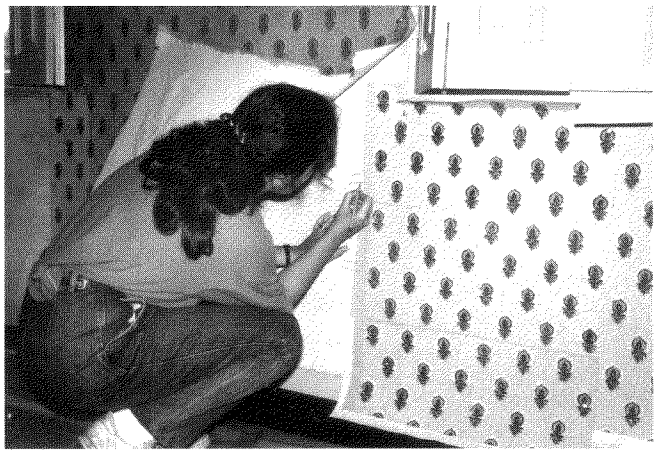

Figure 6. Stylized sprig pattern wallpaper, American, circa 1785–1795, during treatment in which a section of a custom reproduction is being used as fill material.

Stylized sprig pattern wallpaper, American, circa 1785–1795 Oliver Ellsworth Homestead, Windsor, Connecticut

The simple pattern in four colours was unusual because it was reported to be the earliest wallpaper printed in the United States that remained in the location in which it had originally been installed. It was compromised by widespread separation from coarse plaster walls, pronounced staining from water damage around the windows, losses below them (which had been filled with a simplified reproduction during an earlier treatment), and surface grime that obscured the contrast of the pattern against the background.

The original expectation was that the wallpaper could be re-adhered to the walls by local applications of adhesive without having to remove it. However, when the time estimate for this treatment was compared with an overall treatment that entailed removal of the wallpaper, the difference was comparatively small (especially in light of the additional improvements that could be realized by repairing the original plaster on the wall after the paper was removed and the opportunity to treat the wallpaper in a studio). After removal with broad spatulas (the large areas of separation and degraded adhesive enabled this to be done with a minimal use of steam), the historic wallpaper was surface cleaned with vinyl erasers against a smooth surface and washed with water to reduce staining and facilitate lining with Japanese paper. A new reproduction to fill the large rectangular losses below the windows was printed on paper made by hand to resemble the original; the background colour was made somewhat lighter in tone than the darkened original so that it could be used in three large sections where the original wallpapers on either side were not uniform in tone. The original wallpapers and reproduction fills were remounted to walls which had been covered beforehand with fabric and Japanese paper (which also served to protect the original plaster). The reproduction fills were glazed using an airbrush with watercolour to have them match the surrounding original wallpapers.

The decision to undertake a comprehensive in-studio treatment rather than a local on-site treatment was made because significantly more change could be achieved with comparatively few additional resources. The appearance of the wallpaper was significantly affected by the surface cleaning, stain reduction, overall adhesion, and filling of large losses that removal made possible. Local on-site treatment would not have been able to achieve complete re-attachment of the wallpaper to the plaster walls nor reduce the pronounced staining more than partially. Reduction of the surface grime with erasers would not have been possible because of the pronounced texture of the underlying plaster. Overall in-studio treatment also allowed for a more accurate reproduction to be generated (because a reference was in hand), for the original plaster walls to be repaired as necessary, and, not insignificantly, for costs to be saved that would otherwise be spent on maintaining conservators on site.

Although the in-studio treatment and overall remounting represented a project that was more complex, it was more long-lived and it ultimately entailed less risk (there would have been a potential for staining during local re-adhesion if the discoloured historic wallpaper was not washed beforehand).

Wood block printed scenic wallpapers, French, 1812–1830 Prestwould Plantation, Clarksville, Virginia, circa 1795

Three sets of French scenic wallpapers with coordinated borders and dados had been mounted over remnants of English pattern wallpapers during the redecoration of this plantation house in the 1830's by the second generation of inhabitants. The wallpapers covered large areas and their combination of patterns was complex. The historic wallpapers were in a very compromised state with enormous separations from the walls and associated tears and losses, marked staining from exposure, and pronounced loss of the design media from cleavage (a phenomenon to which historic scenic wallpapers are particularly subject). The treatment was designed to restore the scenic wallpapers to their original appearance as much as possible; this was important because of their rarity and their prominence in a decorative scheme for which unusually complete documentation survived and for which many of the original furnishings had been reassembled.

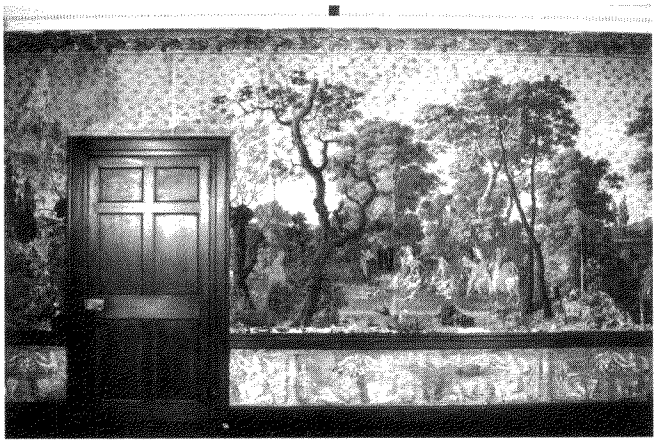

Figure 7. Scenic wallpaper, Chasse de Compiegne *by Jacquemart, French, 1812, before treatment.*

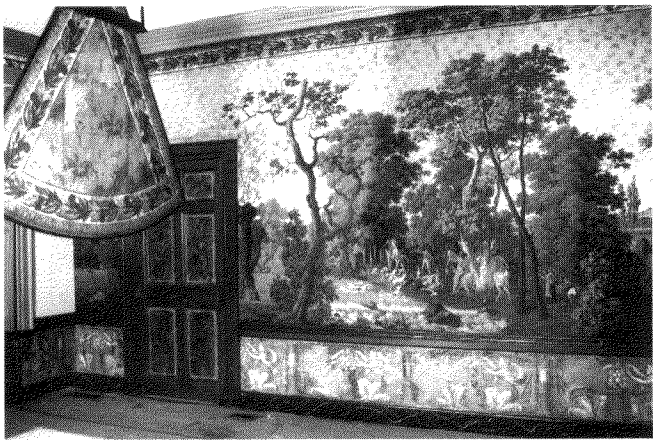

Figure 8. Chasse de Compiegne, *after treatment.*

Removal of the wallpaper was necessary to facilitate in-studio treatment (washing with water to clean and improve the strength of the paper, consolidation of the design media using a suction table, mending, filling losses, and lining) as well as to make repairs to the walls. Losses in the scenic paper were individually filled before lining so that the surface level would be uniform and as invisible a base as possible for the inpainting. In contrast, losses in the borders and dado were filled by the lining papers because the slight differences in surface level were imperceptible in their locations at the ceiling and below the chair rail. Losses in the scenic papers and the borders were inpainted to complete the surrounding design; photographs of another impression of the scenic design were available to reconstruct several larger areas. The lining that filled the losses in the dado was partially toned and then given a background wash where it was revealed. The losses were so large and widespread that inpainting to re-create the design was felt to be presumptuous. Survival in a fragmentary appearance was acceptable because of the repetitive nature of the pattern, the location on the wainscotting (where it was obscured by numerous furnishings), and the fact that it was eclipsed by (and subsidiary to) the scenic wallpaper above it.

Different strategies were also adapted for the use of reproduction wallpapers in re-creating the original design schemes. The scenic design was missing from three of four walls of the room described above. Covering those walls with one of the patterns reproduced from samples found in the house (including an English ivy pattern circa 1795 found behind the scenic wallpaper) was felt to be a distraction in a small room where limited quantities of the original scenic wallpaper survived. Instead, handmade sheets of laid paper that matched the texture and size of those used in the scenic wallpaper were toned a uniform colour of blue to harmonize with the sky and mounted to simulate wall treatments from the same era found at other sites. A reproduction of the original leaf pattern border above the scenic design was continued around the top of the room above the uniform blue side paper. To replace a border, dado, and side paper around an original scenic wallpaper in another room, reproductions were generated using samples, photographs, and examples in better condition from other collections. The original faux-bois paint schemes were also re-created in each room from paint samples.

The enormous change in appearance of these French scenic wallpapers appears to have been made possible mostly by the special attention devoted to inpainting (approximately half of the treatment time). However, it was the preliminary focus on procedures that affected their condition that allowed the inpainting to appear discrete. A remounting in which historic wallpapers appear to have been well-cared-for over time (rather than disproportionately restored) points to how crucial it is for all studio treatment procedures to be directed toward a preconceived and tailored outcome. Rooms of this quality and potential are distinguished in meriting the devotion of the necessary resources to every aspect that will sustain their good preservation and accurate appearance.

Hand-painted export wallpaper, Chinese, circa 1790 Winterthur Museum, Winterthur, Delaware

The Chinese export painting had been mounted to the walls of a room whose dimensions were specifically configured to accommodate it. The architectural mouldings that frame the paintings are contemporary to them, although of English origin, as are the American Chippendale furnishings. The room is a sumptuous simulation. The importance of the painting to that effect is based on its grand compositional sweep, the fine quality of its execution, and the comparative rarity of the earliest examples of large-format Chinese export painting. The appearance was compromised by several features, however. During installation of the paintings in 1931, six simulations of the design had been created for use above the doors and windows because the quantity of original wallpaper was limited, and one larger

simulation had been created to join two otherwise unrelated compositional motifs. Although these simulations were not particularly faithful to the original painting in their materials or manner of depiction, their appearance was not distracting until the papers used for their supports became markedly discoloured from exposure because of their poor quality. Several campaigns of overpainting had been directed at these locations in the past, particularly in the upper reaches where the areas of sky and mountains had been heavily repaired and overpainted.

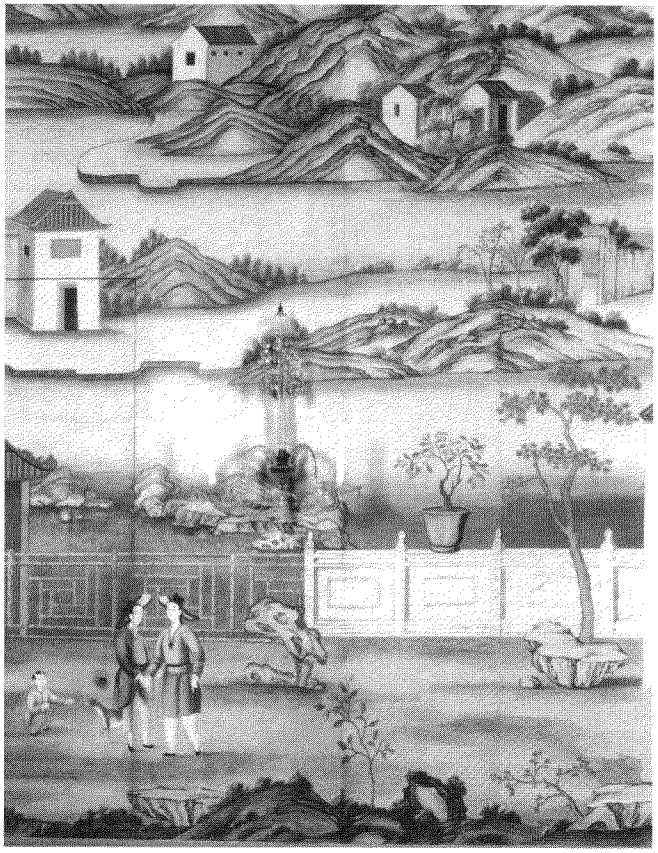

Figure 9. Hand-painted export wallpaper, Chinese, circa 1790, after treatment (the top left quadrant is the simulation from 1931).

An overall in situ treatment was instigated by the installation of new ceiling fixtures that would significantly improve the illumination of the painting (which necessitated closing of the room, at which time conservation could also be undertaken). Attention was devoted to surface cleaning, re-adhering edges that were lifting, filling small areas of loss, reducing small water stains, and inpainting the numerous larger and smaller areas of abrasion. However, addressing the disfigured areas of simulation was appreciably more complex technically, ethically, and aesthetically. There was no wish to replace the simulations because they were part of the original mounting scheme. It was not possible to lighten the darkened paper support by either local cleaning with water or scraping the surface with scalpels to reveal a lighter under layer, although some overpaint could be reduced. On the simulations above the doors and windows it was decided to conceal the areas of sky, where the disfigurement was most objectionable, by covering them with opaque Japanese paper that would serve as a ground layer for a more accurate imitation of the original surface. The paper overlays were shaped to fit above the mountainous horizon, adhered with wheat starch paste, and glazed with watercolour to match the background colour of the original painted surfaces on either side. The one larger area of simulation was not covered with Japanese paper; instead the darkened background was glazed with an opaque watercolour (including pastels and acrylic) to conceal it and render it less distracting. The composition and design were not modified but the more uniform appearance harmonized with and distinguished the original design. With the distractions of the darkened paper and poor quality overpainting minimized, the detailed renderings and panoramic breadth of the Chinese export painting were returned to prominence.

Conclusions

In summary, more than one acceptable option was generally available for each of the five projects described. The treatments were designed in collaboration with the curators in response to what they found compromising to the integrity of the historic wallpapers at their sites. Although each treatment was a major undertaking, they differed in the purposes to which similar procedures were directed and in the means by which improved appearances were achieved. Two of the projects were undertaken on site because conditions did not call for removal (nor would it have been well advised), whereas for the other projects removal was preferred because conditions could only be addressed in a conservation studio. It is understandable, consequently, that greater expectations were generated for the outcome of these projects. Treatment in a studio makes possible controlled exposure to water which is necessary for stain reduction, overall cleaning, removal of discoloured adhesives, and elimination of distortions. It also makes possible the application of a lining for reinforcement and for the control of moisture during the remounting which in turn allows this final procedure to be undertaken with more control and safety. Inpainting was directed at the condition of the media, to losses where the original paper was exposed, to fills or linings, and to disfiguring overpaint that resisted removal. Reproductions were generated in the conservation studio as fill material and by commercial manufacturers for use in conjunction with original wallpapers to re-create historical design schemes.

A room of historic wallpaper should have to undergo conservation treatment of this complexity only once. The handling and procedures it necessitates are not without risk to objects this fragile. The credibility of the change in appearance is founded on the paramount concern being an improvement in condition, and is sustained by connoisseurship and craftsmanship being directed to that end.

Acknowledgements

The five projects described were undertaken in association with many conservators. Particular acknowledgments are due to Lorraine Bigrigg who participated in all of the projects (except for the Chinese export painting) and David Colombo who participated in the treatment of the French 'Landscape Figures' and two rooms of the French scenic wallpaper. I undertook treatments of the English hand-painted grisaille scenes and one room of the French scenic wallpaper while I was Senior Conservator at the Northeast Document Conservation Center, and treatment of the Chinese export painting while under the direction of John Krill, Senior Paper Conservator of the Winterthur Museum, whose professional stewardship was inspirational. Contributions by the conservators of those institutions were critical to the success of the projects.

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Appendix: Research collections of historic wallpapers

Cooper-Hewitt Museum
Smithsonian Institution
2 East 91st Street
New York NY 10028
USA

Musée des Arts Décoratif
107 Rue de Rivoli
75001 Paris
France

Musée du Papier Peint
28 Rue Zuber
68170 Rixheim
France

Museum of Art
Rhode Island School of Design
224 Benefit Street
Providence RI 02903
USA

Society for the Preservation of New England Antiquities
141 Cambridge Street
Boston MA 02114
USA

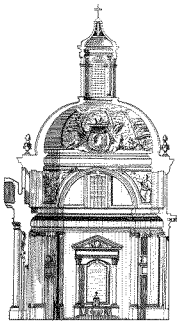
Victoria and Albert Museum
Cromwell Road
South Kensington
London SW7 2RL
United Kingdom

Whitworth Art Gallery
University of Manchester
Oxford Road
Manchester M15 6ER
United Kingdom

Résumé

Les effets de la restauration sur l'apparence des papiers peints historiques

L'état et l'apparence des papiers peints historiques peuvent être affectés par un grand nombre de facteurs, comme la fragilité des matériaux, les grandes surfaces qu'ils couvrent, et le vaste éventail de conditions auxquelles ils sont exposés. Le développement de la restauration des papiers peints en tant que spécialité reconnaît qu'ils sont en effet dignes des ressources extraordinaires qui peuvent être requises pour les traitements de haut niveau. Cet article expose cinq projets qui illustrent les divers dommages auxquels les papiers peints historiques peuvent être sujets, ainsi qu'une variété d'options de traitement. Il est question en particulier de ce qui constitue l'intégrité d'une pièce au papier peint historique, et comment l'apparence d'une pièce compromise par des dommages peut être changée pour en faire ressortir l'intégrité. Les améliorations d'apparence devraient toujours être fondées sur des améliorations d'état, qui doivent être la préoccupation première, appuyée sur le discernement et le métier.



Restoration of the Picture Gallery at Temple Newsam, *Yorkshire, England*

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Abstract

Temple Newsam, a large country house and Grade 1 listed building, came into the ownership of Leeds City Council in 1922, and during its development as a museum of fine and decorative art many of its historic interiors were radically changed. In 1983, new attitudes, directorship, and changes in the acquisitions policy resulted in a new program to restore the rooms to their pre-1922 decorative schemes and furnishings. Twelve rooms have been completed to date, culminating in the restoration of the Picture Gallery (the most important room of its type in England). This paper relates the case history of the Picture Gallery at *Temple Newsam* as it was returned to its 1746 decorative scheme during 1996. Information putting the house into its historical context and an overview of post-1922 alterations are also given.

Introduction

Temple Newsam is not only old (circa 1500 in parts) but also has a highly varied past. At times it was at the centre of English history, and twice in Tudor times it was forfeited to the Crown for Catholic and political intrigue. It reflects, perhaps more than most country houses, the changing and eclectic tastes of its owners and their fortunes. The land has been occupied since before medieval times, and was first recorded in the Domesday book as the *Manor of Newsam.* The Knights Templar, an order of warrior monks who guarded the routes to the Holy Land, had a preceptory and farmsteads on the property until their order was suppressed in the early 13th century. The estate passed eventually to Thomas, Lord Darcy; in approximately 1500 he became the first person to build a house (four wings with a central courtyard) on the present site. All the subsequent owners, including Leeds City Council, have left their mark, many notable interiors having been created, removed, modified, or covered up. Unfortunately, contemporary descriptions, inventories, bills and accounts, and the physical remnants are frequently all that is left, particularly of the earliest schemes. The earliest photographic records are from the 1860's, and much more survives of later room configurations.

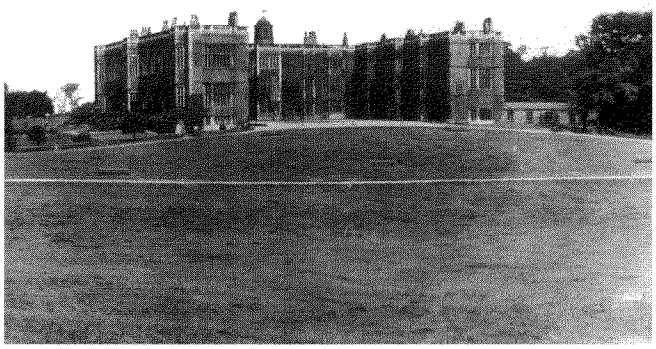


Figure 1. Temple Newsam *seen from the southeast. The Picture Gallery is in the north wing on the first floor.*

The exterior of *Temple Newsam* has also evolved considerably. The house was in a semi-ruinous state (after 80 years of neglect while under forfeit to Elizabeth I) in 1622 when Sir Arthur Ingram purchased it and consolidated the north and south wings. In 1636, a fire in the east wing resulted in its complete demolition, bringing the house to its open courtyard plan. Sir Arthur's descendants lived at *Temple Newsam* for the next 300 years, becoming the Viscounts Irwin after the Restoration of Charles II for their support to the Royalist cause.[1]

When Edward Wood (later Lord Halifax, Foreign Secretary in the Chamberlain government), the last private owner, sold the 371-ha (917-acre) park to Leeds in 1922, the house came free (its contents having already been removed or sold separately). As Leeds City Council declined to purchase these, the house was shown to the public as a more-or-less empty shell until 1938. Its development as a country house museum of art can be traced to this date, when Philip Hendy (Director of Leeds City Art Gallery) was given responsibility for *Temple Newsam* and set about organizing a pioneering exhibition of decorative and fine art from Yorkshire.[2] The foundations for purchasing works of art for the house were laid in 1939 with the repatriation to *Temple Newsam* of the suite of furniture made for the Picture Gallery in 1746 by immigrant French furniture maker James Pascall.[3]

Accounts were kept of discoveries and work undertaken to the building inside and out after 1922.[4] They, and accounts and research by others,[5, 6, 7, 8] tell a tale of most rooms having their pre-1922 decorative schemes removed and discarded. Many chimney pieces were removed and sold, relocated to other rooms, or altered in some way. Much of this work was undertaken in an effort to create more display space for works of art evacuated from Leeds City Art Gallery during the bombing of Leeds during World War II and to provide suitable settings for 20th-century works of fine and decorative arts. Other architectural features like alcoves and doorways were covered over or turned into showcases. In 1939, cork tiles were bonded to most softwood floors and electricity was laid on. Some rooms and window bays lost their dado panelling and window seats when a new heating system with powerful convector heaters was installed in 1968; hardboard and plywood were used to box in the convector heaters and pipe runs. These heaters were the likely cause of much damage to veneers and gilding on wooden objects in the collections.

The decisions to do some of these things were probably pragmatic. By the late 1930's the condition of the rooms may not have been very good. Accounts tell of softwood wall linings in poor condition from wood-boring insects, and softwood floors worn away by visitors. War brought further pressure on *Temple Newsam* to create more display space. Some decisions, however, were the result of curatorial attitudes of the time. Philip Hendy, who went on to become Director of England's National Gallery, was instrumental in many of these alterations. The following comments from his notes indicate his (and perhaps the prevailing) attitudes: "A great many excrescences have been removed such as heavy wood and composition cornices over windows and fantastic obelisks over the large doors" when referring to Victorian features added during Emily Meynell Ingram's ownership of *Temple Newsam*; that Room Seven, a bedroom in the 18th and 19th centuries, had been "much improved by the abolition of the early nineteenth century bed alcove"; and in reference to the south wing bedrooms, they "have never contained anything of serious historical or artistic interest."[4] By 1950, every historic decorative scheme in the house had been destroyed with the exception of the Chinese Drawing Room.

In the decades since 1938, a collection of fine and decorative art has been built up at *Temple Newsam* and the other two art gallery sites. This collection has been called the most important collection of English decorative art outside London.[9] Further recognition was achieved in 1997 when the Museums & Galleries Commission awarded Designated Status to the collections of fine and decorative arts at *Temple Newsam*, the Leeds City Art Gallery, and *Lotherton Hall*. The early 1980's saw changes in directorship, attitudes, and acquisitions policy. Instead of acquiring purely on the basis of aesthetic quality, the acquisitions policy evolved to reflect a much wider range within the applied, decorative, and fine arts. Existing collections began to be redisplayed and new objects that would be appropriate to the various rooms (bedrooms, sitting rooms, dining rooms, libraries, etc.) were acquired. *Temple Newsam* was no longer seen as a backdrop for displaying works of art, but as a venue for interpreting objects in the context in which they would have been used. This meant furnishing according to inventories, and where possible repatriating *Temple Newsam* objects as they became available. The Keeper of *Temple Newsam* at that time, Anthony Wells-Cole (currently Senior Curator of Decorative Arts at Leeds Museums and Galleries), had been researching the building for several years and felt there was enough evidence available to begin re-creating authentic interiors at *Temple Newsam*. A program of restoration began in 1983 with the enthusiastic approval of the then Director, Christopher Gilbert. Funding for this ongoing program has come largely from the interest on capital invested from an insurance claim for a group of stolen snuffboxes and also from some external grants. Significantly, there has never at any stage been a cost to the council taxpayers of Leeds, nor has there been central government support. As with all United Kingdom local authority museum services, Leeds Museums and Galleries is funded almost exclusively by local taxation.

Chronology of the Picture Gallery at *Temple Newsam*

Circa 1630
Sir Arthur Ingram rebuilt the north wing and built an oak-panelled Jacobean Long Gallery.[10] It extended the full length of the wing and the oak panels had images of animals gilded on them. This same oak frame and panelling turns up elsewhere in the house, having been re-used as the timber linings for wall coverings when the Long Gallery was reordered.

Circa 1738–1746
Henry, seventh Viscount, set about transforming the north wing into a Picture Gallery flanked by a library and bedchamber. Very complete accounts and bills of this work survive.[11] Mainly York craftsmen were employed, including the architect. The walls were lined with timber, and a green flock paper was hung. James Pascall was commissioned to make a suite of gilt furniture for the Picture Gallery: 20 chairs, four settees, a daybed, two pairs of tables, eight candle stands, and two magnificent girandoles.[3] Furniture historians now regard this as the finest early rococo ensemble in Britain.

1808
Nearly 90 pictures were listed in the Picture Gallery, including works by Marini, Titian, Rubens, and Rembrandt.[12]

Circa 1826
Lady Hertford redecorated the Picture Gallery and hung a red flock wall paper.

1922
The contents of the Picture Gallery were removed or sold as part of the change of ownership of *Temple Newsam*.

1939
The Picture Gallery suite was bought back for *Temple Newsam* and reinstated in its original room.

1940
The red flock wallpaper and timber linings were removed, from dado moulding to cornice. The walls were relined with hardboard and a red cotton damask was hung. The plasterwork and joinery were redecorated.

1948
More than half of the Picture Gallery paintings were given back to *Temple Newsam* by Lord Halifax.

Circa 1966–1968
Convector heaters were installed in five window bays in the Picture Gallery. The extent of loss in these window bays was unknown until the removal of the heaters in 1993.

1981
Fragments of a green flock wallpaper were found under floorboards in the Picture Gallery. Following structural problems in the trusses supporting the plasterwork ceiling, the paintwork was redone in what subsequently proved to be very unsympathetic colours.

1986
A second exploration under floorboards revealed more pieces of the green flock paper and its likely pattern. This was confirmed in 1992 when a large piece of the paper, showing the complete pattern including stencilling

Figure 2. The Picture Gallery at Temple Newsam *in 1980.*

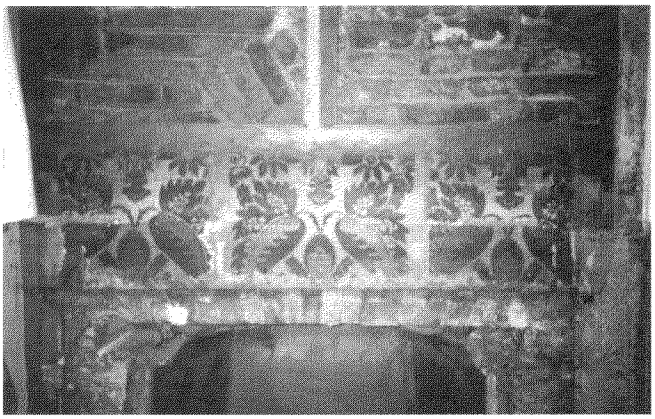


Figure 3. Pieces of the Picture Gallery's green flock wallpaper, discovered in 1992, on re-used timber lining during excavation of a room in the west wing. A William Morris paper, called "Indian" circa 1880, can be seen on the right of the picture.

detail missing in the previous samples, was discovered (during another room restoration) on timber re-used when the Picture Gallery was redecorated in 1826. This paper is of a pattern found at *Clandon Park*, Surrey; *Christchurch Mansion*, Ipswich; the Privy Council Chamber, Westminster.

1993
Missing wooden dado panelling (two window bays) and oak floorboards (five window bays) were reinstated. Enough original dado and skirting moulding survived to go back into three of the restored window bays, leaving two without any moulding.

1994
The decision was made to reinstate the 1746 decorative scheme. Planning permission from English Heritage had already been granted as part of earlier room restorations. An order was placed to Allyson McDermott to reproduce the green flock paper (for which she had already analysed original samples).

1995
The material for the furniture case covers (referred to in the 1808 inventory as "green Manchester check case covers") was made by Context Weavers based on a sample of a blue Manchester check that had been found in an old rat's nest under floorboards during an earlier room excavation. An analysis of the paint layers on joinery, plasterwork, and stonework was undertaken by Patrick Baty of Papers and Paint to determine the first paint scheme. The gilt surfaces and upholstery of the suite of furniture underwent conservation treatment.

January to May 1996
The Picture Gallery was closed and emptied.

The walls were stripped of the red damask and hardboard lining revealing the Tudor and Jacobean masonry from dado to cornice. At this stage the room was recorded by the Royal Commission on the Historical Monuments of England.

The frames of all the paintings were cleaned, as were the gilt surfaces of the girandoles and tables.

The carved stonework of the central north window bay, which had been hacked away for the boxing of a convector heater, was restored by Robert Aagaard, Period Architectural Designers.

The walls were relined with treated softwood. Vertical rebated grounds were anchored to the original locations, either into existing oak plugs in sockets in the brick or modern plastic plugs into pointing. Tongue-and-groove panelling was fixed into the spaces between the vertical grounds using galvanized nails.

Decorative plasterwork that was becoming detached was consolidated by Mark Maniatt.

Carved wooden dado and skirting mouldings, still missing in two window bays, were made by Andrew Hunt.

Figure 4. General view from the west of the plaster ceiling and the Tudor and Jacobean brickwork after removal of intrusive elements.

Hesp and Jones of York prepared the new timber lining of the walls for the green flock paper. The same company also repainted the room according to Patrick Baty's report. Exemption from legislation restricting the use of lead paint was required and obtained through English Heritage.

The case covers for the suite of furniture were made (from the material woven by Context Weavers) by textile conservator Rosalie Hill, who also made acid-free undercovers.

The green flock wallpaper and border were hung by Allyson McDermott.

Green venetian blinds, specified in the 1808 inventory, were installed in the south window bays.

Pictures and furniture were reinstated and the Picture Gallery was reopened on May 6, 1996.

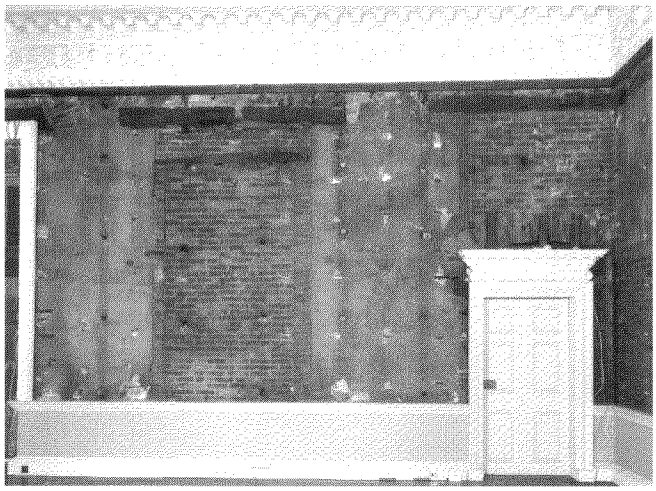


Figure 5. South wall, west end.

Figure 6. North wall, west end.

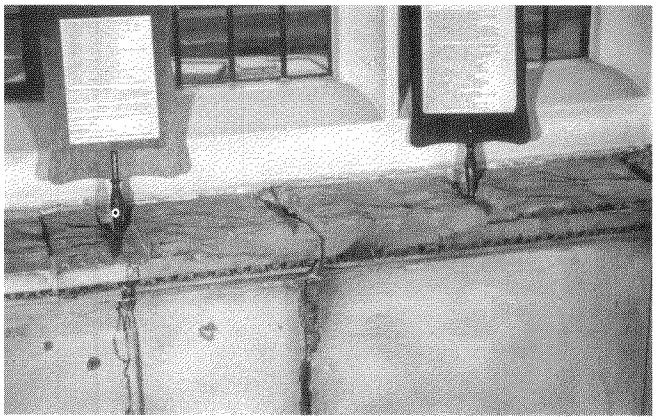


Figure 7. The stone sill of the north central window ball had been hacked away in parts in 1968. This was done so that the boxing of a convector heater, installed at that time, would not project above the dado level.

Figure 8. The north wall central window bay with its restored stonework.

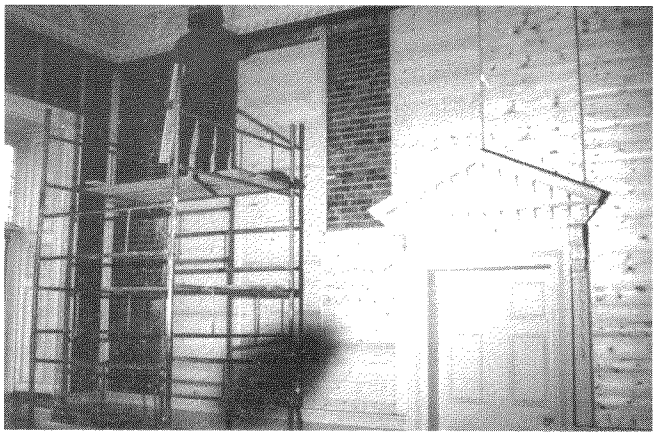


Figure 9. Timber lining being reinstated on the west wall. The vertical timber grounds were positioned on the original locations.

Policy decisions

By the early 1990's it was apparent that the wall linings of hardboard were deteriorating, becoming brittle and inadequate for hanging the large number of pictures that new display priorities required. Something had to be done, and planning for the restoration of the Picture Gallery began. Although strong evidence also existed for the room's 1826 decorative scheme in a red flock paper, the decision was made to restore the Picture Gallery to its 1746 scheme (a decision that was influenced by a number of factors):

a) the materials and pattern of the green flock paper were known from excavation and analysis, and a company existed that could reproduce it;
b) many of the architectural features of the room remained intact, and what did not could be determined by known specialist companies;
c) more than half of the pictures that had hung there in the late 18th century were already there;
d) the suite of furniture that had been commissioned for this room in its 1746 decorative scheme was already there, and its floral needlework and the green flock paper were clearly carefully chosen to harmonize (therefore, redisplaying the suite in this predominantly green setting would assist visitors' interpretation, re-establishing the links of furnishings and their rooms, which in grand schemes like this would have been conceived en bloc);
e) although red has become a favourite colour for the hangings of picture galleries, green was a popular choice in the mid 18th century, and a green flock paper would therefore serve to illustrate an earlier taste and fashion.

As with previous room restorations, we tried (as far as is practical) to be faithful to the materials and techniques used originally. However, conservation priorities (which were included in specifications to give a longer serviceable period) meant that things that would not or could not have been done originally were specified. For example, the original green flock wallpaper had been glued directly to the wooden timber lining such that shrinkage, along with other types of wood movement, could have put stresses on the paper, leading to its possible early failure from tears. The method of attachment (described in the next section) used for the new green flock paper was designed to avoid this completely.

The green flock wallpaper

Samples of the 1746 wallpaper were analysed by paper conservator and wallpaper manufacturer Allyson McDermott. Her tests showed that the green pigment was malachite (basic copper carbonate); the resin, or varnish, was sandarac; the flock fibres were wool; and the paper fibres were a mix of linen and jute, with jute forming the bulk of the mix. Tests to the adhesive on the back of the

paper showed the presence of both a starch adhesive and an animal glue. She was also able to produce a precise facsimile of this wallpaper according to 18th-century printing methods derived from Robert Dossie's book *The Handmaid to the Arts* (published 1758 and 1764). Sheets of handmade paper, 533 mm (21 in.) square, were pasted together to form lengths which were then grounded in varnish pigmented with malachite. The lengths were partly stencilled in a contrasting blue varnish and block-printed with the main pattern (from hand-carved wood blocks) in black varnish. Chopped wool flock, dyed to the correct shade of green, was strewn onto the lengths and then compressed into the varnish with wooden rollers. This technique has probably not been employed much since 1840, when machine manufacturing methods were introduced. Allyson McDermott's company also undertook the installation of the paper and border onto grounds which had already been prepared for them.[13] The timber lining was covered with canvas, fixed to the timber with stainless steel staples at the edges only (i.e. dado and cornice level and corners). To this was glued a layer of lining paper, then a layer of acid-free lining paper, and finally the green flock paper. The adhesive used throughout was carboxy methyl cellulose.

The paint scheme

Patrick Baty of Papers and Paint undertook examination of the paint layers with the purpose of determining the first paint scheme. Two hundred and four samples, down to the substrate materials, were taken from representative areas to see if any areas had any picking in with other colours or gilding. The locations of all the samples were mapped out in the final report. The samples were mounted in clear polyester resin, sectioned, and polished before examination by metallurgical microscope to compare layer structure. Samples appearing to show the full sequence of layers were examined particularly closely and compared with samples that were incomplete or in some way unclear. Once the full sequence of painting had become clear the pigments of the first scheme were identified visually and by polarizing microscope. Samples were then made using near-original materials and compared with the exposed

Figure 10. General view of the Picture Gallery after its restoration to its 1746 decorative scheme.

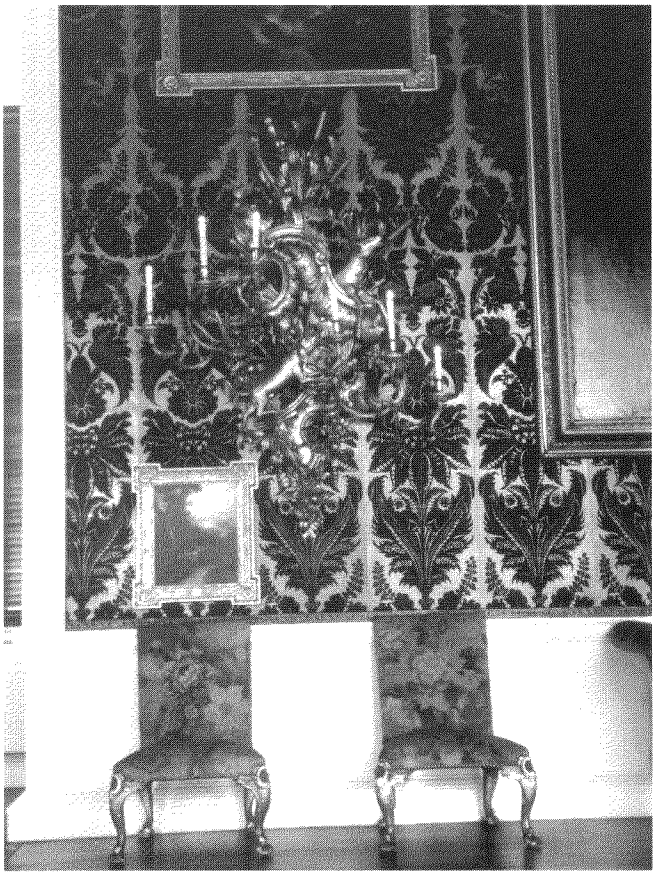


Figure 11. Detail of the green flock wallpaper and some of the furniture made for the room by James Pascall.

first scheme colours. The closest matches were then measured using a spectrophotometer and compared for a match against a database, under continuous development by Papers and Paint, containing details of more than 200 000 colours. Patrick Baty's report concluded that the ceiling had been decorated a total of seven times, and the chimney pieces/overmantels and joinery had received two more decorative schemes. For report purposes and for guidance only, Patrick Baty provided examples of the estimated closest colour in the Natural Colour System.[14] The paint used by the decorators, Hesp and Jones, was made by Papers and Paint using materials and manufacturing techniques consistent with the report's findings and the historical context of the decorating trades.

The ceiling

Ninety-two samples were taken from the ceiling and cornice. The first scheme appeared to have been a distemper paint (ground chalk bound with an animal glue size) tinted with a small amount of red earth pigment, producing a pale warm salmon colour. This was applied uniformly over the entire ceiling and would have had a matte finish.

The cornice

The cornice was painted in the same colour distemper. However, the vitruvian scroll motif, which formed the

lowest part of the cornice, was painted in an oil paint of a similar colour. Patrick Baty's theory is that, as this part of the cornice was so close to the wallpaper, a viscous oil-base paint would have been much easier to control on a brush than a more fluid distemper, thereby reducing the risk of paint splatter on the wallpaper.

The joinery
Fifty-eight samples were taken from door and window cases and their architraves, dado, skirting, and dado mouldings. For the first scheme the samples revealed a white priming coat and a finish coat of untinted white lead oil paint. It was probable that the first scheme had a low sheen as no evidence for flatting could be found.

The chimney pieces and overmantels
Forty-nine samples were taken. The first scheme on the chimney pieces was an untinted white lead oil paint the same colour and sheen as that used on the joinery and dado, on top of a white priming coat. The first scheme of the overmantel also appeared to be of an untinted white lead oil paint, but it is probable that it appeared slightly cooler than the chimney piece. A grey primer was used and darker areas of grey veining were encountered. The original effect therefore was of a pale grey overmantel, probably marbled, sitting above a warmer off-white chimney piece.

The doors
Five samples were taken. The first scheme on the doors was a dark chocolate brown oil paint made up with red earth pigment and carbon black. This was in an oil-rich medium, which would have given a shinier finish than on the rest of the joinery.

Rehanging the room with pictures
The arrangement of paintings was very carefully thought out in the 18th century.[15] Paintings were selected for their size, subject matter, colouring, country of origin, and date. This rehang was equally careful, re-using all the surviving pictures from the 1750 arrangement, and introducing others to replace those that left the house in 1922. The dominating pattern of the flock wallpaper demanded that the positioning of paintings and furniture on individual sections of wall be symmetrical. The arrangement today is as close as possible to that when the Picture Gallery was first finished in 1746 after 8 years of work.

The future

The days when curators and other custodians of cultural material could give far more thought to their ward's past than to its future are largely gone. Today, reducing rates of loss (i.e. preventive conservation) is an important item on the agendas of most museum professionals. To protect both the restoration work on the Picture Gallery and the collections within against various dangers, the following additional features were installed.

Direct physical forces—The furniture was often touched by members of the public, knowingly or unconsciously, as they got close to pictures to view them better; therefore quality oak stanchions were made, fitted with a dark green rope, and installed around the perimeter of the room to protect the furniture and the wallpaper (it seems a basic thing to do, but there had been a prejudice against using ropes, especially in this room).

Contaminants—Conservation quality case covers were installed on the needlework furniture underneath the Manchester check case covers.

Radiation—Ultraviolet filters were installed on all the windows and blinds on the south-facing windows.

Other measures of a building-wide nature were also put in place:

Fire—The entire building was rewired in 1992; a telemetric fire alarm system was installed in 1997.

Water—The entire building is being re-roofed, with completion expected sometime in 2000.

Pests—An integrated pest management program was put in place.

Environmental—Radiation, temperature, and relative humidity are being monitored by a telemetric system supplied by Hanwell Instruments Ltd.

Conclusions

A building is the first and principal means of protection for collections and heritage interiors, and a roof is a building's sou'-wester. The much neglected exterior at *Temple Newsam*, particularly the roof, had reached a critical state by the early 1990's. All conservation work inside would have been undermined by a poorly maintained building, and the war against deterioration could never be won unless a positive effort was made towards upkeep. Maintenance needed to be relentless and correctly

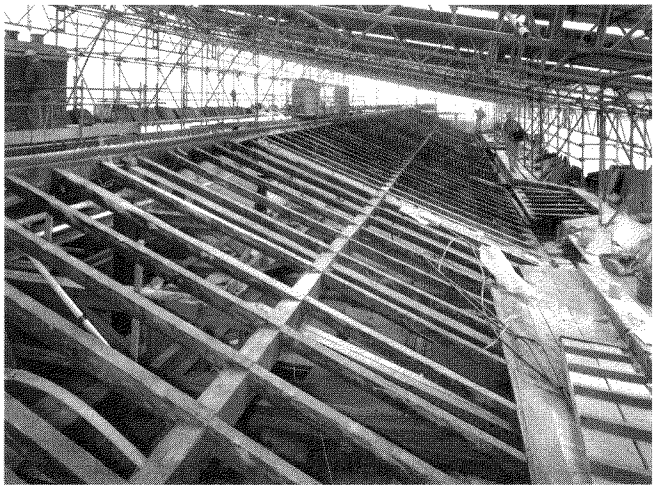


Figure 12. Re-roofing of the north wing.

specified. The fact that it is being dealt with now in an organized way, based on surveys by an appropriately experienced architect, is largely due to Anthony Wells-Cole (with directorial backing) in getting it onto the councillors' agenda. An application in 1998 to the Heritage Lottery Fund for a grant to restore the deteriorated external fabric, renew the heating system to include conservation heating principles,[16] improve disabled access, provide innovative interpretation and education facilities, and finish the program of room restorations was partially successful. A grant of £1.3 million (as 50% of the projected £2.6 million required) was awarded for the first three projects. The balance is being provided by Leeds City Council. Room excavations and restorations are ongoing at the time of writing, and it is to be hoped that they will continue. Getting the historic architectural features and interiors right is every bit as important as the conservation work on the collections. Dividends from this program are manifold. The collections and house interpreted, and presented, as a unified whole gives visitors a far more enriching experience. Most important is the contribution of this program to breaking the cycle of decay and neglect. The downward spiral can be reversed by small successes built on each other.

Acknowledgements

I thank all my colleagues and Anthony Wells-Cole for encouraging my interest in historic interiors. For financial assistance, I thank the Museums and Galleries Improvement Fund in conjunction with the Wolfson Foundation and the Wolfson Family Charitable Trust for their grant towards the Picture Gallery restoration.

Endnotes

1. Historic information about *Temple Newsam* is to be found in a number of different locations, especially in numerous articles in the *Leeds Arts Calendar* (1946–1995) and *Leeds Museums and Galleries Review* from 1998; also guide books, books, articles, dissertations, and catalogues. These are in the curatorial library at *Temple Newsam*. Other principal archive sources are the *Temple Newsam* papers at the West Yorkshire Archive Service, Chapeltown Road, Leeds LS7 3AP; the Marquess of Hertford's papers at the Warwick County Record Office, Priory Park, Cape Road, Warwick CV34 4JS; the Earl of Halifax's papers at the Borthwick Institute, University of York, St. Anthony's Hall, Peasholme Green, York YO1 7PW; and the Meynell family papers, Staffordshire County Record Office, Eastgate, Stafford ST16 2LZ.

2. Hendy, P. *Treasures from Yorkshire Houses*. Leeds: Leeds City Art Gallery and Temple Newsam House, 1938.

3. Gilbert, C. *Furniture at Temple Newsam House and Lotherton Hall*. Published jointly by the National Arts Collections Fund and the Leeds Art Collections Fund, Volumes I and II in 1978 and Volume III in 1998.

4. Notes and photographs by Philip Hendy in the curatorial library at *Temple Newsam*.

5. Wells-Cole, A. *Historic Paper Hangings from Temple Newsam and other English Houses: Temple Newsam Country House Studies Number 1*. Leeds: Leeds City Art Galleries, 1983.

6. Gilbert, C., J. Lomax, and A. Wells-Cole. *The Fashionable Fireplace: Temple Newsam Country House Studies Number 2*. Leeds: Leeds City Art Galleries, 1985.

7. Gilbert, C., J. Lomax, and A. Wells-Cole. *Country House Floors 1660–1850: Temple Newsam Country House Studies Number 3*. Leeds: Leeds City Art Galleries, 1987.

8. Gilbert, C., J. Lomax, J. Rutherford, and A. Wells-Cole. *Country House Lighting 1660–1890: Temple Newsam Country House Studies Number 4*. Leeds: Leeds City Art Galleries, 1992.

9. Cornforth, J. "England in America." *Country Life* (August 17), 1995.

10. *Temple Newsam* papers, West Yorkshire Archives. Reference TN/EA 13/1-74.

11. *Temple Newsam* papers, West Yorkshire Archives. Reference TN/EA 12/10.

12. Connell, D. *The Collection of Paintings made by the Ingram Family at Temple Newsam House from the 17th to the 20th centuries*. Ph.D. thesis, University of Leeds Fine Art Department, 1992.

13. Doyal, S., and M. Sandiford. "Architectural Linings and Backings." pp. 60–66 in *Lining and Backing: The Support of Paintings, Paper and Textiles: Papers delivered at the UKIC Conference, 7–8 November 1995*. London: United Kingdom Institute for Conservation, 1995.

14. This system of colour notation was developed by the Scandinavian Colour Institute and is licenced to ICI (Dulux) Paints, Trade Technical Department, Wexham Road, Slough, Berkshire SL2 3DS.

15. See Endnote No. 12, pp. 54–56.

16. Staniforth, S., B. Hayes, and L. Bullock. "Appropriate Technologies for Relative Humidity Control for Museum Collections Housed in Historic Buildings." pp. 123–128 in *Preventive Conservation: Practice, Theory and Research. Preprints of the Contributions to the Ottawa Congress, 12–16 September 1994.* London: International Institute for Conservation of Historic and Artistic Works, 1994.

Appendix

Health and safety issues
Excavations and room restorations turn rooms into building sites. Common sense and legislative safety measures should be applied rigorously. Large amounts of dust and debris can accumulate in voids in historic buildings, especially around fireplaces. Old fixings, nails, and screws can cause injury. Structural integrity may need to be assessed by a professional. The location of all services, especially electricity, must be known. The following hazards may be present: mercury where there has been a mercury-silvered mirror or a barometer; lead paint; biological hazards from vermin such as rats and birds. Personal protective equipment is therefore essential.

Contractors
Robert Aagaard, Period Architectural Designers, Manor House, High Birstwith, Harrogate, North Yorkshire HG3 2LG: restoration of damaged carved stonework.

Patrick Baty, Papers and Paint, 4 Park Walk, London SW10 0AD: paint analysis and supply of the paints. http:\\sites.netscape.net\colourman\homepage e-mail: prb@colourman.com

Context Weavers, Park Mill, Holcombe Road, Helmshore, Rossendale, Lancashire BB4 4NP: analysis of original case cover materials and weaving of material for new covers.

Hesp and Jones, The Cedars, Beningbrough, York YO6 1BY: painting, canvas and lining paper, and marbling.

Rosalie Hill, 23 Stray Towers, Victoria Road, Harrogate HG2 0LW: fabrication of case covers for suite of furniture.

Mark Maniatt, 9 Farm Road, Crossgates, Leeds LS15 7ND: consolidation of plasterwork.

Allyson McDermott, The Battery House, Petworth House, West Sussex GU28 0DP: wallpaper analysis, manufacture, and hanging.

Sun-X (UK) Ltd., Madeira Parade, Madeira Avenue, Bognor Regis, West Sussex PO22 8DX: venetian blinds and UV filters.

Thompson and Walker, Guiseley, Leeds (no longer trading): supply and installation of the timber lining.

Suppliers
Hanwell Instruments, 12 Mead Business Centre, Mead Lane, Hertford SG13 7BJ: telemetric environmental monitoring system.

W.R. Outhwaite and Son, Ropemakers, Town Foot, Hawes, North Yorkshire DL8 3NT: green rope for barrier system.

Peter West, New Barn, New House Lane, East Dean, near Chichester, West Sussex PO18 0JG: turned oak stanchions for barrier system.

Staff
Anthony Wells-Cole: overall project management.

David Hudson and technical staff: movement of art works, furniture, and overmantels, removal of red damask and hardboard.

Ian Fraser: furniture and joinery conservation, supervision of volunteers, conservation input to project specifications.

Jenny Hack: picture conservation and frame cleaning, supervision of volunteers, conservation input to project specifications.

Volunteers
Andrew Hunt, Conservator of Furniture and Gilding, Manchester City Art Galleries, Queen's Park Conservation, Harpurhey, Manchester M9 5SH (appointed 1997): carving of missing dado and skirting mouldings.

Karen Haslewood, conservation student: picture cleaning and frame cleaning.

Ana Montes, conservation student: picture cleaning and frame cleaning.

Government advisory bodies
English Heritage, Fortress House, 23 Savile Row, London W1X 2HE.

Royal Commission on the Historical Monuments of England, Fortess House, 23 Savile Row, London W1X 2JQ.

Note: Unfortunately I am unable to deliver this paper in person at the conference, so Anthony Wells-Cole has kindly agreed to present it for me.

Résumé

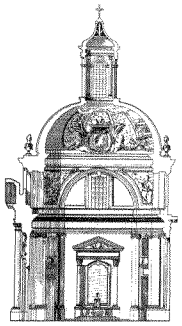
Restauration de la galerie de tableaux à Temple Newsam, au Yorkshire (Angleterre)

Temple Newsam est un grand manoir de campagne et un édifice enregistré de Classe 1, qui est devenu la propriété du Conseil municipal de Leeds en 1922. Pendant son aménagement comme musée des beaux-arts et des arts décoratifs, bon nombre de ses intérieurs historiques ont été radicalement transformés. En 1983, de nouvelles attitudes, une nouvelle direction et des changements dans la politique d'acquisition ont conduit à un nouveau programme pour la restauration des pièces selon les plans de décoration et le mobilier d'avant 1922. Jusqu'ici, douze pièces ont été restaurées, le point culminant étant la restauration de la galerie de tableaux (la plus importante salle de ce type en Angleterre). Cet article expose le dossier de la galerie de tableaux à Temple Newsam alors que l'on rétablissait le plan décoratif de 1746 au cours de l'année 1996. Des renseignements replaçant l'édifice dans son contexte historique et un aperçu des transformations d'après 1922 sont également donnés.

5

Treatment Approaches: Furniture and Textiles

Méthodes de traitement : Meubles et textiles



Treatment of an 1870's Textile Interior: The Drawing Room, Mandeville Hall

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Abstract

In 1994, Artlab Australia commenced an extensive 3-year conservation treatment of the relatively intact textile interior of the Drawing Room of *Mandeville Hall* (an historic house in a suburb of Melbourne which is currently the hub of a large Catholic School for Girls run by the Loreto Order). The interior had originally been installed in 1878 by Gillow and Co., an English firm of decorators. It is valued as an outstanding example of the Aesthetic Movement, and is unique in Australia.

The textile components included an embroidered and appliquéd frieze, a silk damask fill, and a velvet dado, all of which required treatment. The most significant area of work was the treatment of the 10 silk damask fill panels, which were all 2.66 m high and ranged from 40 cm to 3.6 m in width. These panels had to be removed from the walls and transported to the conservation laboratory for treatment. Given their size and fragility, this necessitated careful advance planning and trialing of various treatment techniques.

Introduction

Mandeville Hall is a 25-room house in a suburb of Melbourne, in Victoria, Australia. The house has a number of interesting features, including the rare textile interior in the Drawing Room.

A major conservation project on the house commenced in 1994. The following year, the Textile Laboratory at Artlab Australia was subcontracted by the Ian Potter Conservation Foundation to carry out the work on the textile components of the Drawing Room. This work was completed in June 1998. One-third of the cost was funded by Heritage Victoria and the rest by the school.

History

Alfred Watson built the original house in 1867. On his death in 1875, the somewhat sober and conservative house was lavishly transformed in the Italianate style and renamed *Mandeville Hall* by Joseph Clarke. In 1876, while on business in London, Joseph Clarke's brother commissioned Gillow and Co. (an English firm of decorators and cabinetmakers) to supply interior decorations for the new wing which included a Drawing Room, Parlour, Entrance Hall, Staircase, and Conservatory.

Figure 1. The Drawing Room at Mandeville Hall.

Gillow and Co. sent a team of workman from England to carry out the installation of the interiors in 1878. The design of the textiles in the Drawing Room can be linked stylistically to Bruce Talbert, whose designs were being marketed by Gillow and Co. at that time.

Joseph Clarke's reputation was destroyed by a personal scandal, and he was heavily in debt when he died in 1895. The house was sold and changed hands several times before it was purchased by the Loreto Order in 1924 to be developed as a girls' school. It is due to the care of the Loreto Order that the interiors have remained intact. They are an outstanding example of an Aesthetic interior, and the only such interior known to exist in Australia today.

Description

The Drawing Room at *Mandeville Hall* is approximately 9 m long and 6 m wide, with a ceiling height of 4 m. There is a large bay window on the front wall, and large glass doors on the wall opposite to the Hall lead to the Conservatory. The back wall features a large chimneybreast with original satin wood fire surround and decorative overmantel. The centrally positioned Hall door has an overdoor, and both feature painted decoration in the Aesthetic and Japanoiserie style.

The interior decoration is still relatively complete with an ornate plaster ceiling with gilding and decorative painting, and a deep cornice with gilded decoration, gilding, or gold paint on all the timberwork. The two remaining ornate brass gasoliers have been converted to electric lights. There are fittings in the walls for gaslight ensconces, but these are no longer in place.

All of the walls in the Drawing Room are covered in fabric from the cornice to the skirting boards. These fabrics include an embroidered and appliquéd frieze, a silk fill running from the picture rail to the chair rail, and a velvet dado.

The frieze is 46 cm high and runs around the top of the room just below the decorative cornice. It is a heavy cream silk fabric with appliquéd velvet borders. The borders are hand-decorated with a plush pile velvet wave pattern and satin dots. The central section features appliquéd pomegranate and leaf motifs in a loose trailing design of velvet, felt, brocade, and satin. All appliquéd areas are edged with a thin cord, and additional embroidered decoration is carried out over the appliqué.

The textiles are attached to the plastered brick walls with thin timber battens, which are positioned to correspond with the edges of each textile component on each section of wall. This was accomplished by cutting the existing plaster so that the wooden battens could be recessed, and then areas of lost plaster around the wood were re-plastered flush with the wood.

The frieze is attached to the wall with small iron tacks nailed into the wooden battens through a thin cotton backing fabric along the top and bottom edges, which are then covered with gilded beading at the top and gold-painted picture railing at the bottom.

The silk fills are made up of 10 panels, which are all approximately 2.66 m in height and between 40 cm and 3.6 m in width. They run between the frieze and the dado. The fabric has a satin weave background with a textured weave featuring a Japanoiserie style leaf and blossom pattern. The panels are vertically seamed with a fabric width of 1.57 m.

Each section of silk is attached to the wall around its edges with small iron tacks nailed into the recessed wooden battens. The edges are covered with gilded beading in the corners, gold-painted picture railing above, and gold-painted chair railing at the bottom edge.

Behind the silk is a layer of hessian-backed paper. This is glued to the underlying recessed wooden battens. There is also a later addition of a flat strip of wood which has been painted gold and adhered to the front of the silk directly above the chair rail.

The velvet dado is a maroon plush pile silk velvet with a base of plain weave cotton. It is approximately 55.5 cm wide with selvages top and bottom. Each section is attached in the same manner as the silk fills.

Condition

On first impression the silk interiors appeared to be in surprisingly good condition, albeit with some obvious damage. However, tearing and sagging of the panels had noticeably increased in the few years before treatment commenced and it was felt that treatment was necessary to prevent their rapid degradation.

Colour changes

The frieze, which appeared quite autumnal in tone, was originally a lot brighter with greater intensity of colour. The original colours were revealed after removing some of the beading. Of particular note were the satin dots: where they had been exposed they were cream in colour but underneath the beading they were a bright hot pink.

There was some confusion about the original colourway of the damask. A newspaper article of the time described the silk panels as being a delicate and tender olive green with a pattern of darker green leaves and soft blue flowers, but the silk now appeared to be a monochrome gold/brown. Areas of the silk underneath the beading or behind the overmantels appeared much lighter (a soft grey/green colour) but still apparently monochrome.

After giving up hope of finding any indication of different colours, a very small but distinct area of blue was found along one edge, on the back of the petals of one flower and the back of the veins of some leaves. This blue was very similar to the blue on the ceiling. Why it was still present in this one area, with no other colours evident, remains

unsolved as the scope of the project did not allow for further testing.

More confusion arose after examination of a modern swatch of the fabric[1] said to be following the original pattern and colourway. The pattern was identical but the colourway was different, although not entirely dissimilar to the historical description and what was found. The modern swatch had a blue background and soft grey/green leaves and gold flowers. The blue was similar to the small area of blue found on the back of the flower; however, as it was on the back of the flower (due to the construction of the weave) this would not have been the colour of the flower on the front. So it is possible that the contemporary report was inaccurate (i.e. the flowers were not blue) and the colourway of the modern swatch is a more likely indication of the original, although there has been great difficulty coming to terms with this hypothesis due to the large difference in appearance between the old silk and the modern swatch.

The velvet dado was maroon in colour but had originally been much brighter and more purple/crimson in tone. Thus its present appearance was much more subdued than the original colour scheme.

Clearly the textile components of the room have been significantly altered in appearance. In the 1880's the room would have been very vibrant and (to contemporary eyes) almost gaudy, with the strong and intense colours in the frieze, the blue and gold silk fill, and the crimson/purple velvet dado, all of which were tied in with the decorative schemes on the ceiling and cornice. It is likely the current custodians (being familiar with the degraded colour scheme) would have been shocked by the original colour scheme if the textiles were replaced.

Staining
There was general staining throughout with a large water stain to the left of the fireplace, which was caused by an overflowing downpipe.

Physical damage
There was extensive physical damage to all elements. The thin cotton tacking margins of the frieze and any heavily starched silk satin appliquéd elements were extensively damaged by silverfish. As a result the frieze was very poorly attached to the wall. In many areas only the vertical beading in the corners held it in place. The loss from the satin appliqué was particularly evident in the satin dots in the border, with nearly 50% missing.[2]

The silk fills were of greatest concern. They were attached only around the edges and, with some panels up to 3.6 m wide, there was considerable strain on the silk. This had resulted in tearing in the top edges and sagging and distortion of the panels. There was also extensive damage caused by touching and abrasion above the chair rail where the sagging damask rested, and a large hole just inside the door caused by unsuccessful attempts to locate the light switch, which is in the hall.

The velvet dado was extensively damaged with the pile missing and large areas of abrasion. This damage was noticeably worse in areas where the light levels were higher.

Treatment

Planning and staging
Treatment was carried out in three stages; this enabled the project team to start small and work up to the more complex aspects of the treatment, and allowed the client to seek funding for the separate stages of the treatment.

The first stage of the project included full treatment of the frieze, and removal and complete treatment of one section of silk fill. The full treatment of this one panel provided the opportunity to finalize the proposed treatment and to demonstrate to the apprehensive school community that the panels could be safely removed and rehung. After the completion of the first stage, the representatives from the school were also able to see how the completed frieze and one panel would look before they had to commit themselves to treatment of the remaining panels.

The second stage of the treatment consisted of removal, full treatment, and rehanging of four of the damask panels.

The final stage was full treatment of the remaining five damask panels and treatment of the dado.

Frieze
Removal of some of the vertical beading at the corners revealed that the frieze was a continuous length, not cut at the corners like the silk fill. Repair work had to be carried out in situ as removal was considered unnecessarily hazardous to the frieze.

The entire frieze was gently vacuumed to remove surface dirt and insect debris. In many areas where the pile was fragile only very light brushing to remove heavy deposits of dust was carried out.

In areas where the tacking margin was missing due to insect attack, herringbone cotton tape was inserted and sewn into position with Gutermann's polyester thread. The tape was then tacked to the recessed wooden slats following the original method of attachment.

Areas where the design was visually disfigured by insect attack were restored; thus the missing dots were replaced. Silk satin was dyed to match the remaining dots and lined onto Japanese tissue using starch paste. The dots were cut to shape and heat-set into position using Eva film.

Silk fill

1) Preliminary investigations

In the early stages of the project there was considerable discussion about various methods to provide internal support for the silk panels. It was agreed to use soft-side Velcro on the panels themselves, as this would allow for as full support as possible while still providing easy removal, re-adjustment, and re-attachment if required. However, it was still necessary to determine how to attach the hard-side Velcro to the wall, how to fill the gap between the back of the silk and the wall created by the thickness of the Velcro and any battens required for attachment, and how to resolve these problems without removing the hessian-backed paper behind the panels.[3]

After examining a range of options, it was decided that the internal lines of Velcro would be attached to timber battens recessed into the wall. This method had a number of advantages. With the battens recessed, a wooden batten could be used and the Velcro could then be stapled onto the battens, so that no adhesives were required. The gap between the back of the silk and the wall was now only the depth of the thickness of the Velcro and could easily be filled with a fabric such as felt or pellum.

2) Removal of the silk fills for treatment

Each panel required extensive treatment and had to be removed from the wall and transported to the Textile Laboratory at Artlab Australia.

Initially the beading, picture rail, and chair rail were removed from each section. As each panel had a slat adhered to the silk above the chair rail, they could only be rolled horizontally. It was decided that rolling from the bottom up was the safest as it involved the least risk of damage if per chance the roller was dropped.

Because of the size of the panels and the heights at which the on-site team had to work, removal had to follow a set of planned steps. First, the tacks were removed from the bottom and side edges of each panel and every second tack was removed from the top edge. A 10-cm-diameter cardboard roller was then cut the exact width of the panel (the exact length was crucial for sections on either side of the chimneybreast). Scaffolding was positioned to allow easy access to the top of each panel. Two dowels, each with a screw eye in the end, were tied to the scaffold so that the screw eyes were right into and above the top corners of the panel (see Figure 2). A length of rope was then tied to one screw eye, passed down to the ground, through the prepared roller, and then up through the other screw eye and temporarily tied off on the scaffolding.

To remove a panel, one or two people worked to roll the panel while a third team member, positioned on the scaffold, pulled the rope through the roller, keeping it taut. At any point the rope could be tied off suspending the roller

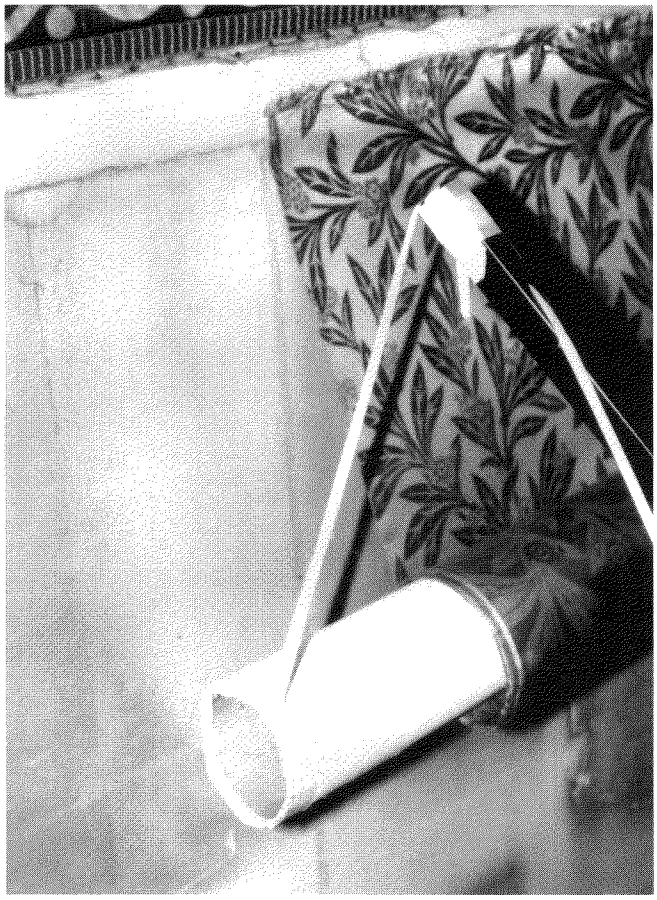

Figure 2. Top of silk fill panel after it had been rolled up in preparation for removal.

at that level. This allowed the people rolling to let go of the roller so they could climb up the scaffold as the rolled section got higher, thus enabling the rolling to proceed in a very controlled way.

Once the panel was rolled up to the top, the roller was again tied off while the remaining tacks were removed. The last portion of the panel was then carefully rolled up, the rope untied, and the roller carefully lowered to the ground.

Once at ground level, the panels were padded, interleaved, re-rolled onto larger diameter rollers, and crated for road transport to Adelaide.

3) Treatment

Once in the laboratory, the first step of treatment was the removal of the wooden slat from the lower edges of the panels. The adhesive attaching the slat to the textile had the characteristics of rubber cement and was soluble in toluene. Toluene softened the adhesive enough to allow the slat to be removed from the damask, but extensive testing failed to find a solvent that softened the adhesive sufficiently to remove it from the silk without damage. For this reason the residue was reduced but full removal was not attempted. Instead, it was decided that after the panels

were completed and rehung the adhesive would be covered with new slats placed over the residue and held in place with Velcro.

4) Cleaning

Dye tests were carried out and the colours were found to be stable, so the panels were wet-cleaned. A solution of 0.02% v/v Teric GN9, 0.005% w/v CMC in softened water was used. Each panel had three baths in wash solution and five rinses. The average pH of the first wash baths was around 4.5 and the average pH of the last rinse baths was around 6.5, which improved the chemical stability of the silk. The colour of the panels was not significantly lighter but the lustre and strength of the silk were significantly improved.

After washing, each panel was placed on its own pre-prepared template designed to ensure that the panels dried to their correct shape and size. The first panel that was cleaned was smaller and in better condition than a lot of the other panels, so it was relatively easy to get it back to its exact original size. However, wet-cleaning some of the larger and more fragile panels resulted in some shrinkage from top to bottom, and it was not possible to get them back to their exact same shape without causing damage. Shrinkage was up to 2 cm in some panels, which was unfortunate but unavoidable. The shrinkage was disguised by the wooden slat that was placed over the adhesive residue.

5) Patching

Patches were prepared for torn areas. A washed silk satin that closely matched the background texture and sheen was selected. The patches were dyed using Deka Silk fabric dyes. The edges of each patch were pinked and then carefully hand-sewn into position. The areas of damage were couched, using a fine Gutermann's polyester thread.[4]

A fine matching-colour Nylon net was sewn over the edges to help support the numerous tack holes.

6) Lining

Washed silk habutai, of a similar colour to the silk fill, was used for lining. Silk was chosen so the lining would expand and contract with the silk fills as they responded to environmental changes. The lining was positioned on the back of the silk and sewn on with Gutermann's polyester thread using a running stitch following staggered vertical grid lines.

7) Hanging system

Soft-side Velcro was machine-sewn to a strip of fine cotton twill fabric,[5] which was pinked at the edges and then hand-sewn into position on the panels using Gutermann's polyester thread. The Velcro was attached around all edges of the panels and in internal vertical lines, approximately 1 m apart in the larger panels.

The treated panels were then padded, interleaved, rolled, and transported back to Melbourne.

8) Preparation of the wall

The original hessian-backed paper was still in place on the walls of the Drawing Room and it was felt that it should be retained. However, this was an added complication in the rehanging process as it made it difficult to determine the condition of the plaster. In some cases the paper had to be cut and lifted to allow for plaster repairs.

Another problem was the positioning of the internal lines of Velcro, which had been placed where support was required on the panel. These decisions had been made in the laboratory without the benefit of closer inspection of the wall. When preparations were made to recess a batten for one of the panels, drawings of possible design features of the Conservatory doors were found on the plaster in which the groove was to be cut. In this case it was necessary to stop the groove above the drawing and restart it below, and the corresponding Velcro on the panel had to be removed.

Initially the paper was cut away where the groove was to be placed, and then the plaster was scored with a purpose-made tool consisting of a piece of wood with two nails protruding from one side at the right depth and width for the channel. This process was very controllable and kept the amount of dust produced to a minimum. The plaster between the scored lines was removed using a cold chisel, and the channel was consolidated using a dilute solution of PVA. The wall was then drilled and wooden wall plugs were inserted to attach the battens.

Once the grooves had been prepared, a strip of hard-side Velcro, pre-sewn to cotton twill, was attached along the top edge of each section using stainless steel staples fired into the original timber battens.

The thickness of the Velcro created a gap between the silk and the wall. To fill this gap, a layer of 3-mm polyester felt was selected. The felt isolated the silk from the acidic paper on the wall, it gave some slight padding to the silk, and the slightly 'grippy' surface provided additional support to the silk.

The polyester felt was cut to approximately the right size and rolled out over the wall. It was then hand-sewn onto a fabric strip below the top Velcro, and the internal wood battens were nailed through the felt into the prepared channel. By doing this the felt was held firmly by the battens and it supported the weak and damaged underlying paper. Because the felt had a certain amount of give, it was possible to pull out any distortions and achieve a flat surface quite easily. At the edges and bottom of each section, the Velcro was stapled to the recessed wooden battens. The felt was then trimmed and stapled just inside the edge of the Velcro.

9) Rehanging the damask

At the beginning of the rehanging process, the vertical lines of hard-side Velcro on the walls were temporarily masked with strips of fabric pinned into position. Each panel was then re-rolled onto the cardboard roller used during removal.

The system for rehanging the panels was basically the reverse of the system used for their removal. The scaffolding, screw eyes, rollers, and ropes were set up as before, but this time with the roller suspended at the top. The soft-side Velcro on the top edge of the damask was then attached to the hard-side Velcro on the wall starting in the centre and easing out to the edges. Small sections of the vertical hard-side Velcro were then uncovered by unpinning the fabric strips. Again, working from the centre out, the soft-side Velcro lines on the damask were attached to the exposed hard-side Velcro on the wall underneath. This was repeated until the entire panel was unrolled and completely attached. The system worked well; it was slow and controlled, and any area that required adjustment could be easily released, corrected, and re-attached.

The re-attached panels were much flatter than they had been before treatment. The internal lines of Velcro were slightly visible in raking light, but not very noticeable.

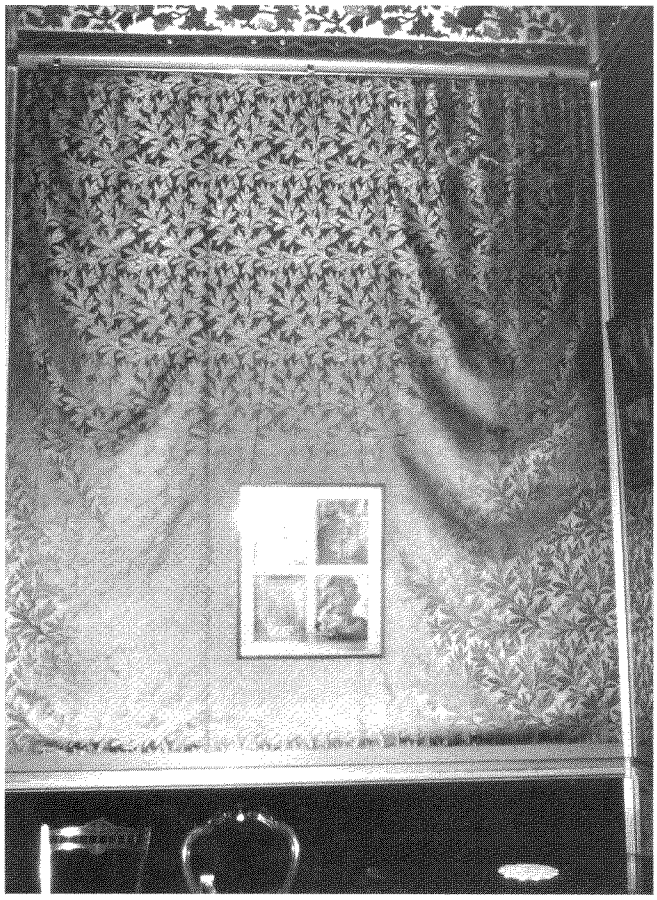

Figure 3. Silk fill panel before treatment.

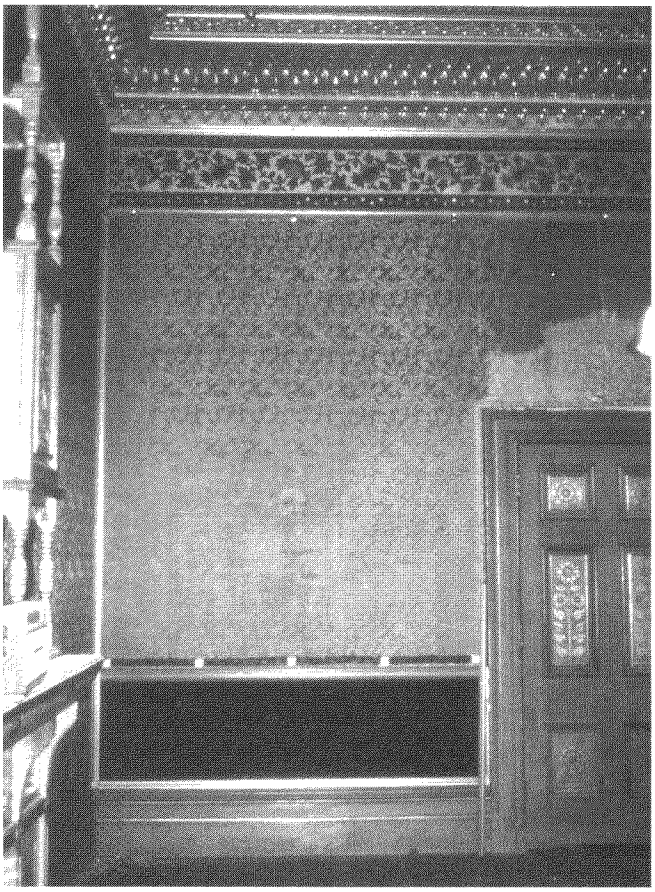

Figure 4. Silk fill panel after treatment but prior to re-attachment of overdoor, beading, and wooden slat.

The panels were much better supported than before treatment as they now had internal support.

The picture rails, vertical beading, and chair rails were replaced by re-nailing them into position using the original nails where possible. Nailing through the silk was obviously not ideal, but the picture and chair rails must support some weight so they had to be securely attached and nailing was felt to be the only way to do this.

Dado

The treatment of the dado consisted of very gentle surface cleaning with a very soft brush, keeping away from any areas where the pile was particularly damaged.

Conclusions

The treatment of the textile components of the room has significantly improved their condition. The frieze is now well attached to the wall, it is much cleaner, and the visual integrity of the pattern has been improved. The silk fills are now chemically more stable, they are adequately supported, and there are no distortions or sagging. The sheen of the silk is greatly improved, and gives a lustrous and opulent feel to the whole room.

The project provided a fantastic opportunity to work on an extremely rare interior. The challenges of working within the confines of an historic house and with such large pieces of silk were great, but the process of finding solutions to the problems was extremely satisfying. The staged approach was vital in allowing the team to fine-tune the necessary skills before the more difficult later stages of treatment.

Now that the treatment is finished the school will continue regular monitoring of the textiles and a regular program of surface cleaning. It is hoped that this treatment of the silks, in conjunction with ongoing monitoring and maintenance, will ensure that this historic interior of *Mandeville Hall* remains an integral part of the spiritual heart of the Loreto Mandeville Hall Catholic Girls' School.

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Endnotes

1. The fabric was rewoven in the 1980's by the Humphries Weaving Company in Braintree, England (the request came from Warner fabrics for an unknown client in Melbourne). The weavers had access to the original patterns, Jacquard cards, and colourway details.

2. There was no sign of recent active infestation and photographic evidence showed that the damage occurred prior to 1981.

3. The first thought was to attach the internal lines of hard-side Velcro to a thin slat of either wood or aluminum, attach this to the wall, and then pad out the wall with a thin fabric-covered lightweight board to fill the gap made by the thickness of the slat and the Velcro (approximately 5–8 mm). There were a number of difficulties with this approach. First, the slat would have to be as thin as possible, as well as rigid. Aluminum could be used to satisfy both these criteria but to attach the Velcro to the aluminum would require an adhesive. Because an adhesive might fail in the long term, leaving the Velcro unattached, it would be preferable to use a physical method such as staples. The next problem was selecting the type of lightweight board to use and developing a system for attaching it to the wall over the paper. But an acid-free board that would definitely not warp could not be found, and no satisfactory method of attachment could be devised. Screwing the boards into position would mean drilling through the paper repeatedly. The use of adhesive to attach the board had to be rejected as this method would further damage the paper, which already did not have sufficient strength to support the boards. The final disadvantage was that when the work was finished, the silk would be 5–8 mm farther out from the wall than it was originally. This would make fitting and re-attaching the picture rails, beading, and chair rails extremely difficult. It was obvious that the matter had to be reconsidered and it was decided that a system keeping everything much closer to the wall was required.

4. The silks were going back into a room that was still used, so a robust thread was necessary. Although slightly thicker and hence more visible in nature than some other threads, fine Gutermann's polyester thread was chosen for sewing throughout because it was quite strong. A polyester was chosen over a silk because it would be more stable.

5. This was selected over a more standard tape as it was strong but did not leave a visible ridge under the silk.

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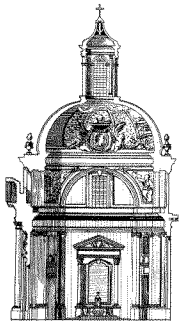
Résumé

Traitement d'un intérieur des années 1870 décoré de textiles : le salon de Mandeville Hall

En 1994, Artlab Australia a entrepris la restauration majeure (d'une durée de trois ans) du salon de Mandeville Hall dont l'intérieur relativement intact est décoré de textiles. Mandeville Hall est une maison historique dans une banlieue de Melbourne, qui est actuellement le bâtiment principal d'une grande école catholique pour filles administré par l'Ordre de Lorette. L'intérieur avait été décoré à l'origine en 1878 par la firme anglaise Gillow and Co. Cet intérieur est considéré comme un exemple exceptionnel du Mouvement esthétique, et il est unique en Australie.

Les éléments textiles—une frise brodée aux motifs appliqués, des panneaux de soie damassée, et une bordure en velours—avaient tous besoin d'un traitement. La partie la plus importante du travail était le traitement des 10 panneaux de soie damassée qui avaient tous 2,66 m de hauteur, et de 40 cm à 3,6 m de largeur. Ces panneaux devaient être enlevés des murs et transportés au laboratoire de restauration pour traitement. Vu leur dimension et leur fragilité, il a fallu une planification préliminaire soigneuse, et la mise à l'essai de différentes techniques de traitement.



Modern Replacement Fabrics in Historic Interiors: Ethical and Practical Concerns

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Abstract

The textiles in historic interiors are highly susceptible to deterioration caused by environmental factors and visitor traffic. Using examples from the textile collection at the Isabella Stewart Gardner Museum in Boston, this paper discusses the development and use of modern replacement fabrics in period settings. Past and present approaches, and the factors to be considered when developing modern replacements, are outlined. Included case studies represent a range of techniques, suppliers, and levels of replication; they also probe various ethical issues regarding the role of reproductions in an art museum setting.

Introduction

Upholstered furniture, wall fabrics, and other textiles are important components of many historic interiors. Due to their innate fragility, these objects are highly susceptible to damage from environmental factors and visitor traffic, raising questions regarding their replacement once the originals are too deteriorated for display. This paper outlines past and present approaches to the use of replacement textiles at the Isabella Stewart Gardner Museum, and discusses both the practical issues and ethical questions raised through a range of case studies.

The Gardner Museum is the creation of a remarkable woman, Isabella Stewart Gardner, who built a Venetian-style Renaissance palazzo in turn-of-the-century Boston to house her extensive collection of paintings, sculpture, books and manuscripts, and a wide range of decorative arts including textiles and upholstered furniture. The museum is unique in that the galleries were all personally installed by the founder, and reflect her singular taste and vision. Indeed, the entire building and its contents can be compared to a single mixed-media artwork. When she died in 1924, Isabella Gardner left her museum and its contents for the "education and enjoyment of the public forever." The museum operates under the restrictions in her will which state that the galleries must remain as she originally installed them, and that the collection may not be expanded. Therefore, the collection is on permanent exhibition with little opportunity for rotation.

Preserving Isabella Gardner's collection

The Gardner Museum combines aspects of both an historic house and a fine art museum. It is often likened to a step back into another time, reflecting an environment and exhibition style in stark contrast to a typical modern-day art gallery experience. Long-term preservation of the collection is sought through climate control, low light levels, and judicious use of stanchions; still, conditions are not always ideal. Crucial to the museum's ambience is the interplay of art-filled spaces with the sunny, plant-filled interior courtyard. Use of barriers and labels is minimal so as to maintain the original appearance of the galleries and to encourage visitors to experience the museum in an unstructured, personal way. These qualities are part of what make the museum a unique and special place, but are often in conflict with the institution-wide priority of collection preservation.

Evolution of a philosophy for replacing museum original fabrics

Although Isabella Gardner stipulated that her installations not be changed, it was not her intention to have her palace become shabby with the effects of time. Textiles are conserved and re-installed for as long as possible, but eventually must be retired to storage where they serve as documents that provide information to assist in creating their replacements. Over the years, some deteriorated originals have been replaced but many have not, resulting in an overall erosion of the original installations. Because each artifact contributes to the overall whole of the founder's installations, the use of replacements in the museum can be viewed as compensation for loss, in which the gallery space is viewed as one cohesive work of art.

Isabella Gardner displayed some textiles decoratively to enhance other art in the room, while others she presented as fine art in themselves. Virtually all of the textiles used in a decorative manner today are replacements. From the documentation provided by the museum's long history of

conservators, several 'styles' or philosophies of replacement can be deduced. Commencing with the museum's first director, antique textiles were purchased and 'used up' as replacements for worn-out upholstery and table coverings. Beginning around 1950, primarily modern replacement fabrics and custom reproductions were used, but often in a simplified way. Gallery installations that originally had many different fabrics upholstering the walls were replaced by one or two damasks. Furniture was re-upholstered, but without the complex Victorian trimmings favoured by Isabella Gardner. Replacement fabric choices were sometimes excellent, but others bear little resemblance to their antecedents. One very conservative approach in the late 1970's consisted of replacing worn upholstery fabrics with very plain, new fabric, the principle being to emphasize the furniture frame.

The current replacement philosophy has evolved from these past approaches. The goal of conservation and curatorial staff now is to choose fabrics that copy as closely as possible Isabella Gardner's originals; this is accomplished through careful study of archival photographs, written descriptions, and surviving textile fragments. Because the collection is on permanent display in sometimes less than ideal conditions, only modern replacement fabrics are used. One major addition incorporated into the current philosophy is the level of documentation generated; not only are the materials and methods recorded, but also the rationale behind the choices made. Past experience at the Gardner Museum has shown that new fabrics have a lifetime of approximately 30 years before they too require replacement. Recording the rationale behind decisions will assist future museum staff in understanding today's choices, and contribute to the continued evolution of the replacement philosophy.

Factors to consider when developing a replacement textile project

Textiles at the Gardner Museum can be classified along several axes. Some, as with tapestries and framed textiles, are presented as fine art, while others serve a more decorative function. Large, ornate textiles assert an important presence, and others play a relatively minor role in their gallery context. Some of the textiles currently on display are Isabella Gardner's originals, but many are replacements. These classifications are carefully weighed when initially considering if a replacement is appropriate, and continue to permeate the decision-making process at all levels.

Once the decision to proceed with a replacement has been made, all documentation is carefully studied to glean as much information as possible about Isabella Gardner's original fabric. Documentation sources can include any of the following.

- Black-and-white archival photos: The pattern and possibly weave structure, but not colour, can be determined. The textile may be clearly visible, but frequently information is ambiguous.
- Written documentation: Early catalogue records of the textile collection by textile specialists Ella Siple (1927–1928) and Mabel Bainbridge (1930–1935), and the general museum inventory compiled by the museum's first director Morris Carter (1924–1955) give general descriptions including colour, pattern, and weave structure.
- The document textile: Many, though regrettably not all, of Isabella Gardner's originals were put into storage after they were removed from exhibition. Often only small fragments were saved, and these were not always identified. For large-scale projects, the search for a similar textile document may expand to include other institutional collections and fabric archives.

From this information, specifications for the replacement are determined. The more information known about the original fabric, the more closely matched the replacement can be. Fabric characteristics consist of the following.

- Fibre content.
- Weave structure.
- Supplementary decoration.
- Surface finish.
- Pattern (including motifs and scale).
- Colour (which frequently has the largest overall impact on the finished project and is often the most difficult to assess; written descriptions give only the broadest sense of colour, while dyes on surviving fragments have likely changed significantly over time).

The level of replication chosen for a project is a synthesis of all of the above information, availability of documentary evidence, impact of the textile in the gallery, plus budgetary considerations. Replacement fabrics can be categorized as follows.

- Commissioned reproductions that copy the original fabric as exactly as possible; a minimum length of 23–46 m (25–50 yd.) is standard.
- Custom-dyed colours of commercially available patterns (stock patterns) from design houses and reproduction fabric firms; a minimum length of 23 m (25 yd.) is standard.
- Fabrics currently in commercial production (stock fabrics), available by the metre (yard) from design houses/reproduction firms.
- High-quality fabric from retail stores; no minimum amount is required.

A variety of sources have provided replacement fabrics for the museum.

- International design houses/reproduction fabric firms (handwoven and machine-woven fabrics).
- Small local companies.
- Skilled individual craftspeople.

How the modern replacement will be integrated into the gallery is also considered, and continues to be a challenging issue. Most of the textiles and furnishings used by Isabella Gardner were already antiques, raising challenging questions especially in terms of colour matching. The interplay of the above factors is best illustrated by examining a series of typical case studies.

Using commercially available replacement fabrics

The term 'replacement' textile as used at the Gardner Museum indicates a modern fabric or trim that has taken the place of a textile artifact in the galleries.

Budgetary constraints: Italian upholstered benches
Situated in the Early Italian Room are a pair of early-19th-century Italian benches, for which the 1963 replacement upholstery had become worn and faded. Fortunately, a portion of Isabella Gardner's original upholstery, a dark blue 19th-century Chinese voided velvet with a pattern of dragons and clouds, had survived. The benches also figured prominently in archival photos. Therefore, enough documentary evidence existed to create an exact reproduction: the colour, weave structure, fibre content, and vertical repeat were all known. In this case, however, due to the prohibitive expense of custom-weaving a figured silk velvet [at the time running well over US$3300 per metre (US$3000 per yard), with a minimum length requirement], compromise was appropriate. The replacement fabric eventually chosen was a stock pattern produced by Scalamandré. It was very similar in scale and pattern to the Gardner original, but was a damask rather than a velvet. The fabric was custom-dyed to the required colour by Scalamandré to produce a fabric in the spirit of the original, if not exactly identical.

An opportunity for experimentation: Figured velvet trim
Small projects provide excellent opportunities to experiment with innovative techniques, and forge new working relationships. When a fresh approach was required to acquire a replacement trim for a late-18th-century English chairback settee, the work was contracted to a Massachusetts College of Art student, who received class credit for her work. In Isabella Gardner's day, the settee's seat cushion had been embellished with a multicoloured figured velvet trim elaborately patterned with crowns and eagles. The trim was of minor importance in the context of the entire gallery, but gave a unique flare to the settee. When a suitable replacement trim was sought during re-upholstery in 1996, such a unique item could not be found; moreover, it was prohibitively expensive to have the small amount custom-woven.

Figure 1. Late-18th-century English chairback settee, after re-upholstery in 1996. A hand-silk-screened velvet replacement trim decorates the bottom edge of the seat cushion. A section of Gardner's original figured velvet trim can be seen in the right corner.

A simplified version of the pattern was silk-screened onto silk velvet, imitating the texture and pattern of the Gardner original but using a printed rather than a woven technique. Great care was taken to match the colours to the document trim as closely as possible. Although the pattern itself is greatly simplified, the replacement trim conveys the overall impression of the original at a normal viewing distance. On closer inspection, visitors can see a fragment of the document trim displayed for comparison. Such projects allow conservators and curators to evaluate the strengths and limitations of new techniques, and provide information for future projects.

Use of accurate reproductions

In special cases, a custom-made textile that replicates the original as closely as possible is the preferred option; these textiles are referred to as accurate reproductions.

Commissioning custom-woven wall fabrics: The Blue Room project
Custom-woven accurate reproductions were commissioned for the refurbishment of the Blue Room walls, a major project completed in November 1998. Excellent photodocumentation of the room in 1926, and the existence of document textiles for all five of Isabella Gardner's original fabrics, allowed this installation to be closely replicated. The wall fabrics consisted of a blue striped moiré, two 18th-century lampas (figured weaves), two blue damasks, and a patterned trim. The original installation had been simplified in the 1950's when a reproduction of the striped moiré was used to replace all five fabrics. For the current restoration, custom reproductions were commissioned for the three dominant fabrics in the room plus the trim.

The fabric orders were divided between two firms, Scalamandré and Classic Revivals, Inc. The two reproduction lampas were handwoven in England on 19th-century jacquard looms by Humphries Weaving Company Ltd. (represented by Classic Revivals). The 18th-century moiré stripe and the trim were machine-woven by Scalamandré in New York. Working with two companies was complicated

Figure 2. Isabella's Gardner's Blue Room installation, as photographed in 1926 (southwest corner). Some fabrics were stretched taught, others draped, and several hung sideways. One of the wall fabrics, an 18th-century lampas with a feather and floral design, may originally have been bed curtains as suggested by the size of the panels and placement of the trim. This fabric is seen on the diagonal walls in the photograph.

Figure 3. The Blue Room in 1998 after installation of the reproduction wall fabrics. Archival photos were essential in restoring the details of the original installation, including positioning of the motifs in relation to the artworks, and placement of the tacks and trim.

but assisted in keeping the quality of the work very high, and kept the project running on time.

Careful consideration was given to the selection of colours for the reproduction fabrics, especially as they were woven by two different companies. Colour matching was done along hems and seams thought to date from the Gardner installation. Dyed yarn samples, weaving samples, painted renderings, and paper point-patterns were all reviewed and approved at each stage of production. In this way a successful match between the Gardner original and the reproduction was achieved. The result was a textile that, although sumptuous and fresh in its lustre and flawless condition, still conveyed a muted, antique look.

The newly refurbished gallery is considered a success. The fabrics relate to and enhance the many artworks hung in the room, and give the visitor a truer sense of Isabella Gardner's cohesive installation. The integration of the new silks into the room was not entirely straightforward, however. The initial scope of the project had been to replace only the wall fabrics, but it quickly expanded to include painting the ceiling and mouldings, refinishing the floor, and relighting the gallery. Despite efforts to avoid escalation of the project to include extensive object treatment, last-minute cleaning and treatment of many gilded frames and other objects eventually became necessary. The additional expense and time commitment required for this outcome appears to have been unavoidable.

19th-Century printed linen: Working with local talent

The overall character of the Macknight Room had been significantly altered 30 years ago by the removal of the colourful floral printed linen panels displayed throughout the gallery. To reproduce this fabric, the decision was made to work within the rich textile manufacturing tradition in New England. The work was contracted to Hampshire Printed Fabrics, a silk-screen printing company based in Lawrence, MA. The small scale of their operation allowed for a relatively small print run of fabric [less than 90 m (100 yd.)] which would not have been possible with a larger, faster, roller-printing operation. The company's dedicated staff were enthusiastic about working on a museum reproduction, and were very accommodating to the high standard required for the job. Due to the mill's close proximity to Boston, museum staff were able to attend the printing of the fabric to make final colour and design adjustments. The finished product was excellent and more cost-efficient than working with an established historic reproduction firm.

Goblin-stitched embroidery: Decorative or fine art?

Woven textiles, though technically complex, are in some ways straightforward to reproduce mechanically as the historic fabrics themselves were manufactured on machines in the form of jacquard or draw looms. Then and now, as soon as the design work is complete, the pattern can be woven repetitively to generate any desired amount of fabric. The same holds true for printed textiles. Other more hands-on techniques, like embroidery, are more difficult to reproduce as they seldom translate well into today's methods of mass production. In addition, although the artistic merits of machine weaving and printing are not disputed, the intimate nature of embroidery allows for more creative input from the individual needleworker, generating an object that is more 'one-of-a kind' than a mass-produced item.

The issue of what characterizes an object as art, and by extension fine art or decorative art, is highly debatable and largely beyond the scope of this paper. Two relevant concepts implicated in the debate, however, are the object's method of production/creation, and the context in which it is displayed. A large 18th-century embroidered panel in the museum's collection makes a good test case to discuss further the role of reproductions because it shares characteristics of both a mass-produced object and a unique work of art. Although the panel is embroidered by hand, the counted stitch technique and a repetitive pattern bear some similarities to the more mechanistic nature of weaving. In its gallery context, the panel is draped casually on a settee; thus it is displayed decoratively, not presented as fine art.

The panel was retired to storage in 1972 and the embroidery's elegant presence in the gallery requires replacement. For this project, the option of a high-quality handmade replica is being explored. A local needleworker has been contracted to embroider a small prototype which will encourage discussion on several fronts. Issues of integration into the gallery will be evaluated. Will the reproduction overwhelm the art? Will it look too new and appear out of place? The suitability of commercially available machine-made, chemically dyed materials will also be assessed. From the prototype, time and material costs for a full-scale reproduction can also be extrapolated.

Italian armorial hangings: The reproduction of fine art

All the textile projects presented thus far were originally installed by Isabella Gardner with a decorative function in mind. However, she also frequently presented textiles as fine art, many of which are still on permanent view. As time passes, the museum is frequently forced to face difficult decisions regarding the role reproductions may play in this area. The case of two large armorial hangings has become a platform on which to launch discussion of these issues. The pair were hung on brackets on either side of a fireplace extending out into the Raphael Room, and were removed in 1994 because they were in poor condition. The red velvet hangings embellished with three-dimensional appliqués, couched metal threads, and a painted coat-of-arms had a grand presence, and accentuated other representations of prestige and power in the room. Although not considered masterpieces in the wider context of art history, they were nonetheless of great importance as a focal point in this gallery installation. A combination of their extremely poor condition and their free-hanging display made conservation treatment and continued display impossible. Accordingly, the decision was made to stabilize the pieces as documents and to store them indefinitely.

The question of how to compensate for their loss in the gallery remains, however. The space could simply be left empty as it is presently, an impoverished version of Isabella Gardner's original creation. A range of options for replacement also exists. Possibilities include hanging

Figure 4. This pair of 18th-century Italian armorial hangings, photographed in 1926, had a commanding presence in the Raphael Room before they were deinstalled in 1994. The museum is currently evaluating the option of replacing them with an historically accurate reproduction.

lengths of plain red velvet, exploring photoreproduction techniques, or commissioning a high-quality historically accurate replica.

The idea of a replica is worth exploring. The sheer size and complexity of the project, and the high degree of skill required for its fabrication, would perhaps invest the reproduction with value for the viewer, albeit a different one from experiencing the real artifact. The possibility of the museum taking an active role in supporting or revitalizing a craft tradition is also attractive, and in keeping with Isabella Gardner's practice of generous art patronage. An international search has been undertaken to determine what material resources are available, and inquiries for locating skilled craftspeople have been made. Incorporating this information, a prototype will be produced to provide a concrete object on which further discussion can be based. However, there are other issues to be considered. Will modern materials successfully convey the appearance of the original, and how will they age? Is the skill level of the handwork acceptable? What degree and manner of artificial aging will be needed?

The display of a high-quality historically accurate reproduction in a fine art museum raises challenging ethical and practical issues. The museum may feel compelled to inform

visitors of reproductions, but the manner of conveying the information appropriately is problematic, as labeling at the Gardner museum is deliberately minimal. More importantly, the act of identification itself may give the reproduction undue emphasis and isolate it unnecessarily from the unified whole of the gallery installation. This might be comparable on a smaller scale to labeling a fill used in an individual artifact treatment to compensate for a loss. Also worth considering is the enormous cost of the reproduction. It is entirely possible that the replica could end up being worth more monetarily than the original. The museum would then likely be compelled to treat its preservation with the same care invested in Gardner's original artifacts. Finally, there is the issue of boundaries. It seems clear, for example, that the reproduction of an old master's painting would not be attempted within the Gardner Museum's organizing concept; less clearly defined, however, is the point at which the reproduction of a decorative art is or is not appropriate.

Conclusions

To preserve the founder's original gallery installations at the Isabella Stewart Gardner Museum, it has been necessary to replace worn-out decorative textiles. The most successful modern replacements have resulted when projects were evaluated individually to determine the textile's relative importance to the gallery, its most significant characteristics, and whether modern or traditional technology would be appropriate for its production. Through necessity, the museum is now exploring ways to integrate in an ethical manner the use of reproductions for textiles displayed as fine art within the galleries. The commissioning of prototypes, and continued careful discussion between conservator and curator, will assist in coming to terms with these challenging issues.

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Résumé

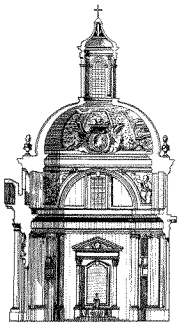
Tissus de remplacement modernes dans les intérieurs historiques : préoccupations d'ordres éthique et pratique

Les textiles présents dans les intérieurs historiques sont très vulnérables à la détérioration causée par les facteurs environnementaux et par la présence des visiteurs. À l'aide d'exemples provenant de la collection de textiles du musée Isabella Stewart Gardner, à Boston, cet article traite de la mise au point et de l'utilisation de tissus de remplacement modernes dans un cadre d'époque. On y présente les méthodes actuelles et passées, de même que les facteurs à considérer au moment de mettre au point des tissus de remplacement modernes. Les études de cas présentées offrent une gamme de techniques, de fournisseurs et de niveaux de reproduction, en plus d'aborder diverses questions d'éthique liées au rôle des reproductions dans un musée.

6

Treatment Approaches: Paintings and General

Méthodes de traitement : Peintures et généralités



Conservation, Restoration, Reintegration, and Re-creation: Can They Exist Together in Harmony on One Site? Swifts, *a Case Study*

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Abstract

Swifts is a grand Gothic Revival mansion situated close to Sydney Harbour. For the past 2 years it has undergone a process of conservation, restoration, reintegration, and re-creation.

Dating from the 1870's, *Swifts* was designed by French architect Gustavus Morell for the Sydney brewing family Tooth. The original interiors were in the late Victorian style, but by the 1930's this style was no longer popular and the interiors were either overpainted in neutral colours or overpapered in the style of the day. When the Catholic Church inherited the property in the 1960's, the mansion was assigned as the Cardinal's Residence, the Ballroom was converted into a chapel, and further plain redecoration took place. By the 1990's, the building had fallen into disrepair.

The current owners purchased *Swifts* in 1997 with the intention of restoring it as a family home. A heritage architect was engaged to carry out one of the options that had been proposed in a 1995 conservation report, i.e. to re-create the interiors as they existed in photographs taken in 1908. Conservators were requested to remove layers of old wallpaper and overpaint in small areas to reveal colour ladders of all the layers down to the original scheme. This investigation revealed richly coloured decorative schemes that were remarkably well-preserved (having been protected by the application of the 1930's wallpaper). However, as with all buildings in continuous use, the removal of wallpapers also uncovered large areas of wear, deterioration, and intervention by later occupants that left a patchwork of surfaces without consistent chronology or relationship.

The architect proposed a course of treatment that mixed different approaches: the conservation of existing fabric through stabilization only; the re-creation (as closely as possible) of the original scheme as revealed by the photographic and archaeological evidence available; and, where no evidence remained, the creation of a new scheme that was sympathetic with the original.

The juggling that resulted from this approach sometimes saw as many as three companies (the conservators, the flat wall decorators, and the decorative finish painters, each specialists in their different disciplines) working on one wall. The process brought into question some of the ethics held by the conservator of cultural material, in relation to the ethics of other professions. For a happy outcome, the issue of ethics had to be rationalized and adapted to the overlap of the professions as they existed in relation to the job. The outcome is a credit to the co-operation and sensitivity of all the various teams involved.

The constraints imposed by national, state, and local governments, and the charters adopted by professional organizations, provide valuable guidelines for the long-term preservation of built heritage, but it is the considered judgements and the interpretation of the intent of such constraints and guidelines that will preserve the integrity of buildings such as *Swifts*.

It is recorded that a Crown land grant of "9 acres and one rood" was made to a Mr. Thomas Baker in November 1833 for the land now occupied by *Swifts*. The property changed hands several times between 1833 and 1875, when part of the land was purchased by Robert Lucas-Tooth (eldest son of Edwin Tooth, founder of the brewing company R.&F. Tooth and Company). On March 18, 1876, Beatrice (infant daughter of Robert Lucas-Tooth) laid the foundation stone of the house that became known as *Swifts*.

The 1877 Rate Assessment Book of Double Bay Ward made the first description of the building as a "Cottage and 3 acres of land." The next year's entry described it as an "unfinished house," but by 1878 the entry was made for "an house, grounds and outbuildings owned and occupied by Robert L. Tooth," with a rateable value of 400 pounds. The name *Swifts* was derived from the name of Robert's grandfather's home in England (*Great Swifts*, at Cranbrook, Kent).

The house that was built in 1876 was a very ordinary red brick building modeled on *Great Swifts*. In 1882, Robert

Lucas-Tooth wanted to extend the house, and approached the office of architect Gustavus Alphose Morell. Part of the original house was to remain, but the extensions were conceived in a grand style. The architect received instructions that it should be built in stone in the same style as Government House, Sydney (though told that it should not be quite so elaborate as Government House, there were nevertheless instructions that *Swifts*' new Ballroom be larger than that at Government House). The castellated Gothic style house that resulted has survived to this day with only minor alterations to the 1882 design.

The family of Robert Lucas-Tooth resided in *Swifts* for only a short time. At the end of 1889 the family left Sydney to live in England. Little is known about the occupancy of the house until 1900, when land title passed to Mr. Edmund Resch.

The Resch family also owned breweries, and their company (Resch's Ltd.) was acquired by Tooth and Co. in 1929. Following the deaths of Edmund Resch in 1923, and then his wife Coralina in 1927, the property became part of the residuary estate of Edmund Resch, in which his sons Edmund Junior and Arnold had an interest. They had a dispute about the future of the property, and were forced to sell it at public auction in 1929. At that time Arnold wanted to subdivide the property while Edmund Junior wanted the house and 1.2 ha (3 acres) of land sold intact. Edmund Junior successfully purchased the property at auction, and lived there for the rest of his life. At the time of his death in 1963, he had amassed the largest personal fortune in Australia, most of which was held in the form of the Tooth shares acquired when Tooth and Co. bought out Resch's Ltd. in 1929. Edmund and his wife Florence had no children, and *Swifts* was bequeathed to the Catholic Church with the express wish that it become the official residence of the Catholic Archbishop of Sydney. There was also a condition that the property not be sold or demolished for at least 20 years after his death.

During Edmund Resch Junior's occupancy there were only minor alterations to the property, mostly the addition of sombre wallpapers that were applied over the hand-painted decorative scheme. During the Catholic Church's occupancy, cream and white paint schemes were introduced. The Ballroom was converted for use as a chapel-of-ease, the walls painted between dado and cornice in a plain cream, and the cove of the cornice painted with bronze paint. The delicate paint scheme on the ceiling dating from the 1880's appeared at first to have been untouched. However, closer inspection revealed that there had been extensive flaking, and the entire background colour had been repainted, cutting in around each decorative element. This repainting appeared to be an attempt to answer the problem of the flaking. The composers' portraits that most likely had been painted on paper and adhered in the medallion space in the dado were probably removed at that time.

The Ballroom Hall, richly decorated with trompe l'oeil, was completely overpainted with plain cream paint when it was converted into the narthex of the chapel. Cream or white paint was also applied throughout the house anywhere that the 1930's wallpaper was not in good condition or inappropriate to the 1960's lifestyle of the archbishop.

The Catholic Church sought to sell *Swifts* in 1983 (after the expiry of the condition of the bequest that the property not be sold within 20 years of Edmund Resch's death) claiming that the cost of maintenance and repairs was about AUS$945,000 a year, and they could no longer afford to keep the house. The following year a Permanent Conservation Order was made under Section 41 of the Heritage Act. In 1986 the property was transferred for AUS$9 million—the highest price ever paid for a house in Australia up to that time (which indicated that a Permanent Conservation Order was certainly not a deterrent to the sale of the property).

Some people may regard as negative any constraints on the development potential of a property. However, such constraints are intended to preserve not only the integrity of the property in question, but the entire precinct in which the property is located. The more important the building, the wider reaching the precinct.

Swifts is listed with the Australian Heritage Commission on the Register of the National Estate. A listing on this Register does not allow the Commonwealth Government any rights of management, right to acquire the property, or right to enter private property; nor does it provide any legal constraints or controls over the property. However, it does protect the listed property from any adverse actions that may be taken.

Swifts is also classified in the Register of the National Trust of Australia (New South Wales). This classification was made in 1971, and the reason given for the listing is that *Swifts* was considered "A fine 'Brewer's Baronial' mansion, perhaps, the grandest house remaining in Sydney which is being carefully preserved both externally and internally by its owners, set in well planted and extensive grounds." It is ironic that it was listed at a time when much of the original interior decorative schemes were being covered with a carefully applied layer of paint, in some areas permanently destroying evidence of the fabric of the building. It is important for us to consider that current thinking can so easily become unseated with the passage of time and the development of a more sophisticated philosophy.

The purpose of the National Trust Register is to alert the appropriate authorities should a listed property be threatened, so that measures can be adopted to preserve the

special qualities that led to the listing. There is no legal effect to being included in the Register; it is merely recognition of the significance of the property. However the Trust will take action on behalf of a listed property to ensure its protection, seeking the use of the State Heritage Act and the planning powers of local government to afford that protection.

Legislative controls were applied to *Swifts* through a Permanent Conservation Order (No. 146) under Section 44 of the Heritage Act, 1977, administered through the Heritage Council of New South Wales. These controls include some general constraints that prevent the demolition, damage, movement, or alteration of the relic, prohibit any development or display of notices or advertising on the relic, and forbid the damage, removal, or destruction of any tree or other vegetation on the site.

On a local government level, *Swifts* is listed as a Heritage Item. The listing includes the buildings, grounds, and gardens including specific trees, gates, fences, and garden sculptures. This prevents the owner from demolishing, altering, removing, or damaging any of the listed items, subdividing the land, or erecting new structures without permission.

These regulating bodies rely greatly on the self-regulation of the various professions involved in the care and restoration of cultural heritage. The professions have accomplished this self-regulation by adopting a Charter that provides guidelines for standards of practice. The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter), having regard to the International Charter for the Conservation and Restoration of Monuments and Sites (Venice 1966) and the Resolutions of 5th General Assembly of ICOMOS (Moscow 1976), provides definitions and a code of practice. It not only ensures that the significant fabric of a relic is preserved, but also that the intellectual property that accompanies the physical fabric is preserved.

The intellectual property that is most essential to the ongoing management of a place or relic is the conservation plan or conservation policy. The development of conservation policies and guidelines for *Swifts* was undertaken in 1995 by conservation architects Clive Lucas, Stapleton and Partners, who later became the architects for the conservation work carried out from 1997 to 1999. The conservation plan was created in response to a development application for the site which proposed subdivision of the land and the building of highrise apartments, similar to those that had been built on surrounding sites in the 1960's and 1970's. It was developed after surface examination of the fabric of the building, and a thorough search of available literature and other documentation, including photographs that provided comprehensive evidence of the interior decorative schemes of the main rooms as they existed around 1908. The results were in keeping with the sentiments of Edmund Resch Junior.

The conservation plan identified the significance of the buildings and their surroundings, garden, and grounds, and recommended that work should be limited to "stabilisation and maintenance; restoration and/or reconstruction and introduction of interpretative devices in accordance with the Interpretation Guidelines." It also recommended that investigation of the place should be allowed, which "may include physical intervention to increase knowledge of Australian History and other aspects of occupation and construction of the place." This research, however, would have to be guided by specific research goals when there were adequate resources available to carry them through to completion, leaving the place in a stable condition afterwards.

The current owners wanted to restore the house as a family home, and a heritage architect was engaged to carry out the conservation recommendations of the 1995 conservation report, one of which was to re-create the interiors as they existed in photographs taken in 1908.

Further investigative work was requested in 1997, requiring conservators to remove layers of old wallpaper and overpaint in small areas, thus revealing colour ladders of all layers down to the original scheme. All paintscrapes and colour ladders were given a protective coating of Paraloid B72 (1% in xylene) which acted as a very thin physical barrier should the scrapes be covered by further work but did nothing to saturate the colour which would affect the surface sheen.

Investigation revealed richly coloured decorative schemes that were remarkably well preserved (having been protected by the application of the 1930's wallpaper). The scheme shown in the 1908 photographs was not the original scheme in the 1880's interior, which was much plainer. It was suggested that the first scheme was intended to be temporary until the plaster of the new extension was properly cured, after which the more decorative scheme was applied.

Following the completion of the paintscrapes and wallpaper removal, and colour matching the scrapes to a comprehensive commercial colour chart, it was decided that it would be possible to remove all layers above the second scheme of the 1880's decoration, taking care to record and sample carefully. Samples were placed with the Historic Houses Trust, a public collection.

As with all buildings in continuous use, the removal of the wallpaper and paint uncovered large areas of wear, deterioration, and intervention by occupants that left a patchwork of surfaces without consistent chronology or relationship. For example, the ceilings above the Grand

Stair, the Ballroom, the Ballroom Hall, the Moorish Room, and the Small Front Hall were largely intact, but other ceilings had either been scraped off or the whole ceiling replaced. When the ceiling papers were first removed, some ceilings showed ghosting of lines (which faded within a day or two) from the 1880's decoration. It appears these lines were residues of oil gilding which resisted the steam used to remove the ceiling papers. This residue masked the plaster, allowing the steam to penetrate into the plaster of surrounding areas, which then took several days to dry out. In some places the walls had been excavated to introduce electricity and other services, leaving behind extensive and obtrusive patches (perhaps explaining the reason for the application of the wallpapers). Even though the walls had been damaged in this way, the decoration was mostly intact. It had not been scraped off, even though in some rooms the frieze had been painted on paper, not directly on the plaster.

The revelation of these richly decorated interior surfaces was elating for the owners, the architect, and the conservators. Progress to the next phase of cleaning off any residual glues and dirt, and stabilizing the fabric of the building, allowed time for reflection on the projected outcome for the interiors. From the owner's point of view this was a house to be lived in, not a museum. It had to be pleasant, durable, and decorative. The architect took the view that now that information had been gathered about the original decorative finishes, the original schemes should be covered up for their protection and a new scheme created on top of the protective layer. The conservator took the view that now that the scheme was uncovered there should be as little intervention as possible, where it was undertaken it should be isolated from the original by a physical barrier, and any conservation work carried out should be done using materials that could be easily reversed in the future. It was difficult to impart the information that reversibility does not compromise the stability and durability of an introduced material, but rather enhances it.

The final outcome saw a combination of approaches in response to the physical condition and aesthetic appearance of the decorative schemes, working within the definitions and guidelines set by the Burra Charter. There were places where the plaster of the wall or decorative plaster elements had deteriorated so badly as to threaten the existence of surrounding sound material. In such instances new material was introduced and the decorative scheme re-created, but integrated with the original scheme so that optically the differences between the new and the original were not discernible.

There were some rooms where it was decided that the original paint had faded or discoloured to such an extent that continued exposure would hasten further deterioration and was aesthetically unpleasant. These rooms were papered with a lining paper and the decorative scheme reproduced. With such a variety of approaches being undertaken by several different companies, it was inevitable that different identifiable styles would emerge. Rather than see this in a negative way, the architect had already identified characteristics that were known as the 'male' or 'female' decorative styles of the various rooms, and matched the activities of the contemporary painters and decorators with the original characters of the rooms. The conservators tended to hover between the two, desperately trying not to imprint any style or character to their work, to allow a natural integration of the old with the new.

Inevitably comparisons were made between the new work and the conserved work. More cosmetic work was requested than would normally be the case for conservation. The level of finish to conserved areas was more like the level of finish expected for new work, and we are yet to see if liability for defects is judged on the same basis for new as for conserved work.

A combination of conservation, restoration, re-creation, and reintegration was used in the Ballroom. The ceiling was dirty, but largely intact. Extensive, deep cracks were visible toward the outer edges in a number of locations. When viewed from the floor, these were disruptive. When scaffolding was made available for closer inspection, it was discovered that the cracks were full of adhesive that had been pressure-injected into the ceiling from above, and the adhesive had penetrated through the cracks onto the surface of the ceiling, bringing with it dirt that had stained the surface of the paint. The adhesive had by this stage hardened, and could be removed only with solvents and mechanical action. This was extremely difficult to accomplish without endangering the original paint. In some instances it was deemed safer to leave the adhesive on the surface and overpaint it so that it was optically integrated. This too proved to be a difficult course of action, because the slight planar difference allowed different reflectance of the paint, making it difficult to integrate the new work optically.

Even cleaning a ceiling of these dimensions with large areas of flat colour was a challenge. For many years four large gasoliers had deposited soot on the surrounding ceiling; over the years several attempts had been made to clean these areas, but had only resulted in the soot being deeply embedded into the paint, made more porous by surface abrasion. As much of the soot as possible was removed with a 5% solution of triammonium citrate in water; even poultices failed to remove more. Fortunately, the soot was limited to an area of decoration that had natural boundaries. It was decided to apply an isolating layer of Paraloid B72 (1% in xylene) in this discrete area, and then overpaint the darkened background colour to integrate these areas optically.

The cornice of the Ballroom had been selectively repainted over the years. The most noticeable amendment was the

cove, which had been overpainted with bronze paint (probably in the 1960's). When newly applied it may have added a brightness, but with the passage of time it had oxidized and become dull and brown. Scrapes showed that the original colour had been a deep terra cotta, so it was decided that, following cleaning, consolidation, and filling of losses, this colour be re-introduced as an overpaint.

The frieze was in reasonable condition, with the exception of several substantial areas. There were small areas of flaking throughout but in the areas of major damage, which had been caused by ingress of water, the paint of the frieze was completely lost for up to two running metres. The stable areas of the frieze were conserved by cleaning, consolidation, application of an isolation layer, and then discreet inpainting in the areas of loss. Only large losses were filled; shallow losses were inpainted directly into the loss. Where the plaster had been seriously compromised by the constant attack of water, the plaster was replaced, sometimes including the decorative plaster of the cornice. These areas were restored, and optically integrated into the conserved frieze.

The main body of the wall and the frieze had been covered by wallpaper which had then been painted. When the wallpaper was removed it was obvious that it had failed at some point in the past, and had been peeled away where it had failed, prior to being repainted in the cream paint characteristic of the Catholic occupancy. This paint, consistent with an oil medium, covered large irregularly shaped areas of the original painted decoration. The main body of the wall, with its plain light pink background and delicate, sparsely spaced, floral-stencilled decoration, had suffered badly from the installation of electric wiring and other services. The walls were a patchwork of chasing and filled-in holes. The adhesive from the wallpaper had also left residual staining that cleaning could not remove or substantially reduce. It was therefore decided that the walls should be prepared and painted as new, the work extending from the bottom line of the frieze down to the top line of the dado.

The dado was in remarkably good condition. It had been coated with a varnish, which had darkened considerably, leaving an impression of a grubby surface rather than a mellow old varnish. It contained lumpy accretions, which on closer examination appeared to be lumps of solid wax. This varnish must have been contemporary with the Catholic occupancy, unless it was applied at an earlier time, and the loss of the paper discs containing the composers' portraits also occurred prior to the Catholic occupancy. The darkened varnish was easily removed, but its removal revealed many small discreet but discoloured retouchings. Some of these were removed with solvents, but some were resistant to removal without endangering the original paint. Following application of Paraloid B72 as an isolating layer, these retouchings were overpainted to the correct colour match using an acrylic paint. Skirting boards and window and door architraves, as well as the doors themselves, were restored.

The approach in the Front Hall, Drawing Room, and Dining Room was similar to that in the Ballroom, except that the ceilings had to be re-created. A designer reviewed the 1908 black-and-white photographs and created new ceiling plans that integrated whatever information could be discerned from the photographs with sympathetic new designs where there was no evidence. Even though the plans were intricate and detailed, their translation to an actual ceiling often required a number of attempts before the proportions of spaces and decorative elements appeared to read in the same way as the photographs on which they were based.

This drawing together of the different approaches of conservation, restoration, reintegration, and re-creation has re-created an elegance and excitement to this grand house that can only be explained and appreciated by a visual presentation.

The approach is not purist, but it has conserved the life of an old building. Those who participated in the project sought to do so in a way that would not compromise their own professional practice. The integrity of the site was preserved while meeting the needs of the client.

Résumé

Conservation, restauration, réintégration et recréation peuvent-elles coexister de façon harmonieuse? Swifts, une étude de cas

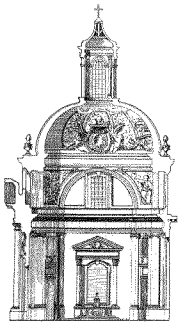
Situé près du port de Sydney, Swifts est un vaste manoir néo-gothique qui a été soumis, au cours des deux dernières années, à divers travaux de conservation, de restauration, de réintégration et de recréation.

Construit dans les années 1870, Swifts a été conçu par l'architecte français Gustavus Morell pour la famille Tooth, des brasseurs établis à Sydney. À l'origine, le manoir était décoré dans le style de la fin de l'époque victorienne, mais dans les années 1930, ce style était passé de mode et l'intérieur a été repeint avec des couleurs neutres ou tapissé de papier peint au goût du jour. Quand l'Église catholique a hérité de la propriété dans les années 1960, le manoir est devenu la résidence du cardinal et la salle de bal a été convertie en chapelle; l'intérieur a de nouveau été décoré avec sobriété. Dans les années 1990, le bâtiment était complètement délabré.

Les propriétaires actuels ont acheté Swifts en 1997 avec l'intention de le restaurer pour en faire la demeure familiale. Un architecte spécialiste du patrimoine a été chargé de réaliser une des options proposées dans un rapport de conservation produit en 1995, soit recréer l'intérieur en fonction de photographies prises en 1908. Les restaurateurs ont enlevé des couches de vieux papier peint et de surpeint à certains endroits pour retrouver les échelles de couleurs de toutes les couches jusqu'au concept original. Ces travaux ont révélé des décors richement colorés et très bien préservés (par l'application de papier peint dans les années 1930). Cependant, comme dans tous les bâtiments qui n'ont jamais cessé d'être utilisés, l'enlèvement du papier peint a également révélé de vastes zones d'usure, de détérioration et d'intervention par les occupants, offrant une mosaïque de surfaces sans liens entre elles et sans aucune cohérence sur le plan chronologique.

L'architecte a proposé un traitement mêlant différentes approches : la conservation du tissu existant par la seule stabilisation; la recréation (la plus fidèle possible) du concept original révélé par les photographies et les travaux d'archéologie; et, là où il ne subsistait aucun vestige, la création d'un nouveau concept compatible avec l'original.

Cette approche a déclenché tout un branle-bas, trois corps différents (les restaurateurs, les plâtriers et les peintres) travaillant parfois sur le même mur. Elle a également entraîné la remise en question de certains éléments de l'éthique des restaurateurs de la culture matérielle par rapport à l'éthique d'autres professions. Pour mener le projet à bien, il a fallu rationaliser cette question d'éthique et tenir compte des diverses professions en présence. Le résultat témoigne de la coopération et de la sensibilité des équipes participantes.



A Conservator's View of the Restoration of a Rococo Timber Building in Bergen, Norway

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Abstract

This paper outlines the role of conservators in the restoration of *Damsgård*, a rococo mansion in western Norway. In the course of several month-long work periods, teams of conservators carried out colour examinations in 24 rooms, and conserved and restored the interior of the main building. Also included is a discussion of the experience gained from this comprehensive, multidisciplinary, discontinuous project (which lasted a total of 9 years), and a brief note on the use of the building as a museum.

Figure 1. Damsgård, *dated 1770, main facade. Photo from the 1860's.*

Introduction

Some 3 km west of Bergen lies the country house of Damsgård, one of the major examples of eighteenth century architecture in Norway. Part of the structure is from the early part of the eighteenth century, but the building in its present form dates largely from c 1770-1780, when it was converted into a fine country residence. Apart from some minor alterations by the family who bought the property in 1796, it has remained practically unchanged to the present day.

Damsgård represents a synthesis of native building traditions and impulses from abroad. The continental formula of a U-shaped layout with the side wings enclosing a rear courtyard has been executed in the local building material - wood - and at the same time has been reduced to the modest proportions more typical for Bergen. The main facade, however, displays a delight in ornamentation which makes Damsgård an outstanding example of a wooden Rococo building.[1]

Damsgård was purchased jointly by the State and Bergen City Council in 1983 so it could be preserved as an historical monument as part of the Museum of Applied Arts (MAA) in Bergen.

This paper presents a brief survey of the restoration work in the main building from 1984 to 1993, with an outline of the climatic conditions to which it is exposed. The experience gained from this comprehensive, long-lasting, and discontinuous project is discussed, together with the use of the building as a museum since 1993.

Background

Generally speaking, buildings in Norway typical of the rococo period and style are more modest than *Damsgård*. Prior to restoration, *Damsgård* was looked upon as a well-kept but rather worn house, to which few changes had been made since its erection. Its qualities, condition, singularity, and (last, but by no means least) charm were decisive factors when the Directorate for Cultural Heritage (Riksantikvaren) decided to allot resources for the building's restoration. The exterior was more-or-less that of the 1770's although many more changes had been made to the interior. However, the interior plan had not been changed, and even though many of the rooms had been redecorated, a greater number still displayed wallpaper and decorations of the late 18th and early 19th centuries: two rooms retained wallpaper from 1770 that had never been covered; one room had small, framed landscapes from 1797 painted directly on the canvas stretched on the wall; and one room still had marbled interior from 1797. As for the first floor's main room, early-19th-century French wallpapers (which had

been mounted for a wedding in the 1860's) make it indisputably one of the finest in the building.

The restoration project

Comprehensive in scope, the restoration project included the main building and the side buildings, along with reconstruction of the rococo garden that surrounds the house, and the park (laid out in 1820) that lies just outside the walls.[2] A variety of firms, official institutions, and craftsmen were involved. Joiners, carpenters, painters, plumbers, electricians, masons, and engineers dealing with heating, ventilation, security, and sprinkler systems all contributed their skills to the project, in close collaboration with architects, art historians, and conservators.

But could the charm of the dormant beauty survive all these intruders?

Responsibility
The project started out under the direction of Riksantikvaren, but responsibility soon came to be shared among Riksantikvaren, the MAA, and the county conservator. *Damsgård* is situated on Norway's west coast, about 550 km across the mountains from Oslo, the capital city. Because of that, responsibility for the day-to-day running of the project was given to a reputable local firm of architects.[3] Riksantikvaren's conservation section was responsible for (a) planning and carrying out the colour examinations, (b) the conservation and restoration work in the building, and (c) to a great extent establishing the standards and ethical principles of the restoration, in consultation with the architects. The MAA was responsible for the furniture, curtains, and other movable objects.

The architects started their work in 1984 by measuring, assessing, and describing the condition of the main building and the wings as well as the side buildings.[4] At the same time both the architects and the museum curators started to collect written documentation and archive material concerning the property and the building. The information thus generated was organized and made accessible to the conservators and craftsmen working on the project. The architects provided solutions for the structural work and the restoration, maintained close supervision of the ongoing work in the building, and gave the craftsmen the necessary instructions and drawings.

Resources and cost
The building restoration project at *Damsgård* was the most comprehensive project of its type for which Riksantikvaren had ever been responsible. It was demanding, not only financially but also as regards acquiring the necessary professionals to do the job. When the project started, Riksantikvaren had no more than five conservators qualified to undertake building examinations. The limited annual conservation budget and the lack of professional

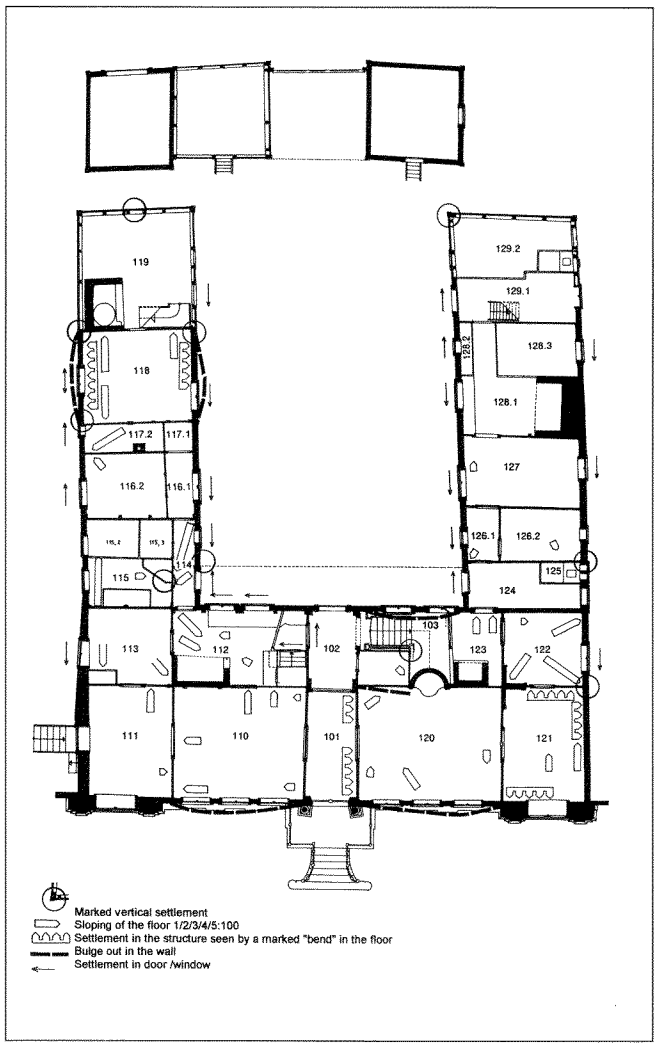


Figure 2. Plan. Ground floor. Assessment of structural weaknesses in the building before restoration. Photo: Arkitektene Hansteen A/S.

conservators were contributing factors to the prolongation of this project.

On completion of the project in 1993, the total cost of the restoration had reached nearly 10 million NOK.[5] This did not include the restoration of the park and the garden,[6] which was paid for by the county, Bergen town, and sponsors.

The conservators worked at *Damsgård* for a total of about 19 months, and the cost of this work has been calculated as 1 million NOK. In addition to this (and probably representing an additional 25%) came all the hours spent in the workshop in Oslo, on conservation of wallpapers, on examinations and preparatory work, and on follow-up work after each work period in the building.

Guidelines for the restoration work
The work started with a somewhat vague aim: the restoration of the building was to be carried out in accordance with the 'best principles in architectural conservation'.

Based upon the first thorough assessment of the building, the following guidelines were set up.

- Each room was to be thoroughly examined, and all conservation and restoration work was to be carried out with as little intervention as possible in the structural framework and the surfaces. The architects' proposals for actions to stabilize the building structure were to be carried out.[7]
- The distinctive character of each room was to be respected, and each room was to be restored to the period when the latest significant change had occurred (the interiors from different periods would thus turn the building into a full-scale architectural history book).
- Examinations and restoration work were to be planned and carried out with the future use of the building in mind.

The building was bought to be restored and maintained as a living, functioning exhibit of cultural heritage. A plan for guiding visitors through the building was set up prior to the start of colour examination work. The idea was that, upon entering any particular room, the impression gained by the visitor should be exclusively that of the selected period. And the documentation in situ should allow the visitor to read the history of the room when inside the room.

The conservators' work

The conservators worked in teams of three, and two teams worked for about 4 weeks twice a year. Each team had a leader, whose responsibilities included instructing and updating the following team. With some exceptions, the conservators working at *Damsgård* were paintings conservators with broad working experience, and team members were selected so that each team should, collectively, have the necessary in-depth knowledge of building history, building structure, and historic colours. For work on the wallpapers, a paper conservator joined the team.

The colour examinations began when work on stabilizing the building structure was nearly finished. The structural repair work proved beneficial to these examinations. In several parts of the interior all the layers covering the wood had to be removed, and it was therefore possible to 'go deeper into the building' than originally intended, or indeed wanted. Every element in 24 rooms in the main building was examined,[8] and high priority was given to obtaining the best possible understanding of the different phases of decoration in each room since 1770.[9] Analyses to identify pigments or binding media were not undertaken.

Conservation included consolidation and lamination of wallpapers, consolidation of paint (both monochrome and decorative) on canvases stretched on the walls, and relining of parts of the painted canvases.

Restoration included repainting the main parts of the painted surfaces with the paints and colours proper to the period chosen for the rooms, removing covering paint layers, mounting new wallpaper copies (in whole or parts of rooms), repairing original wallpaper, and retouching and reconstructing decorative paint.

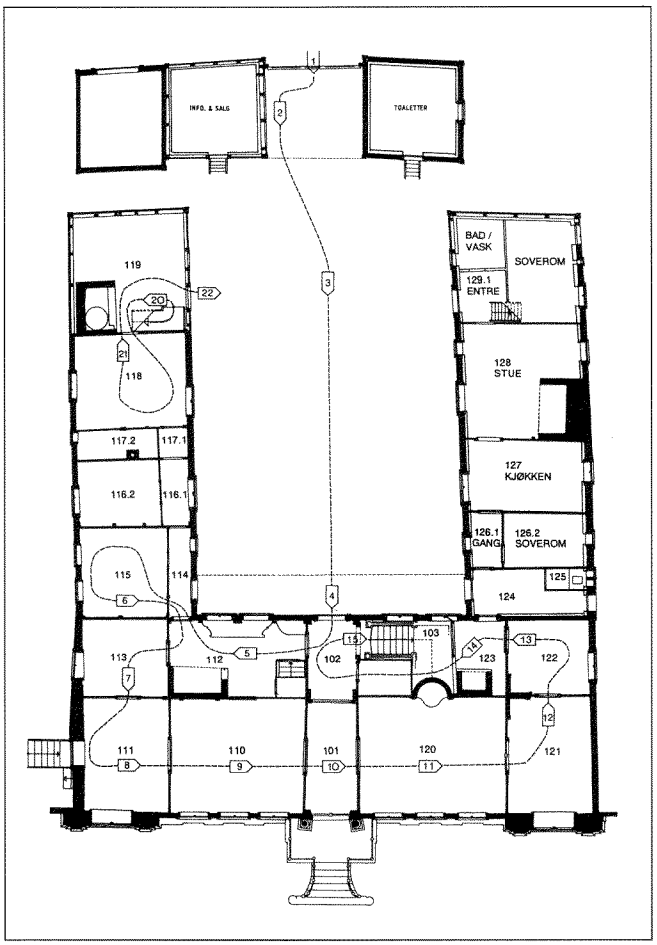


Figure 3. Plan. Ground floor. The main part comprises the museum. Rooms 124–129, in the west wing, built within the existing building, are an apartment for the keeper/gardener. The attic is used as the museum's storage room and for temporary exhibitions. Room 116.2 is a small kitchen and room 188, a cafe. The direction of the guided tours is marked on the plan. Photo: Arkitektene Hansteen A/S.

The extent of conservation and restoration varied from room to room. The room with the least intervention was the last owner's kitchen; it was cleaned, the curtains and towel pegs dating from the 1950's were rehung, and the kitchen stove from 1960 was replaced with a similar one.[10] More work went into the havestue (the room opening on to the garden). Here, covering paint was removed from the monochrome surfaces, cracks were filled, and the paint was consolidated and retouched. Framed landscapes painted directly on the wall canvas were conserved and restored. The dado was repaired and the marbling was partly uncovered and partly repainted as the original. A new protective floor was laid as a sacrificial layer on top of the original.

In general, rooms with historic wallpapers demanded a great deal of work. In the room with the Dufour wallpaper, the room's northern corners had become rotten as a result of more-or-less constant water leakage, and both wood and wallpaper had to be replaced. Luckily, surplus original Dufour wallpaper was found stored in the attic,[11] and was used to cover the restored corners before the wallpaper in the rest of the room was cleaned and retouched.

In the 'maximum intervention' rooms, every surface was either painted or covered with copies of the original wallpaper.

The working process as seen from a conservator's point of view

At the end of the project the conservators held a meeting to discuss and evaluate their work at *Damsgård*.[12] The most important general conclusions of this meeting were that:

- aims and principles for projects like this should be clearly formulated before work starts;
- responsibility should be clearly defined at every level;
- the work at *Damsgård* had provided useful experience and an increased knowledge of building history.

Figure 4. During the examination, an English flocked wallpaper from the 1760's was discovered under the painted decorations from 1797. The canvas with its decorations from 1797 was kept and restored. The older wallpaper can be 'rediscovered' by future generations. Photo: Brænne.

Task coordination, and cooperation among the various participating professions
Ideally, all the structural work in the building should have been finished before the conservation and paint work started. As this was not the case, plans and work processes had to be adjusted to suit the other professionals working on site. This led to some problems. Painting sometimes had to be redone because of all the dust in the building from the structural work, and conservation had to be postponed. Rarely were the conservators able to work alone in the building. Working side by side with other professionals (architects, carpenters, joiners, art historians, and painters) called for, and fostered, true collaboration. And being part of a multidisciplinary team added useful information and experience, in both directions. The conservators benefitted from the advice of others, respect for each other's profession increased, and the conservators were able to pass on something about ethics in conservation.

The conservator and the painter — When working in a building, the line between the work of the painter and the conservator is sometimes a fine one. At *Damsgård* we worked hard to draw the division line: only occasionally were conservators required to do ordinary painting, and painters were not allowed to do the conservators' job. A reputable firm was hired to do the painting work, but as the project proceeded it was an apprentice who ended up doing most of the real work, which meant that the conservators had to spend some time training him. This was in fact a blessing in disguise, as he was more disposed to accept advice (and take abuse) both from the other painters and from the conservator in charge. The conservators blended all the paint that was used in the interior, and were responsible for instructing the painters.[13] Cooperating with the painters was quite easy as long as we respected their professional skill and made our instructions clear; it was necessary to specify not only what we wanted them to do but, just as importantly, what we did not want done. One of the painters' major problems was that sometimes contradictory instructions were issued by the different team leaders. The conclusions reached at the evaluation meeting were that the painters must be monitored to ensure that their work maintains the right standard; written contracts specifying materials, methods, and standard of work are a must; and only one person, not several, should be responsible for approving the quality of the work.

The conservator and the architect; the conservator and the art historian — Our examinations in the building benefitted greatly from the collated information that was given to us before we started. This was a kind of luxury, as conservators usually have to include this kind of background research as part of their examinations. We were also fed with information by the art historians during the project. Working in the building with the architect close

at hand meant that we could discuss problems on the spot, and thereby solve them faster.

A lengthy, discontinuous project
The 19 working months in the building were spread over 9 years (1985–1993) and among 13 conservators and students. Spreading out tasks and time like this is not efficient, despite the fact that the short duration of each work period ensured a hard and concentrated effort. We have also learned that the passing of information from one team to the next should have been done by overlapping the departing and the relieving teams, thus allowing them to work together in the building for a few days. As the work had to progress, each team had considerable autonomy when it came to making decisions on how to treat the interiors and which solutions were the most appropriate in any given situation.

It was natural that the profession's attitude towards restoration would alter during the course of a 9-year period, and the intervals between work periods afforded time for reflection and consideration. This, together with the fact that so many of the interior surfaces were either repainted or covered with copies of the original wallpaper, made us (when halfway through the project) completely change our plans for the main staircase. Instead of restoring it to the way it looked in 1770, which would have entailed new paint and wallpaper copies, we decided to keep it as it was when the last owner moved out, with wallpapers from 1770 and 1860, paint from 1779 and from about 1960, and curtains from the 1950's. We even decided to leave in place the thumbtacks and small pieces of blue paper used by the last owner to repair the wallpaper. The change was approved, and the room was conserved as it was, which was also meant as a tribute to the last owner for the loving care he had shown the house.

Plus, we managed to interfere a little less with *Damsgård*'s quiescent beauty.

Climatic factors and environmental monitoring

The building, which had been partly heated from 1864 to 1982, was left unheated from the time the last owner moved out till the autumn of 1989. It was decided to heat the building to stabilize the interior climate, as some of the painted surfaces had undergone visible changes during the unheated period. No environmental recording had been conducted before the heating system was installed. Bergen is 'famous' for its rain, and the choice of the heating method was probably based on the assumption that the relative humidity (RH) could be controlled by raising the temperature (T). The building was divided into five zones, each with a hygrostat and a thermostat to control the electric heaters within the zone. The hygrostats were set to a RH maximum of 55%, the thermostats to a T minimum of 8°C. When the RH exceeded the set RH value, the heaters turned on. The hygrostats were in charge as long as T was higher than the set minimum. If T fell below the minimum the thermostat overrode the hygrostat. Neither the hygrostats nor the thermostats were able to work within both a maximum and a minimum level. RH and T were monitored from September 1989 till September 1991, but not continuously and not in all the zones all the time.[14] Conditions in the different zones seemed to be more-or-less the same.[15] The system seemed to moderate fluctuations in RH for parts of the year, and improved the climate in the building. But to say that the recorded RH fluctuation was acceptable, with reference to the range of values recommended,[16] would be a lie. The system did not work in summer when it was warm and rainy, and had to be kept turned off. In cold winters, it did not work either. The thermostats turned the heaters on at around 8°C, regardless of the RH, which then decreased somewhat. If the RH was very high the heaters did not seem to have the capacity to heat the rooms to the temperature needed to reduce the RH to a more acceptable level.

Various proposals have been made for improving the system but all involve considerable expense; therefore the heating system remains in use unmodified. No environmental monitoring has been undertaken since the restoration project was completed and the responsibility was transferred to the museum. From this we conclude that it is essential to build up the best possible picture of the conditions to be controlled, and assign responsibility for ensuring optimal interior conditions to one person right from the start of any project.

The building as a museum: Management, maintenance, and use

Damsgård is run as a section of the MAA in Bergen, and is open from mid-May to the end of September. During opening hours, visitors must join a guided tour, and are required to put protective coverings on their shoes. The maximum number for each tour is 15; visitors waiting to see the interiors may enjoy the beautiful garden on their own, or in groups guided by the gardener. The annual number of visitors varies between 4000 and 6000.[17]

The building may be hired for cultural events or receptions, but preferably not from October to April. Furthermore, there is an upper limit of 20 events per season, and the number of persons attending each event is not to exceed 50. As this is quite expensive, the building is in fact seldom hired. The museum claims it needs the income to be able to maintain the building, and the authorities have continued to grant permission, as long as certain rules set up by the museum and Riksantikvaren are followed.

Maintenance
A committee was set up in 1993 and meets every year to inspect the building: the exterior, interior, and structural

condition. The exterior needs continuous care, and lack of frequent maintenance might become a menace to the building. No damage arising from careless behaviour has so far been observed in the interior, and there is no sign of attrition caused by visitors. It seems that factors such as inferior cleaning and poor environmental conditions represent a greater threat than do visitors. It took some time for the museum to establish good housekeeping practices, but they now have routines that include simple precautions like using blinds to cover at least some of the windows when the museum is closed.

Conclusion

The project has given the conservators and the other participants valuable experience, the building itself received a much-needed repair and long-overdue restoration, and the general public gets to visit a beautiful building that has kept its charm. On a cautionary note, however, *Damsgård* has also kept its structural weakness, its 'traditional' leakiness, and conditions favourable to wood-boring insects. Without a doubt, it needs (and deserves) continuous tender, loving care to survive as the restored, restful beauty it now is.

Acknowledgements

The authors thank English language consultant Rory Dunlop, NIKU.

Endnotes

1. Indahl, T.M. "Damsgård hovedgård - en festlig krusedull i norsk arkitektur." *Årbok - Foreningen til norske fortidsminnesmerkers bevaring* (1989), pp. 11–26. [Names have been omitted from the quotation.]

2. Fægri, K., D. Moe, and P.M. Jørgensen. "Damsgårds have." *Årbok - Foreningen til norske fortidsminnesmerkers bevaring* (1989), pp. 63–84.

3. Arkitektene Hansteen A/S, architects Tale and Hans-Jacob Hansteen, Bergen.

4. Hansteen, T.K., and H.J. Hansteen. "Damsgårds istandsetting. Intensjoner og arbeidsmåter." *Årbok - Foreningen til norske fortidsminnesmerkers bevaring* (1989), pp. 27–46.

5. 1 US$ equals 7 NOK (1993). The restoration was funded by the State through Riksantikvaren. During the project period, approx. 20% of Riksantikvaren's annual budget for building conservation was spent on *Damsgård.*

6. The garden has been open to the public since 1988.

7. The examination revealed that structural interventions were necessary to stabilize the building. When the work was carried out these interventions were much larger than expected.

8. Brænne, J. "Fra barokk til louis-seize." *Årbok - Foreningen til norske fortidsminnesmerkers bevaring* (1989), pp. 47–62.

   Frøysaker, T., and K. Solberg. "Damsgård. Fargeundersøkelser 1985 - 1988 - 1993. Systematisering og tolkning av funn, samt restaureringsforslag." *NIKU Oppdragsmelding* 30 (1995), p. 111.

9. Important dates in the history of the building: circa 1730, a baroque house is built; circa 1770, the baroque house is rebuilt as the rococo building; circa 1796, parts of the interior are modernized into the so-called Louis-Seize-style; circa 1860, minor parts of the interior (the main room on the first floor) are redecorated.

10. The original had been thrown away before the decision to keep the room as it was had been made. The same thing happened to the pegs. The copies in the room are from a mountain cabin belonging to one of the conservators.

11. The rolls of wallpapers had suffered from water damage from leakage in the roof. Fortunately, there were several rolls, and enough was saved undamaged for use in the room.

12. *Restaureringsatelierets evaluering av restaureringsarbeidene på Damsgård 1984 - 92.* Unpublished report.

13. A linseed-oil paint was used as a base for blending most of the different colours for redecoration.

14. The monitoring was done using thermohygrographs and a data logger (Swemalogg 15), looked after most of the time by the gardener.

15. One of the zones (the cafe and the kitchen) has the minimum T set to 18° C because the museum wants to have some of the area heated during the winter.

16. Erhardt, D., and M. Mecklenburg. "Relative Humidity Re-examined." pp. 32–38 in *Preventive Conservation: Practice, Theory and Research. Preprints of the Contributions to the Ottawa Congress, 12–16 September 1994*. London: International Institute for Conservation of Historic and Artistic Works, 1994.

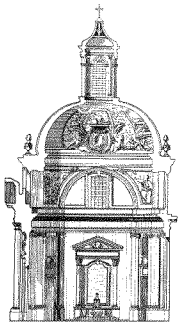
Thomson, G. *The Museum Environment*. London: Butterworths, 1978, 270 pp.

17. 6000 visitors spread over the 133 days that the museum is open gives an average of 45 visitors per day.

Résumé

Restauration d'un bâtiment en bois de style rococo à Bergen, Norvège - Point de vue d'un restaurateur

Cet article traite du rôle des restaurateurs dans la restauration de Damsgård, un manoir de style rococo situé dans l'ouest de la Norvège. Au cours des travaux qui se sont étalés sur neuf ans, de façon intermittente, des équipes de restaurateurs ont examiné les couleurs présentes dans 24 pièces, en plus d'assurer la conservation et la restauration de l'intérieur du bâtiment principal. L'article traite également de l'expérience acquise grâce à ce projet multidisciplinaire global, et aborde brièvement l'utilisation du bâtiment comme musée.



The Conservation Treatment of the Painted Ceiling Panels in the Tudor Chapel at Ightham Mote

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Abstract

A major building project to restore and conserve the structural framework of *Ightham Mote* necessitated the removal and conservation treatment of the painted ceiling panels in the Tudor Chapel. The project involved a feasibility study to determine if the panels could be removed, preparation of specifications for the conservation treatment, design of a cradle for handling the panels and a storage system, installation of environmental control and insulation systems, and an overall management system for the project within the major building works.

Ightham Mote is an important late-medieval timber-framed house; its complex architectural history spans 6 centuries of building, rebuilding, and restoration. The first major remodelling occurred in 1521 when Sir Richard Clement purchased the house. At this time the range to the north of the central courtyard was enlarged and altered, and the Tudor Chapel was constructed. In 1890 another new owner, Thomas Colyer Fergusson, began a major restoration program which, though well intentioned, was to be the source of major structural problems almost a century later. His use of dense exterior cement renders instead of traditional lime plasters channelled the rainwater onto the wooden structures, which resulted in deterioration and fungal and insect infestation.

When the National Trust acquired *Ightham Mote* in 1985, a complete structural survey of the house was undertaken and a major phased restoration and conservation program was planned. This involved literally stripping the house back to its 'bare bones' by removing all the cement rendering in order to conserve and/or replace decayed structural timbers. Once an approach to the restoration of the structure of the building had been agreed upon, the National Trust turned the project over to an architect who oversaw the work of the main contractor. However, the Trust retained direct involvement in an advisory capacity for the conservation treatment of the painted ceiling in the Tudor Chapel.

The Tudor Chapel is a half-timbered structure with a barrel vaulted ceiling consisting of 46 curved and painted oak panels, each measuring approximately 2.950 by 30.9 by 1.5 cm (length by width by depth), which are fitted between painted ribs (soulaces). The panels are painted with an alternating sequence of various English and Spanish royal emblems (roses of York, Lancaster, and

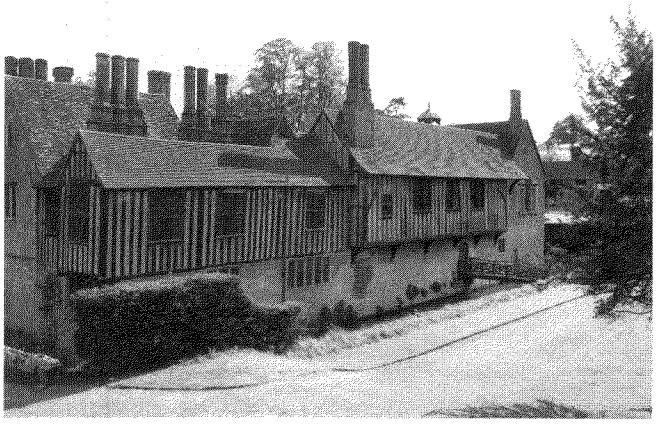

Figure 1. The north range of Ightham Mote *which shows the Tudor Chapel above the wooden bridge. Photo: the National Trust.*

Figure 2. The interior of the Tudor Chapel. Photo: the National Trust.

Tudor, portcullis, pomegranate, castle of Castile, and a quiver of arrows) to commemorate the marriage of Henry VIII and Catherine of Aragon, and green and off-white chevron patterns centred with either a Tudor rose or fleur-de-lis. The ribs are also painted with green and off-white chevrons edged with red banding. The origin of the panels is uncertain, but David Starkey (in his paper *Ightham Mote: Politics and Architecture in Early Tudor England*) suggests that Sir Richard either commissioned the painting of the panels or obtained them from the Revels stores which housed decorative fittings originally made for use at the Field of Cloth of Gold.[1]

The painted surfaces were in poor condition with extensive loss of paint, overall flaking, and desaturation of the paint layer due to the deterioration of the binding medium. A whitish bloom on the surface obscured what little remained of the decorative elements. The panels were also in poor condition structurally, with numerous cracks and splits and extensive areas of woodworm attack on the reverse. Of the 46 panels, only 14 original panels remained intact, 11 had been replaced by blank panels, and 21 had been replaced with smaller inserted sections or infills, some of which were now distorted. Environmental monitoring of the chapel and the roof void above the ceiling indicated an annual deviation from −9 to +24.4°C in the chapel and from −6.8 to +29.2°C in the roof void, with corresponding relative humidity readings of 47.5–85.5% in the chapel and 38–90.5% in the roof void. Thus it is hardly surprising that the panels were in poor condition.

The only recorded restoration treatment had occurred in 1890, when the panels and ribs were removed during a major structural restoration of the building. The 1890 accounts of H. Walford and Spokes of Oxford indicate that the ceiling panels and ribs were repaired and sections were renewed with wainscot oak.[2] Little attempt was made to conserve the original panels as large sections were simply replaced with the new oak. Subsequent to this restoration, the oak inserts were painted with a lime and charcoal scumble in what we assume was an attempt to match the deteriorated appearance of the originals.

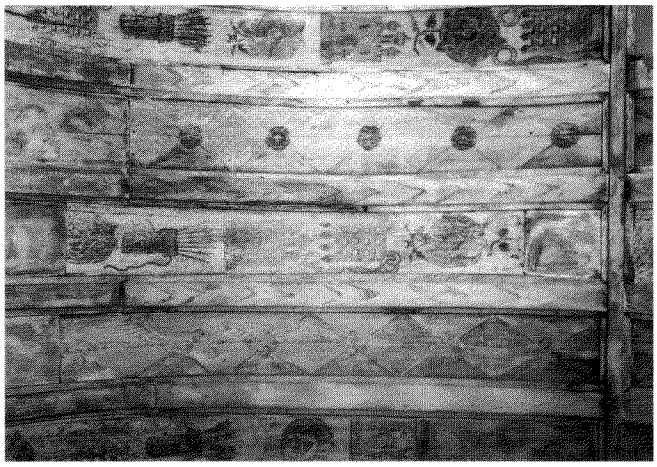

Figure 3. The painted ceiling panels and ribs before conservation treatment. Photo: the National Trust.

An examination of the reverse of the panels revealed that the cracks had been bridged by battens and secured with screws through the front of the panel. Where 19th-century additions had been butt joined to the original panels, the same fixing method had been used. Many of the screws were rusty and had stained the surrounding paint film. The individual panels were screwed along the top edge to the central purlin and were secured onto the side rebates of the ribs by small wooden blocks nailed into the ribs. Years of debris including bird nests and droppings had accumulated on the reverse and this, combined with the ingress of water, had encouraged insect infestation and fungal growth leading to the deterioration of the wood.

Structural work on the chapel required complete removal of the tiled roof, replacement of deteriorated structural timbers and the wall plate, removal of the cement rendering, and replacement of decayed laths, in essence leaving a skeletal timber framework around the ceiling. Thus the first major consideration was whether or not to leave the ceiling in situ, albeit protected from the elements and the surrounding structural work.

The initial conservation opinion was to conserve the panels in situ and then construct a protective enclosed framework around them (it was felt that their removal might cause the panels to distort once they were released from their present position). However, the architect felt that it would be difficult to protect the ceiling from accidental damage despite the protective framework as the erection of a covered scaffolded framework around the exterior of the building was a possible hazard. In addition, the location of the ceiling panels adjacent to areas of the timber structure that required replacement placed the panels in possible danger.

Removal of the ceiling panels presented enormous problems, not only the actual removal of the panels but also their handling and storage. Assuming that the panels could be removed from the ceiling, storage/conservation studio space would have to be found on site as it had already been agreed that transporting the 46 curved panels safely to an off-site location would be impractical and difficult (even the physical handling of the panels when moving them to the storage area could damage the thin panels). Environmental control of the storage/studio space would also be necessary to avoid any distortion of the panels.

Lengthy discussions with the architect, contractor, and conservation advisers led to a pilot project to deal with these individual problems and assess the feasibility of the proposed solutions with relation to the potential damage to the panels. The pilot project was to include the selection of one panel for in situ conservation treatment to determine an appropriate consolidant that would ensure the stability of the paint surface prior to removal. At the same time,

an appropriate method for removing the fittings that secured the panel in the rib structures was to be devised. A curved wooden cradle for lowering and carrying the panel from the ceiling to the storage area, with an additional requirement that the support structure could be incorporated into the storage system to minimize handling, was to be designed. And once the panel had been consolidated, released from the ceiling, and carried to a storage area, the curvature of the panel was to be recorded and monitored for any changes over a 6-month period. At the end of the trial period, the committee met to assess the results and consider the proposals and cost implications.

The panel had remained stable and there was no evidence of new flaking. The removal of the panel from the ceiling had been less difficult than anticipated but it was noted that the roof tiles would have to be removed before the remaining panels could be removed (the roof void was very small and the proximity of the tiled timbers at the lower edge of the panels impeded their safe removal). However, the removal of the tiles would expose the panels to possible damage. It was therefore agreed that the panels would have to be protected by 50-mm sheets of Plastazote (a semi-rigid foam) cut to fit behind the panels and then covered by Tyvek sheeting to protect them from dust and debris.

Locating a suitable storage/conservation space had proved to be rather difficult as most of the available space was within the building works and, therefore, not suitable. However, the Old Chapel (which predated the Tudor Chapel) became available, although there were several problems associated with it. The room measured only 3.240 m wide by 6.480 m long with a ceiling height of 4 m, which was barely sufficient to take the 46 panels and provide a conservation space for the further treatment of the panels. Also, the access door was via a small room that could not accommodate the turning space needed for the long panels; therefore the panels and cradle would have to be passed through a small opening in the wall.

The architect and the conservation advisers had designed a vertical racking system that consisted of a metal framework with short horizontal tubes projecting at the ends of the framework. The horizontal tubes were intended to support cotton slings, which would house the panels. The sling system was proposed to accommodate the different curvatures of the panels and to minimize the amount of space required. To control the humidity levels, the existing wet heating system was supplemented by portable oil-filled radiators controlled by humidistats.

The design of the support cradle had been contracted to Kent Services. It consisted of a lightweight timber framework and a central cotton sling with cross straps to prevent the panels from moving during handling. The sling was attached at both ends to small lengths of rigid tubing seated in a housing unit. The tubes with the sling could be lifted out of the housing and slid onto smaller metal tubes which projected from the racking system. To position the slings on the higher sections of the rack, a pulley system was devised to raise and lower the cradle to the appropriate height. A similar pulley system was used to lower the cradle from the scaffold platform in the chapel when the panels were removed.

Although the panels would be consolidated prior to their removal, further conservation treatment to the front and back of the panels would have to be undertaken in the storage area. Therefore, two curved worktables had been designed to accommodate and support the panels during treatment, one with a concave surface and the other with a convex surface.

Having agreed that the panels could be removed from the ceiling, stored, and treated in the Old Chapel, it then became necessary to set up a work schedule that included every aspect of the conservation treatment and its relation to other work being undertaken on the site.

The first phase involved the appointment of a conservation team(s) to undertake all the conservation treatment and the removal of the panels. Although National Trust conservation advisers had consolidated and removed the test panel, the Trust usually contracts conservation work to private conservators. Therefore, paintings and joinery conservators were invited to undertake consolidation, cleaning, and removal trials so they could prepare a method statement, budget costs including contingency fees for changes in the treatment, and time requirements for the different parts of the project based on the National Trust's specifications. [As the conservation work was to be tendered, detailed specifications were necessary so that the conservators could compete on an equal basis.] The conservators' estimates proved to be an anathema to the quantity surveyor (the contractor's agent in charge of finance) as he was accustomed to working with known quantities such as a length of timber, the number of screws, and the time taken to fit the new wood in place. He wanted the cost broken down to cost per square metre for consolidating, cleaning, and varnishing a panel, and it was only through lengthy discussions and a gradual understanding of conservation that he accepted that it was difficult to provide such precise costs. However, the experience was of mutual benefit as he proposed methods for costing and advice on the different tendering methods.

Once the contract had been awarded to the two conservation teams (the paintings conservators and the joinery conservators), a detailed work schedule had to be devised. This involved slotting the individual phases of the work into the main contractor's schedule. To simplify the lengthy discussions into a clear and concise schedule, the architect prepared 14 schematic drawings (cartoons) of the chapel structure depicting the activities and listing the events for each cartoon so that conservators and the contractor knew what was occurring at each stage.

The conservation treatment was divided into two areas: the conservation of the panels and ribs, and technical analysis to aid the conservation treatment and provide information about a possible date for the panels. It had been agreed that the treatment would involve minimal intervention and concentrate on the stability of the painted surfaces and the panels. After testing various consolidants, BEVA 371 was chosen as the most appropriate as it not only resecured the flaking brittle paint layer while retaining a matte appearance, but also had little darkening effect on the exposed areas of wood. Initial cleaning tests indicated that Shellsol D40 (mineral spirit) was suitable for removing the dirt and grime, and some of the whitish deposit. Technical analysis of this deposit using chemical tests and EDX identified calcium sulphate as well as calcium carbonate. Both materials may have migrated from the ground layer under the damp conditions or they might be the residues of a former treatment such as a lime wash. Further cleaning with Shellsol D40 reduced the whitish appearance although it tended to persist in those areas adjacent to cracks where water had penetrated. A dilute application of BEVA 371 minimized its appearance, probably due to the re-saturation of the paint layer and the similarity of the refractive index of the calcium sulphate/carbonate and the BEVA 371.

Extensive paint loss of the decorative surfaces precluded any retouching but it was agreed that a final thin varnish layer was required to provide an overall saturation of the paint layer (while retaining its matte appearance) and a protective coating. Varnishing trials were undertaken using Paraloid B72, BEVA 371, and MS2A with fumed silica as a matting agent. There were noticeable differences between the varnishes, with Paraloid B72 and MS2A having a higher sheen and more darkening of the exposed wood. Paraloid B72 accentuated the blanched appearance while the MS2A reduced it, but at the expense of a higher gloss. BEVA 371 proved to be the most suitable varnish as it reduced the blanched appearance and provided a more aesthetically pleasing surface. This conservation treatment was also undertaken on the painted ribs.

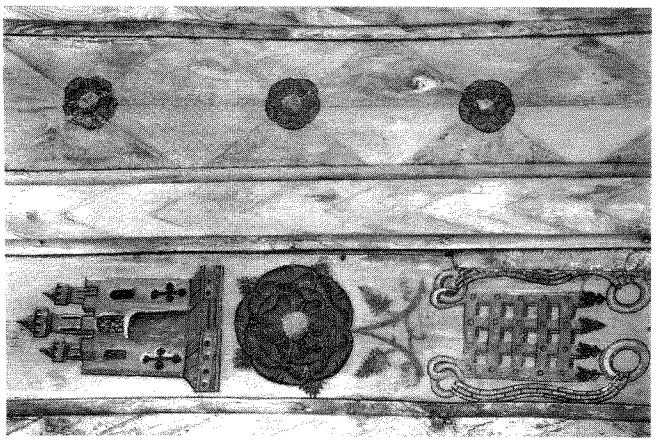

Figure 4. The painted ceiling panels and ribs after conservation treatment. Photo: the National Trust.

For the structural work on the panels it was agreed that the cracks should be bridged but not filled with inserts, and there should be no attempt to realign them. The cracks and splits were bridged with 5-cm^2 pieces of oak (approximately 5 mm thick) and bonded with Resin W. Where the edges of the panels were badly deteriorated or missing, new sections of oak were attached. The reverse of the panels was consolidated with BEVA 371 to strengthen the porous surfaces which had been attacked by woodworm and to provide an equal moisture barrier between the front and back of the panels. The agreed method for reinstating the panels involved placing an oak batten on 6-mm Plastazote at the top edge and at panel joins on the reverse and screwing them in the back of the ribs with stainless steel screws. Smaller sections of oak and Plastazote were secured along the length of the panel.

Paint cross sections indicated that the majority of the pigments were earth pigments in oil, with some paint layers containing a size. Copper resinate and vermilion were also found but all the pigments were typical of the 16th century. A varnish layer was not present. Dendrochronology was undertaken but, unfortunately, there were insufficient rings on the panels to allow for any accurate dating. However, samples could be taken from the ribs and these provided a felling date of between 1470 and 1481. This finding is significant in that this date is earlier than the previously accepted date of circa 1520. This presents a slight mystery regarding the age of the panels because the decorative motifs (the Tudor and Spanish royal symbols) clearly identify them with Henry VIII and Catherine of Aragon (circa 1520–1530). It is now believed that the Tudor Chapel may have been a gallery or part of a guest range with a curved ceiling that was subsequently converted to a chapel with the painted decoration added. Further investigations may help to reveal the decorative history of the chapel in relation to the painted ceiling panels.

During the conservation treatment, consideration of the future environmental control of the Tudor Chapel was discussed by the architect, the Trust's environmental control and paintings advisers, and the contractor's environmental engineers. In addition to environmental control by an installed heating system with humidistats and a data logger for recording temperature and humidity, it was felt that an insulation system was required in the roof void to minimize the extreme fluctuations. Various types of insulation material were investigated and Celotex (a foil-coated foam laminate) was selected. Individual sheets were cut and fitted between the roof collar and rafters; this allows air circulation behind the panels and access to the panels for periodic inspection. To avoid dust and reduce the risk of water penetration, a vapour-permeable sarking felt was attached to the tiling battens. A natural flow of air was created by the insertion of wire mesh panels at the junction of the rafters and the wall underneath the roof tiles.

Reinstatement of the panels in the chapel presented the final problem. As the interior walls of the chapel were to be re-plastered and painted with distemper, it was initially agreed that a 6-week period would be required prior to re-installation; this would allow the plaster and the distemper to dry thoroughly and provide time to test the new environmental control system. However, as this was part of the overall building contract, the main contractor was anxious to finish ahead of time. A compromise was reached whereby re-installation would not take place until the humidity levels remained stable for 2 weeks; in the end this meant that the waiting period was reduced to 3 weeks.

Considering the complexity of the project not only in terms of the removal, storage, and treatment of the panels but also the number of people involved working together within a specific time frame, the project was certainly a success. The removal of the panels raised ethical questions concerning the advisability of removing sensitive objects from their normal environment as opposed to treating and protecting them in situ. Fortunately, the understanding of the architect and the willingness of the main contractor to participate in lengthy discussions and consider conservation issues meant that compromises could be reached. Thus team management was an essential part of the project in order to ensure the safety of the panels and the coordination of different phases of the project within the scope of the building works.

This project was the first time that the National Trust had handed over the day-to-day management of a conservation project to an outside contractor, and it proved to be a valuable experience as it helped to establish a framework for future projects of this nature should they ever arise again.

Acknowledgements

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Endnotes

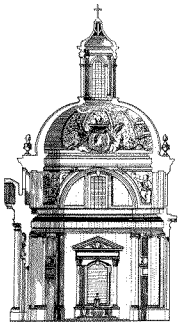
1. Starkey, D. *Ightham Mote: Politics and Architecture in Early Tudor England.* London, England: Society of Antiquaries of London, 1982, pp. 153–163.

2. "The Restoration, Additions and Drainage of Ightham Mote, Kent carried out and completed by H. Walford and Spokes, Oxford for T. Colyer Fergusson Esq." (in the archives of *Ightham Mote*).

Résumé

Restauration du plafond à caisson peint de la chapelle Tudor d'Ightham Mote

Un grand projet de restauration et conservation du cadre structurel d'Ightham Mote a entraîné le retrait du plafond à caisson peint de la chapelle Tudor afin de le soumettre à un traitement. Le projet incluait une étude visant à déterminer la possibilité de retirer les caissons, la préparation d'un devis pour la restauration, la conception d'un support pour manipuler les caissons et d'un système d'entreposage, l'installation de systèmes de régulation des conditions ambiantes et d'isolation, de même que la mise en place d'un système de gestion globale du projet qui faisait partie des grands travaux de construction.



A Jacobean Tragedy — 'A Tayle of Ignorance and Irreversibility told in Five Actes'

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Abstract

This paper discusses English Heritage's research into the Pillar Parlour of the Little Castle at *Bolsover* in Derbyshire, England. The history of the building indicates that the Little Castle had been little used since the 18th century. Recent research has also established that it retained most of its original painted finishes (including a black grained and gilded scheme that was applied circa 1620) until the 1970's, when an unsympathetic restoration program destroyed or obliterated much of this early work. This research has illustrated the importance of acquiring a full understanding of an historic interior's structural and decorative history (through documentary research, physical investigation, and architectural paint research) before undertaking irreversible procedures such as the stripping of historic paint layers.

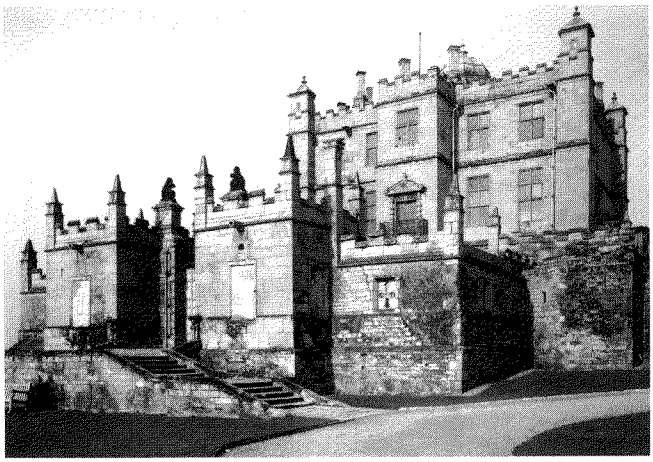

Figure 1. The exterior of the Little Castle at Bolsover, *1953.*

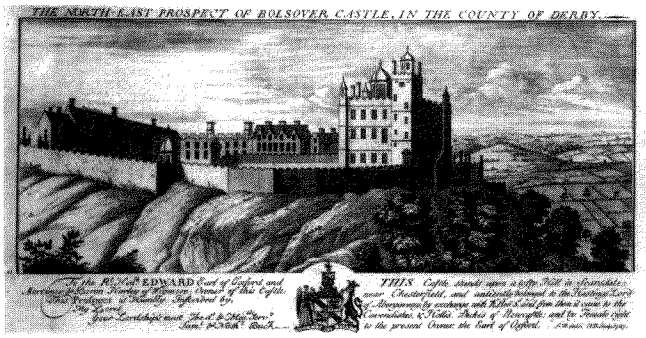

Figure 2. A general view of Bolsover. *Engraving by Buck, 1727.*

Prologue

Bolsover is troubled and stormy.....the Castle stands gaunt and empty on its crag, abandoned to the weather and shaken and riven by mines beneath, but its romantic fire must touch and heat the blood of all who see it (Sitwell 1945, p. 24).

.....Harwicke is rich, Welbecke is fine / Worsope is stately, Bolser divine (Richard Andrews, contemporary 17th-century poet).

The rooms have a curious living stillness, as though the music of the bundles of instruments carved on the chimney-pieces had only just died away. One wanders through them entranced but also puzzled, for Bolsover is like nothing else in England. It is a completely convincing expression of something, but of what? (Girouard 1983, p. 209).

Bolsover in Derbyshire has been described as a prime example of English Renaissance architecture. The castle complex includes the Little Castle, the Terrace Range, the Fountain Garden, and the Riding School. It was built between 1612 and 1670 by Sir Charles Cavendish (son of the famous Bess of Hardwick) and his heir Sir William Cavendish. The Cavendish family had abandoned it as a major residence by the early 18th century, and some of the ancillary buildings were stripped and partly dismantled. The Little Castle was kept partially furnished and used as a picturesque tea pavilion. It was inhabited by a local vicar during much of the 19th century, but has remained unoccupied since 1883.

The site was presented as a gift to the nation by the 7th Duke of Portland in 1945, but by this point the

Little Castle had severe structural problems and the interiors were in a poor state of repair. Various restoration works of questionable quality were subsequently carried out throughout the castle complex. As part of the current conservation project, English Heritage has conducted extensive research into the Little Castle to acquire a better understanding of the original use and appearance of the interiors, as well as of the later alterations (Hughes 2000). This paper focuses on one particular room within the castle, the Pillar Parlour, in order to highlight some of the problems that face those involved in the conservation and presentation of historic interiors.

Act I — 'A castle is born'

Building work started at *Bolsover* in 1612 under the direction of Sir Charles Cavendish. When he acquired the estate, a ruinous medieval castle already existed on the site. Cavendish undoubtedly intended the Little Castle as a means to enhance the prestige and status of his family. It was a fantasy that placed his family at the forefront of the contemporary fashion for chivalric tournaments, masques, and pageants, which were a great obsession within Elizabethan and Jacobean court circles. There had been a long tradition since medieval times of constructing mock castles out of cardboard and canvas to stage entertainments. The contribution of the Elizabethan and Jacobean revival was to make such events ever more sophisticated and ambitious. These events were not just displays of sporting skills, but also an opportunity to create spectacles and generally revel in a profusion of allegorical references and masques. The stunning setting of the Little Castle at *Bolsover* can be seen as the culmination of the tradition of the castle masquerade.

There was a break in the building works in 1617 following the death of Sir Charles Cavendish. It would appear that by this date the shell of the Little Castle was complete, and the interiors on the ground and first floors were in the process of being finished. Some of the rooms on the lower floors may even have already been plastered and fitted with chimney pieces and doors. Sir Charles probably envisaged the Little Castle as a private retreat with fairly sparse interiors, but it is equally clear that his aesthetic ambitions were high. He was considered to be "a good architecture" with a liking for "fair vaults." His son, Sir William Cavendish, evidently planned to entertain on an even more lavish scale, for he decided to embark on a more elaborate decorative scheme. After his father's death, Sir William first took time to review the project completely. Beginning with the form of the building that he inherited from his father, he then devised the complex integrated interior we know today.

Sir William sent his architect, John Smythson, to London to absorb some of the newly imported Renaissance ideas and fashions of court circles, with the aim of incorporating these into his new works at *Bolsover*. At this time Inigo Jones' Banqueting House was being constructed, and during his visit Smythson sketched various rusticated arches, windows, and balconies which he described in his notes as "Italyan." Some of these features were duly worked into the exteriors of the buildings at *Bolsover*. It must be stressed, however, that Smythson was not only interested in copying the latest fashions and developments; *Bolsover* was also intended to be a fantasy castle, and it is likely that Smythson was fully informed of his patron's slightly esoteric intentions. On his way to London, therefore, he also visited the old royal palace *Theobalds* in Hertfordshire which was well known to the Cavendish family, and there he made a sketch of a section of panelling. The drawing is entitled *The Platte of the Seelinge of the greate chamber at Thyballes taken the 8th November: 1618:- By Jo: S:*. Smythson not only copied the intricate detailing of the panelling, but carefully noted the applied decorative finishes. Elements that were painted black were denoted by the word "sabell," or by the abbreviation "sa" (the heraldic term for black), and small raised details that were gilded were designated with the term "or" (gold). The drawing of the lower panel bed was also elaborated with a sketchy representation of wood figuring, and alongside were written the words "wallnutte culler." This suggests that the panel beds of the panelling at *Theobalds* were fully grained in imitation of walnut, rather than being painted using a plain walnut-coloured paint.

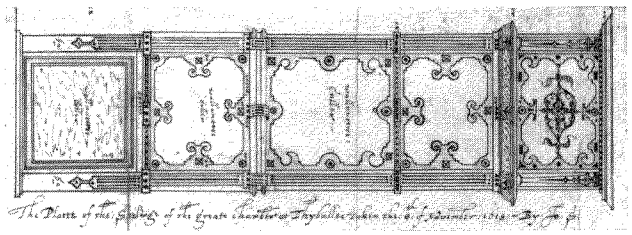

Figure 3. Panelling at Theobalds, *Hertfordshire. RIBA, Smythson III/13.*

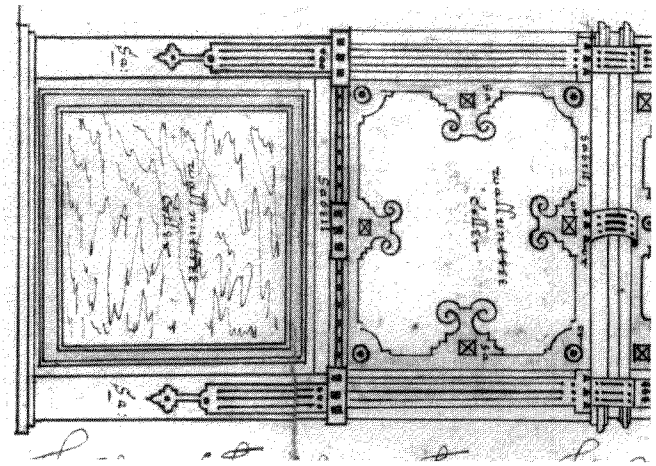

Figure 4. Panelling at Theobalds, *Hertfordshire. RIBA, Smythson III/13 (detail of lower panels).*

The sequence of events is important in understanding the new design intentions of Sir William Cavendish. The panelling that Smythson chose to record (or was perhaps instructed to sketch) in such detail at *Theobalds* had been in place for more than 40 years, so it was relatively old-fashioned at the time. On his return to Derbyshire the following year, Smythson used this sketch as the basis for the design of the panelling in the Pillar Parlour in the Little Castle. The Pillar Parlour was the room leading off the Great Hall which was used for more intimate banquets and entertainments, and it is believed that construction of this room was probably already fairly advanced at the time of Smythson's trip to London.

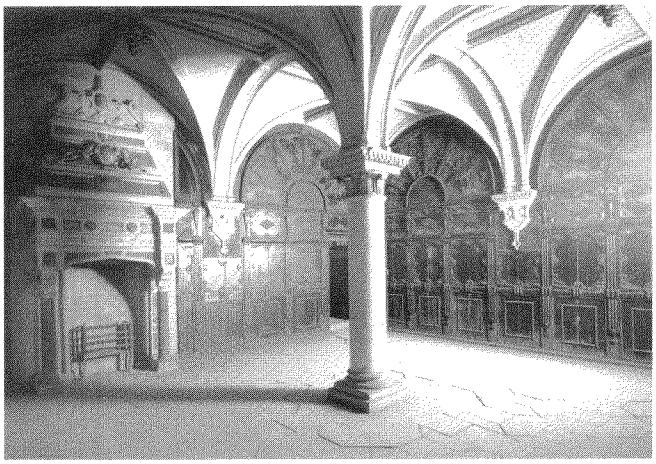

Figure 5. View of the southeast corner of the Pillar Parlour, 1949.

It is certainly probable that the complex vaulting of the ceiling of the Pillar Parlour had been completed by 1617, and that the original intention had been to finish the walls in tinted stucco incised to imitate stone. Recent research has established that the panelling and the wall paintings in other rooms were indeed an addition made by Sir William Cavendish after 1619. In the completed scheme, Smythson ingeniously adapted the design of the rectilinear panelling at *Theobalds* to fit in with the existing vaulting. He also incorporated a small lunette within each of the five bays to house a series of panel paintings that depicted the five senses: *Visus* (sight), *Auditus* (hearing), *Ordoratus* (smell), *Tactus* (touch), and *Gustus* (taste).

On completion of these revised works, the room was no doubt given a thorough cleaning. Then the oak panelling was painted, grained, and gilded, thus adapting the decorative scheme that had been applied to the panelling at *Theobalds*. Against the dark decoration, the small paintings in the lunettes would have sparkled intensely.

The subject matter of the five senses provided appropriate iconography for a banqueting room, but the paintings were also an important component in the decorative scheme

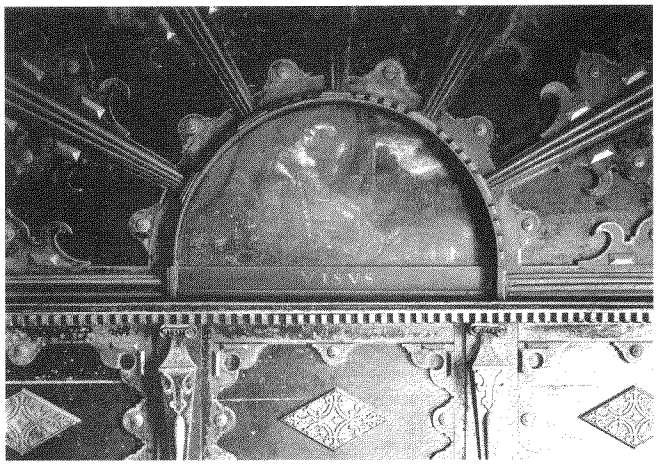

Figure 6. Visus *(circa 1619). Photograph taken in 1958.*

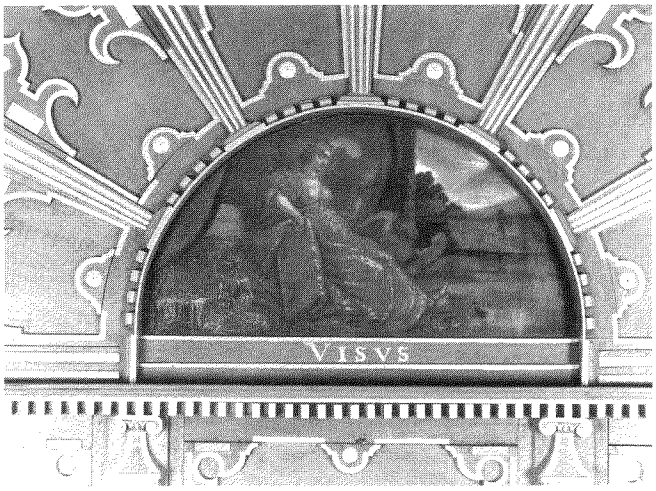

Figure 7. Visus *(circa 1619). Photograph taken in 1994.*

devised by Sir William for the whole of the Little Castle. As Sir William's guests progressed through the Little Castle they would have noted the imagery of the paintings in the Ante-Room and Great Hall (Raylor 1999). In the latter, Hercules is depicted struggling with wild beasts. The literate guest would have read these images as an invitation to divest themselves of their baser temperaments, and overcome their own bodily lusts and vices. On reaching the Pillar Parlour, the noble visitors (having left their servants behind in the Great Hall) could now be invited to partake of a banquet with a sense of virtue and self-knowledge. Then on leaving the dining room after the feast, the guests would ascend the Grand Stair to view the heavenly Star Chamber as well as other delights.

Act II — 'Festivities and war'

On July 30, 1634, Sir William Cavendish played host to King Charles I and Queen Henrietta Maria at *Bolsover*. It is recorded that he provided "a stupendous entertainment

which.....no man even after in those days imitated" (Clarendon 1888). The whole event lasted 6 days and cost more than £14,000, which is the equivalent of more than £1 million in today's money. A set of tablecloths and napkins bought for the feast was said to have been worth £160. Ben Jonson's masque *Love's Welcome at Bolsover* was also written especially for the occasion. The masque began in the Pillar Parlour, in the presence of the King and Queen, while a banquet was served, and the text made direct reference to the arrangement of the paintings decorating the room:

1st Tenor *When were the senses in such order placed?*
2nd Tenor *The* ***sight****, the* ***hearing****,* ***smelling****,*
touching, taste*,*
All at one banquet? (Jonson 1634).

The splendour of that evening in 1634 may be contrasted with the fortunes of King Charles I and Sir William Cavendish a mere 10 years later, as a consequence of the Civil War. Sir William was appointed Commander-in-Chief of the King's forces to the north of the River Trent, and after suffering a humiliating defeat faced years of exile in Antwerp. In 1644 the Royalist Garrison stationed at the castle were forced to surrender, and the castle was then occupied by Parliamentary forces until 1649. Charles I was executed.

Parliamentary forces ordered the demolition of the major walls of the new complex at *Bolsover*, along with the replacement of strong doors with weaker ones, but the actual extent of the damage caused during this period is unclear. It is known that the whole estate was sold off, although it also appears that members of Sir William's family who remained in England were able to repurchase it. Sir William even sent instructions over from Antwerp to tell his family to sell pictures and furniture to ensure that the buildings remained habitable.

Sir William Cavendish returned to England with King Charles II in 1660, and was able to survey the state of his damaged properties. His wife noted the houses at "Welbeck and Bolsover much out of repair.....no furniture or any necessary goods left in them" (Cavendish 1667). But it is clear that the Little Castle was soon made habitable again, and was refurnished with plentiful hangings and tapestries. An inventory of 1676 indicates that the Pillar Parlour was back in use, and now contained "12 cloth-of-silver chairs, a table and a grate" (BL 1676). Recent paint research also indicates that no redecoration of the panelling was carried out at this time. Smythson's scheme in the Pillar Parlour remained unaltered.

After his return, Sir William and his wife lived in *Bolsover* and continued to write courtly chivalric poems. But they were both increasingly regarded as slightly ridiculous figures. In his diary entry for March 18, 1668, Samuel Pepys described the couple as "...a mad conceited, ridiculous woman, and he an ass" (Pepys 1668). Sir William died on Christmas day, 1676. The vision that had conceived and built *Bolsover* as a fantasy playground of chivalric values died along with him.

Act III — 'Benign neglect'

Sir William's son Henry, who became the 2nd Duke of Newcastle, was the last member of the family to make regular use of the buildings. The Abbey at *Welbeck* became the principal residence of the family, and by the 1740's *Bolsover* was used more and more infrequently. However, the Countess of Oxford (who was Sir William's great granddaughter) still kept furniture there, along with her "tea Aequipage with a dutch tea kettle and lamp." In 1750 she even bought "2 Mahogany Dumb Waiters" for the room. She was also probably responsible for a substantial alteration to the room which consisted of the removal of the original windows and shutters, and the insertion in

Figure 8. Parliamentarian Troops in Pillar Parlour. *Watercolour by H.W. Todd, 1846.*

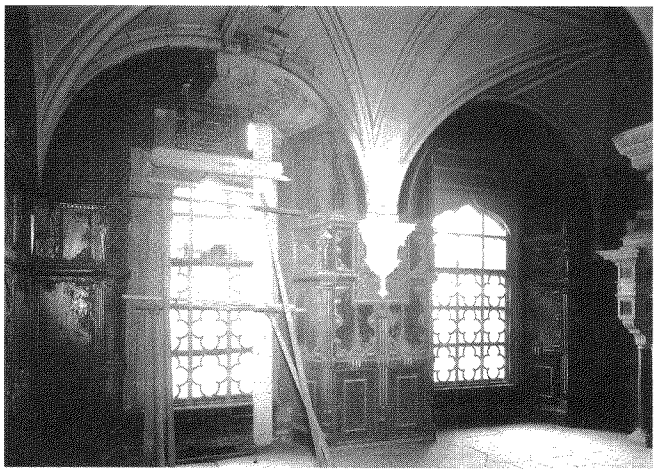

Figure 9. North wall (Gothic windows added circa 1750). Repairs carried out in 1953 revealed small upper window openings that had been blocked.

their place of large 'Gothic'-style windows and upper infill panelling.

These new 'Gothic' windows were painted black when first installed, but the panelling on the walls of the Pillar Parlour was not redecorated at this time. It was noted that *Bolsover* was generally in good repair, albeit uninhabited, when tourists visited in 1789. Between 1834 and 1883 the castle was leased by a local vicar and his wife. He made only minor alterations, such as the insertion of a Victorian-style fire grate in the Pillar Parlour.

The next definite record of the Pillar Parlour is when it was photographed in 1904 by *Country Life* in a relatively intact state. As late as the 1930's the room was still being described as "panelled and richly painted in brown and gold" (Goulding 1936). Lady Ottoline Morrell even attempted to re-create the effect in her own home, as she put it "as I remembered them in the old panelled rooms at Bolsover" (Gathorne-Hardy 1974). It is clear then that an important historic interior had managed to survive for nearly 3 centuries.

In 1945 the Duke of Portland, the then owner of *Bolsover*, gifted the building and grounds to the nation and the property came into the care of the Department of Works.

Act IV — 'Smartened up'

The Department of Works, later subsumed into the Department of the Environment (DOE), was the state body responsible for looking after the historic buildings owned by the British government in the period following the Second World War. The archives of these agencies that relate to building conservation are now held by English Heritage. Among other matters, these documents record the works carried out to the Little Castle at *Bolsover* from 1945 onward. The severity of the structural problems that faced the Little Castle at first precluded the formulation of a proper conservation program for the interiors. A proposed schedule of works drawn up in 1954 included an item for the "Examination and repair of internal partitions and timber work, including stripping of all panelling" (DOE Archives), but this was not carried out. Photographs taken between 1945 and 1964 record a marked deterioration of the paintings and decorative finishes during the period. It was not until 1964 that a paintings restorer finally prepared a report that set out recommendations for the conservation of the interiors at *Bolsover*. This document concentrated on the panel paintings and murals in the Little Castle, but unfortunately it revealed a rather careless approach to the investigation and treatment of the wooden panelling. It did suggest that the panelling should be carefully investigated to establish the original colour, which could be re-created if necessary. The underlying assumption of the report was that in any event the panelling would eventually be redecorated, and that there would be no attempt to retain any existing finishes (DOE Archives).

A study of the archival minutes and correspondence from 1964 to 1979 revealed the often irreconcilable approaches to the conservation of historic interiors that were held by various professionals involved in the project. The paintings conservators were mainly interested in restoring the wall paintings and the figurative panels paintings, not the building fabric. Although entrusted with the investigation of the decorative paint finishes as well, it is clear that the conservators regarded these elements as being the province of the house painter. Similarly, the architects involved felt that the panelling should simply be smartened up to ensure that "it did not appear in dismal contrast to the paintings" (DOE Archives). The historians and inspectors seem to have been alone in recognizing the archaeological value of the existing decorative finishes in the Little Castle, and hence it was only they who seemed at all anxious to preserve as much of the surviving paint work as possible.

The outcome seems to have been utter confusion. On one hand, the aforementioned conservator's report of 1964 concluded that in the Pillar Parlour the "fine panelling has been ruined by applications of oil which has been applied through the years. Tests for the original colour should be carried out" (DOE Archives). But not long after, the guidebook published in 1972 put forward the opposing view by suggesting that the panelling in the Pillar Parlour "retains its original colouring, much darkened" (Faulkner 1975, p. 54).

Given such imprecision about what was historically authentic, let alone what action should be taken, it is not surprising that the restoration project at *Bolsover* lost impetus. It was not until 1974 that some initial investigation of the decorative finishes was even attempted. It is also evident, however, that this analysis was restricted to a few cursory paint scrapes rather than a detailed investigation of paint samples using high magnification or material analysis. More worrying still is that as an outcome of this partial investigation, a works specification was prepared in July 1974 that included the following item:

> *Pillar Parlour:*
> *Prepare panelling..... paint three coats finished in approved solid colour. Regild all previously gilded surfaces in 23-carat gold leaf* (DOE Archives).

The specification was later amended to include total stripping of the panelling to reveal the bare oak which was then to be gilded but not repainted. On this basis, redecoration work eventually began in September 1976 with the stripping of the Smythson scheme. Even at this late date historians were still questioning whether the black decoration they saw was an original scheme, as it had been noted that the black paint appeared to underlay the gold

leaf and had been used to correct irregularities in the placement of the gold. In response to this the conservators carried out another visual examination and declared, erroneously, that the panelling had originally been varnished and that the "black stain" and gilding had probably been applied in the 19th century. It was concluded that the stripping and regilding of the elements was the first step toward any further treatment, and that consideration of other possibilities should be left until this operation had been completed.

Stripping continued until a newly appointed inspector who, unlike the others involved, realized the folly of the action ordered it halted. This order came too late to save the finishes in most of the room but at least the paint work in the northeast corner of the Pillar Parlour was not removed. The panelling that had already been stripped was then subjected to the further indignity of being glazed with a polymer glaze and regilded (DOE Archives).

Other mistakes compounded the misguided restoration program at *Bolsover* in the 1970's. In many of the rooms, perfunctory 'paint scrape analysis' had revealed a blue-coloured decoration that was presumed to be an original 17th-century scheme. As a result, much of the panelling throughout the castle that was not stripped was indiscriminately redecorated using a blue oil paint that was referred to in the specification as "Butcher Blue" (DOE Archives). But recent analysis of the original blue paint has revealed that it contained the blue pigment Prussian Blue, which was invented circa 1704 and was not commonly used in house paint until the late-18th century. Therefore, on completion of the 1976 work program, the interiors of the Little Castle at *Bolsover* were presented using a range of disparate decorations that did not convey any sense of the original function or status of the rooms. Nor did the decorative schemes in any way attempt to suggest just how these rooms would have been perceived by the Jacobean intelligentsia of the period.

To add insult to injury, the stripped-oak and gilded scheme in the Pillar Parlour proved to be very popular with visitors over the next 20 years, and was even cited as a fine example of the use of unpainted oak in the Jacobean period!

Act V — 'An understanding is reached'

Very soon after completion it was generally acknowledged that the interiors of the Little Castle had not been sensitively handled. However, attempts to instigate and

Figure 10. Panelling in western bay of south wall in 1975, before stripping.

Figure 11. The panelling in the Pillar Parlour on completion of the 1976 program. The room retained this scheme until 1999.

implement an alternative presentation had to wait almost 20 years. During the early 1990's, more systematic research was instigated that involved archival investigation, building analysis, and the examination of extracted paint samples. This process established that although some relatively minor alterations and redecoration had been carried out in the 18th and 19th centuries, the Little Castle had, up till the commencement of the 1976 program, retained much of its original 17th-century decorative finishes. Thankfully, substantial amounts of these finishes have survived in areas that were in storage or in areas of the castle not included in the 1976 program.

The new understanding of the original decorative finishes offered by modern paint techniques helped to clarify the hierarchy of the rooms and their original use. The research also helped to determine alterations to panelling, and confirm the design and placement of original hangings and tapestries. In Jacobean times, wall panelling that was intended to be hung with fabrics was not intended to be seen; thus even in the grandest rooms this panelling would have been finished in cheap, utilitarian colours. In contrast, the panelling on the window wall in the Pillar Parlour, which was intended to be visible, was expensively grained and decorated with gilded stencil patterns.

Investigation of the surviving section of painted panelling in the Pillar Parlour confirmed that John Smythson had accurately re-created the scheme that he had so carefully recorded at *Theobalds* in 1618. At *Bolsover* the graining applied to the panel beds was quite crudely carried out, and the inaccurate placement of the thick hand-beaten gold leaf around the edges of the panel frame had required much correction with black paint. The paint work and gilding applied around 1620 could be described as 'robust and vigorous' and was quite characteristic of the period.

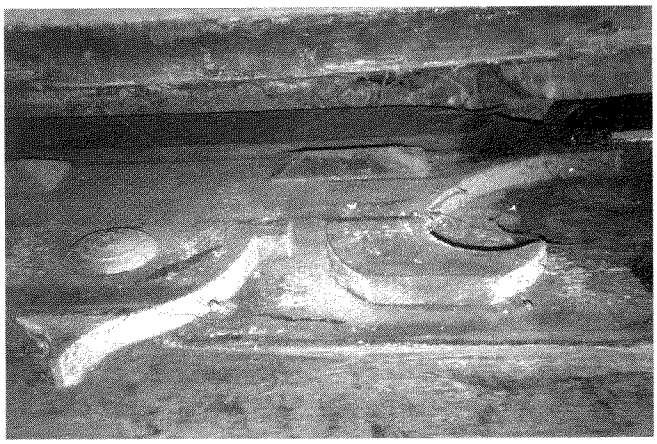

Figure 12. Detail of original decorative finishes on west wall protected by the 'Gothic' window.

Having assessed the new research findings, English Heritage needed to decide how to represent the ravaged Pillar Parlour and the other rooms that had been inappropriately decorated. A conservation strategy was drawn up for the treatment of all the decorative finishes within the Little Castle. Following this strategy, all of the original 17th-century finishes that survive are being carefully conserved and reinstated in the castle, and the 1976 overpainting is being removed. The large areas of panelling that were stripped are to be repainted using traditional 17th-century techniques and materials.

It is this new more-informed strategy that is now being implemented, and is due for completion in May 2000. By that point the Pillar Parlour will have been completely redecorated using lead-based paints tinted on site with authentic pigments. The scheme will attempt to re-create the original decoration by relying on the archaeological

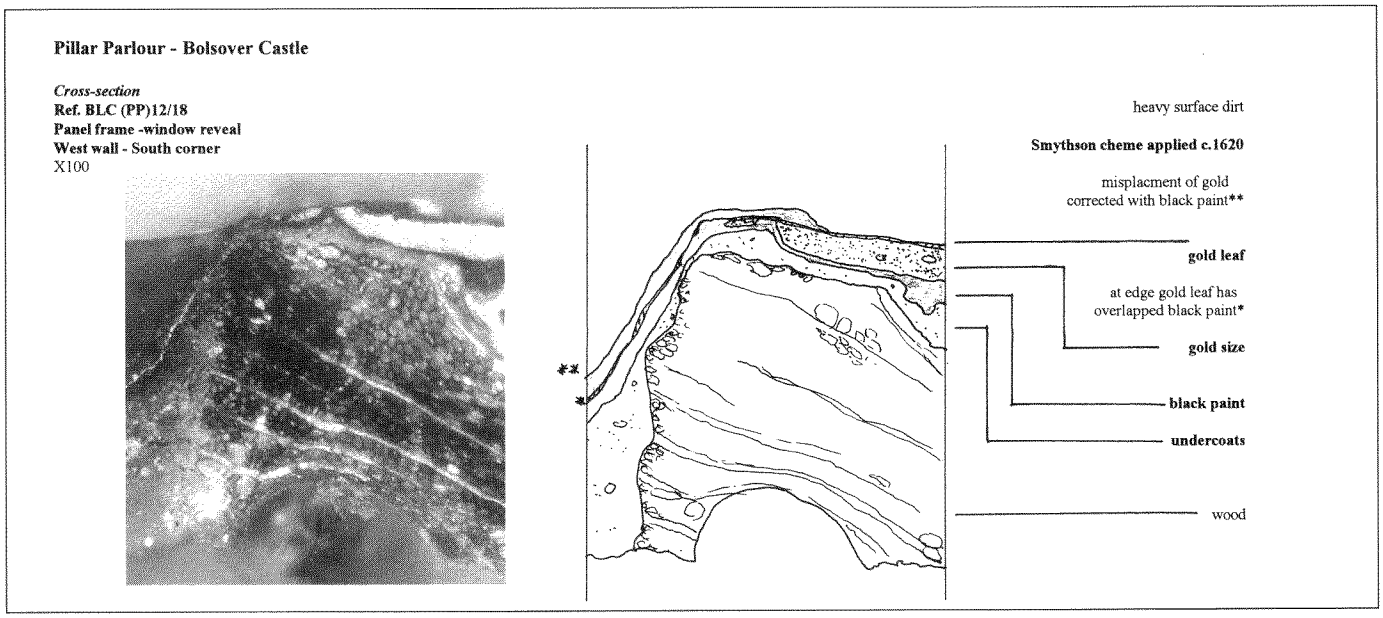

Figure 13. Photomicrograph of cross section and diagram of paint from the Pillar Parlour.

evidence retained within the room, as well as on early photographs and Smythson's drawing. There will be no attempt to patinate or distress the paint finishes, and thus when the work is complete the room will once again appear as it did all those centuries ago when Charles I was entertained by Ben Jonson's sumptuous masque.

Epilogue — 'The moral of the tale'

The destruction of the John Smythson scheme, which we now know had survived for more than 300 years, can only be regretted. We cannot take any consolation in the fact that this happened way back in the 1970's, or dismiss the mistake as just reflecting the insensitive approach of that period to historic interiors. For it is true to say that the ill-considered stripping of paint from historic interiors still continues today. Indeed it is a procedure that in some quarters is still considered good practice, and even forms part of standard redecoration specifications for historic houses. Heavy-handed and thoughtless stripping of historic paint finishes has generated a whole industry and a range of products that now make it a relatively easy process. However, the evidence offered by paint layers and other decorative finishes is a valuable analytical tool, and their preservation can add to the genuine understanding and enjoyment of historic buildings. It is time for a conceptual turnaround. Paint stripping must always be seen as an irreversible act that requires exacting justification and proven certainty in all cases before it can even be contemplated.

So keep this cautionary story of the Little Castle at *Bolsover* in mind, face up to your responsibilities as conservators and guardians of national heritage, and never let its like happen again!

Acknowledgements

The general information on the development of *Bolsover* is taken from the work of Patrick Falconer and Mark Girouard. I have had access to many unpublished reports that were commissioned by English Heritage as part of the current conservation project. I am also indebted to the unpublished research of David Bostwick.

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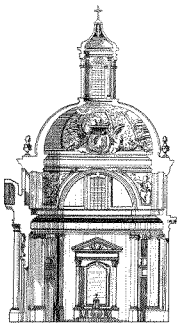
Résumé

Une tragédie du XVII^e siècle — « Un conte d'ignorance et d'irréversibilité en cinq actes »

Cet article traite des recherches d'English Heritage au sujet du Pillar Parlour situé dans le Little Castle du château Bolsover (Derbyshire, Angleterre). L'histoire de l'édifice révèle que le Little Castle a été peu utilisé depuis le XVIII^e siècle. Des recherches récentes ont également établi qu'il avait conservé la plupart de ses finis peints originaux (y compris un décor noir grené et doré appliqué vers 1620) jusque dans les années 1970, lorsqu'un programme de restauration peu respectueux a détruit ou oblitéré une bonne partie de cet ancien ouvrage. Cette recherche a illustré l'importance de bien connaître l'histoire de la décoration et de la structure d'un intérieur historique (grâce à des recherches documentaires, des examens physiques, et des recherches sur la peinture architecturale) avant d'entreprendre des procédures irréversibles comme le décapage de couches de peinture historiques.



Pink Pearls and the Pink Parlor: Fostering a Positive Relationship in the Conservation of Historic Interiors

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Abstract

Poor communication, misunderstandings, insufficient technical research, and unrealistic expectations can all contribute to the failure of any project. This is particularly true of conserving historic interiors where many different professional disciplines (e.g. conservator, curator, architect, engineer, and museum administrator, among others) are represented. This was certainly the case in the conservation of the McFaddin-Ward home, an early-20th-century stately mansion in Beaumont, Texas. The interior of this home is a combination of haute bourgeois and regional beaux-arts, with elaborate painted fabric walls, *boiserie*, gilded surfaces, stained glass, and historic woodwork; the most elaborate of the rooms is the Pink Parlor. The ultimate goal of the project was to turn this majestic residence into an historic house museum. This paper describes the conservation efforts necessitated by the project, and how a successful outcome was achieved through a positive working relationship among all involved.

The initial difficulties and setbacks to the project taught us, as conservators, that other professionals will not understand our profession unless we explain our purpose clearly. Within the framework of such a complex project to conserve and restore cultural property, it took a plea for common sense and understanding to retain as much of the original building fabric as possible while still meeting the multiple requirements of making a private home into a climate-controlled modern house museum. Working as a team that goal was achieved.

History

The McFaddin-Ward house was built in 1906 by American architect Henry Conrad Mauer (1873–1939) in the distinctive beaux-arts colonial style, using only the finest materials of the time (Figure 1). The stately mansion comprised three floors, an expanse of 4000 m^2, and a lavishly appointed interior that reflected the lifestyle of the prominent residents (W.P.H. and Ida Caldwell McFaddin moved into the completed house in 1907, and their family lived there for 75 years). The wealth that supported this lifestyle came from Mr. McFaddin's part ownership in the first successful commercial oil well at Spindletop, as well as his success as a businessman in the cattle industry, rice farming, commercial real estate, and trapping.

Figure 1. Exterior of the McFaddin-Ward house, Beaumont, Texas, 1999. Photo: McFaddin-Ward House Museum.

The interiors of the McFaddin-Ward home are a combination of haute bourgeois and regional beaux-arts, with elaborate painted fabric walls, *boiserie*, gilded surfaces, stained glass, and historic woodwork. The house features sparkling silver, elegant furniture, Oriental rugs, European porcelains, and American brilliant-period cut glass collected by the McFaddins and their daughter, Mamie McFaddin-Ward, over a period of 60 years.

The most elaborate room is the French-inspired Parlor decorated with pink damask draperies and Louis XV-style furniture. The walls and ceiling are covered in painted fabric (actually artist's canvas) transfixed to plaster and lath walls. Accenting the adornment is finely carved and gilded decoration known as *boiserie*, imitating French 18th-century carved and painted panels. The overall effect is stunning in its palatial extravagance. Many of the room's furnishings reflect this embellishment of surface; crystal chandeliers, gilt mirrors, and woven rugs intensify the visual impact of the room (Figure 2).

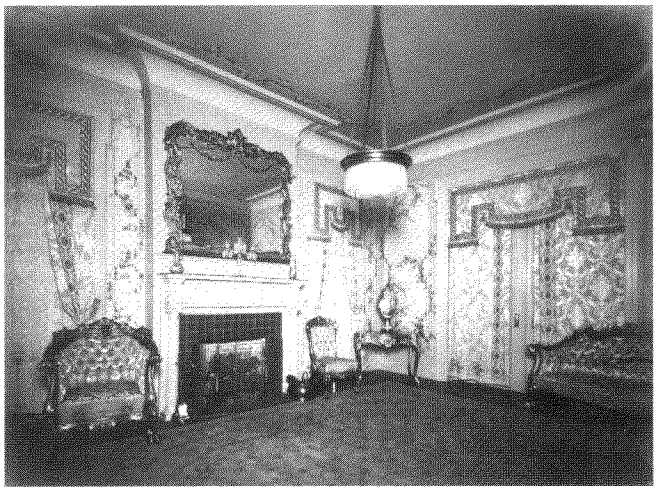


Figure 2. Pink Parlor of the McFaddin-Ward house in 1907; note the painted wall decoration. Photo: McFaddin-Ward House Museum.

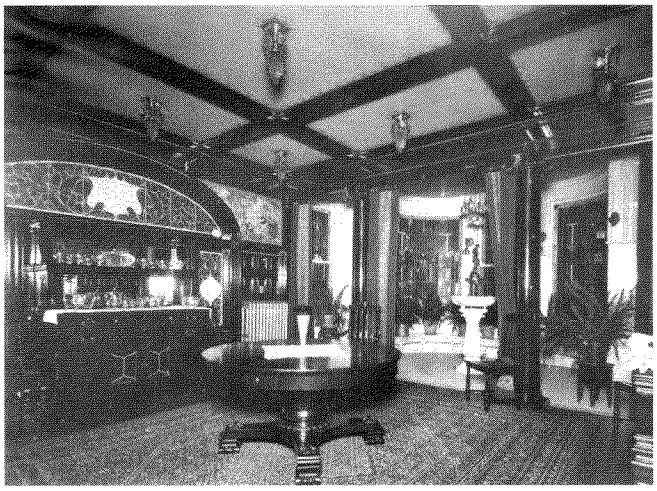


Figure 3. Breakfast Room and Conservatory of the McFaddin-Ward house in 1907. Photo: McFaddin-Ward House Museum.

The Breakfast Room and Conservatory form a unique architectural ensemble within the house, as the rooms adjoin each other, providing a space for intimate meals and small luncheons. The ornamentation is of note as well; the ceilings are hand-painted canvas in a floral motif and the walls consist of intricate tapestry fabric, woven by Scalamandre. Stained glass windows in the Conservatory complete the serene environment, while also providing ample light for the many plants kept in this room (Figure 3).

Other decorative elements within the establishment augment the lavish interior. The house features sparkling silverware, and Oriental rugs of many sizes are found throughout the house (most were woven in Kerman or Sarouk). Art glass created by Quezal, one of Tiffany's leading competitors in the early 1900's, accents various quarters along with cut glass of fine workmanship by the Hawkes Company.

Several other rooms located on the first floor are also worth noting, as they form part of the public rooms in this house museum. The Entry Hall is of remark for the 86-cm (34-in.) statue of an Arab hunter, circa 1880, by Emile Guillemin, Paris, France. The Dining Room was used for formal occasions, where food was served in the Russian manner with butlers serving each guest on trays. The Music Room, which is located across the hall from the Parlor, was the scene of many family gatherings; an Ivers and Pond piano along with a phonograph provided the music. The musical theme of this room is realized by Cordonay-stitched lyres on the valances and portieres. The final formal room is the Library. The woodwork was originally quite dark, but was lightened in the 1940's by Mrs. McFaddin. Large bookcases still dominate the room along with several portraits of family members including Ida Caldwell McFaddin and W.P.H. McFaddin.

Mrs. Ward, who lived in the house until her death in 1982, established the McFaddin-Ward Heritage Foundation to preserve the historic home and its contents as an educational and cultural resource for future generations. Her foresight provides for museum operations and curatorial research. Administrative mechanisms were established for the creation of a privately funded museum infrastructure between 1984 and 1985.

The house is one of the best preserved large-scale examples of a beaux-arts style home in the United States, while also reflecting the lifestyle of an early-20th-century wealthy Texan family. It remained unaltered for many years, and minor upgrades in the kitchen and other areas did not seriously compromise the historic integrity of the structure (this was crucial for the later adaptive use of the house as a museum).

Mural conservation project

The museum staff understood the need to use professional conservators for the restoration of the artistic elements of the house (such as the elaborately decorated walls of the Parlor), and we were hired to conserve the painted ornamentation. It immediately became apparent to us that the project could not be completed within the allotted time frame of 2 weeks and additional support would be essential to the success of the project.

Inadequate technical analyses and a misunderstanding as to what our role as conservators would be hampered the initial conservation efforts. Also, because of time constraints, many of the technical issues (such as HVAC installation) had unfortunately been completed before we arrived, further impeding our effectiveness. Intense

discussions amid all parties involved, as well as a thorough examination of the interior finishes, resulted in a collective conclusion that the conservation could not be done with toxic cleaning agents, as had been proposed earlier. Instead, mild soaps and Pink Pearl erasers would have to be employed in the removal of decades of petrochemical grime and other deposits. A cautious pro-preservation approach slowly emerged as the principal course of action.

Minimizing health hazards in mural conservation

During January and February 1986, the Pink Parlor in the McFaddin-Ward house was conserved using methods that were safe for both the murals and the health of the conservation staff—a principal concern in the undertaking of the project. Part of the house's recent renovation had been the installation of enclosed climate control, with air circulating through ducts from one part of the house to another. These air ducts could not be easily closed, so a safe method of cleaning the walls was necessary to prevent toxic fumes (which might have been generated by the cleaning process) from spreading throughout the house.

The Pink Parlor of the house has approximately 325 m^2 of painted surface accompanied by gilt *boiserie* overlay. The paint film is oil on canvas lined with lead white adhesive to attach it to the plaster walls and ceiling. Over the course of time the painted walls had become covered with built-up grime and industrial pollutants from the nearby petroleum industry. Settling of the building over the years had resulted in ripples and tears in the support.

As a preliminary step in the treatment of the décor, a series of chemical mixtures to remove grime were tested. However, none proved effective in cleaning and they all jeopardized the health of staff. Dry cleaning methods were then tried: 18 dozen soft Pink Pearl erasers were employed to remove the grime. This method proved safe to both the property and personnel.

The work was carried out on four, 4.5-m (15-ft.) scaffolds, each fitted with a small mattress for the comfort of the staff. These constructs were necessitated by the nature of the project, as staff spent nearly 2000 h positioned on their backs, with only 0.3 m (1 ft.) of space between them and the ceiling. For their protection, staff were outfitted with dust particle filter masks, head caps, and smocks. The only electrical implement utilized was high wattage lighting. As the time necessary to complete the project had been underestimated and the opening was only a few months away, volunteers from the museum staff, including the president of the board, assisted in this cleaning endeavour. This cooperative effort gave rise to an *esprit de corps* among the team, and respect for the conservation field grew among the other professionals involved in the project.

Cleaning the painted walls and ceilings was a labour-intensive activity; in the Parlor more than 325 m^2 of embellishment was cleaned and conserved, and in the Breakfast Room/Conservatory 150 m^2 of decoration was cleaned. Over a 2-month period, through the work of a dozen technicians working two 8-h shifts, literally thousands of square centimetres of dirt was erased. In total, nearly 2000 h was spent conserving the wall paintings (Figure 4).

In addition to the murals, the gilded surfaces, stained glass, and woodwork were all conserved. The gilt *boiserie* of the Pink Parlor was consolidated with low viscosity BEVA 371 and cleaned where possible with water and erasers. When solvents had to be used, such as in the treatment of ripples in the support or selective varnishing, the air ducts were temporarily closed, respirators were used, and all toxic work was conducted at night. These precautions were taken so as not to jeopardize the health of the staff by prolonged solvent exposure. The ripples in the support were injected with BEVA 371 and set down with an electric tacking iron after solvent evaporation. Inpainting was executed in watercolour.

Over the years the woodwork in the Pink Parlor had been painted to match the soiled walls. After cleaning, the woodwork had to be repainted to match the bright pink walls and beige ceiling that were now revealed. Stratigraphic sections from the woodwork also assisted in establishing the original colour scheme of the room.

As conservators, we worked on building team spirit as well as conserving the Pink Parlor and the rest of the decorative splendour of the interior of the McFaddin-Ward House Museum. This dedication and assiduousness throughout the project were rewarded: the results of the cleaning were dramatic and exquisite. The museum opened on March 15, 1986, right on schedule.

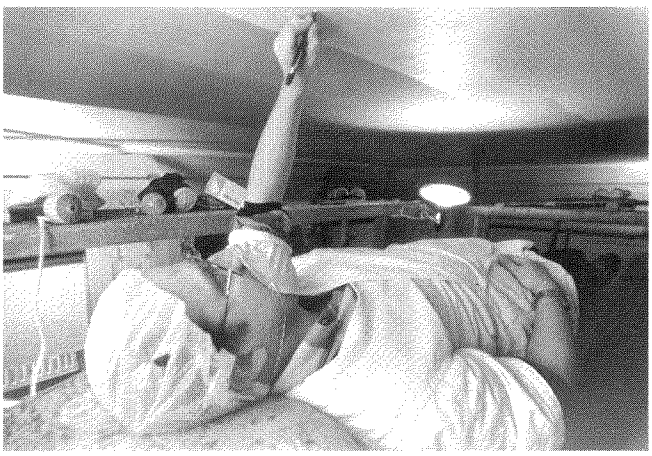


Figure 4. Tony Rajer cleaning the painted canvas ceiling of the Pink Parlor in 1986. Photo: McFaddin-Ward House Museum.

Summary

Through our contribution as conservators in this endeavour we have come to realize that other professionals cannot understand or appreciate our profession unless we elucidate it through experiential learning. Within the framework of this complex project of conserving and restoring cultural property, it took a plea for common sense and understanding to retain as much of the original construction as possible while still meeting the multiple requirements demanded in the transformation of a private home into a climate-controlled house museum. Working as a team we achieved that goal.

Further encouragement came from the local press, which looked favourably upon our unique cleaning system and supported our efforts with newspaper and TV coverage. We held weekly staff meetings to discuss the successes and shortcomings of the task, and to revitalize and encourage the staff. In addition, we held informal picnics to expel tension and assuage the anxieties associated with the demands and concerns of the duty. Some of us even turned to prayer for further support. All involved experienced a significant feeling of pride upon the completion of the conservation project.

Acknowledgements

We sincerely thank the staff at the McFaddin-Ward House Museum for their aid in the preparation of this article. The exquisite result of the project could not have been realized without the dedication and hard work of all those involved.

Résumé

Gommes roses et Salon rose : La recherche de relations positives dans la conservation d'intérieurs historiques

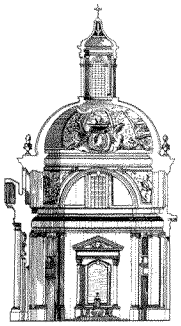
De mauvaises communications, des malentendus, des recherches techniques insuffisantes et des attentes irréalistes peuvent tous contribuer à l'échec d'un projet. C'est le cas tout particulièrement dans la conservation d'intérieurs historiques où un grand nombre de disciplines professionnelles différentes sont représentées : restaurateurs, conservateurs, architectes, ingénieurs, administrateurs de musées, et d'autres encore. C'était assurément le cas pour la conservation de la maison McFaddin-Ward, une imposante demeure du début du XX^e^ siècle à Beaumont, au Texas. L'intérieur de cette maison est une combinaison de style haute bourgeoisie et de style académique régional, avec aux murs des panneaux de tissu peint raffinés, des boiseries, des surfaces dorées, des vitraux et de l'ébénisterie historique; la pièce la plus décorée est le Salon rose. Le but ultime de ce projet était de transformer cette majestueuse résidence en une maison historique. Cet article décrit les efforts de conservation qu'a nécessités le projet, et comment le succès a été atteint grâce à des relations de travail positives entre tous les participants.

Les premières difficultés et les ratés du projet nous ont appris, en tant que restaurateurs, que d'autres professionnels ne comprennent pas notre profession à moins que nous n'expliquions notre but très clairement. Dans le cadre d'un projet aussi complexe pour conserver et restaurer une propriété culturelle, il a fallu faire appel au sens commun et à la compréhension pour conserver tout ce qui pouvait l'être de l'édifice original, tout en respectant les multiples exigences de la transformation d'une maison privée en une maison-musée moderne à climat régulé. En travaillant en équipe, ce but a été atteint.

7

The Interior Environment

Les intérieurs



The Four Seasons Restaurant in the Seagram Building: A Case History

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Abstract

Although light is essential it is also one of the most destructive elements for the fugitive organic materials found in historic buildings and their contents. This paper discusses a lighting tool that provides safety, longevity of service, economy of operation, and a pleasant environment, as illustrated in the retrofit of the original lighting in the Four Seasons Restaurant in the Seagram Building in New York City. The lighting solutions found for the two sections of the restaurant (the Grill Room and the Pool Room, erected some 40 years ago) fulfilled numerous different criteria. One of the key criteria was that everything had to end up looking exactly like the original design (which was sacrosanct), so it was critical to protect all existing architectural and decorative components from damage. This required meticulous central control and close coordination among many trades and disciplines. The initial concept, planning, supply, and installation of the project are all explained.

Modernist architect Mies van der Rohe's Seagram Building in New York City, now a National Historic Landmark, was erected some 40 years ago. The main floor has always contained the elegant Four Seasons Restaurant, designed by Philip Johnson. The Grill Room, with its square bar, is on one side of the central entrance lobby; the Pool Room, on the other side, has a central white marble surface pool that contains gently turbulent water and is surrounded by four tall life-sized trees which are changed with the seasons (from which the restaurant gets it name).

Even after 40 years, most of the original lighting was intact, although that for the pool and trees needed attention. The large openings for the uplights in the tree planters had become receptacles for debris, and the underwater fixtures in the pool had become corroded and were a problem for maintenance. These lights were retrofitted with the latest invisible technology—glass fibre-optics architectural lighting (a system eminently suited for historic architecture). This is just one of the available options that can provide long-lasting architectural service. It is especially useful for solving difficult problems of inaccessibility, wet or hazardous conditions, or the need for excellent colour rendering with protection for vulnerable materials. Also, the use of fibre-optic lighting can eliminate the need for obtrusive track lighting (the effect of which is often marred by misfocused or burned out lamps).

The lighting designer (Ann Kale) first suggested fibre-optics as a functional (as opposed to decorative) system to the restaurateurs in the spring of 1996, after reading an article about it in a professional magazine. The concept is quite simple. It is made up of three parts: a light source, harness of tails, and fittings (if necessary). A light source the size of large shoe box (called a 'projector' or 'illuminator') sends light rays into an octopus-like harness of thin, flexible light guides ('tails'). The tails are composed of multiples of 400 strands of glass, each the size of a human hair. A size 1 is 400 strands (1.13 mm in diameter); a size 36 is 36 times 400 strands [0.65 cm ($^1/_4$ in.) in diameter]. The larger the tail size, the larger the footprint of light. Throw distances of 30 m (100 ft.) can be achieved with the larger sizes. No electricity (only light) flows through the glass, emerging at the end. Threaded metal end ferrules on each *end-emitting* tail enable all types of fittings to be easily screwed on or off to control or alter the light. [Glass with an attenuation (the physical loss of light as it travels along its conductor) above 200 dB/km must not be used as it would transmit green or orange colour and not provide expected light levels.]

The fully assembled harness is inserted into the opening in the light source, and from then on the project is just like any other lighting job (i.e. providing the usual power and control wiring and fishing the glass tails through the building's interstitial spaces to where points of light are needed). An alternate type of fibre-optic lighting is known as *side emitting*, but it is used only for decorative purposes. It resembles neon, but is much less expensive to maintain.

The light source of choice is metal halide, made specifically for glass fibre-optics. There are 100- and 150-W versions, each more efficient than standard metal

halide units. One lamp in a projector can power from 400 to 4 tails, depending upon the combination of tail sizes in the harness. Each light source can handle a maximum of 160 000 to 200 000 fibres. A dichroic tungsten halogen source can also be used, but its life is only about 1000 h compared with the 6000-h life for metal halide; halogen also burns much hotter and uses much more energy than metal halide.

If the light source is placed in the middle of a space, it can serve a distance of 27.5 m (90 ft.). However, if colour rendering is important, good quality tails that do not exceed 15 m (the point at which a natural colour shift starts to occur) must be used. To achieve an acceptable result, good quality glass and compatibility of all three components are necessary.

The glass fibre-optics system has many properties that have long been sought for lighting.

It is very cost-effective—A fibre-optics system provides great longevity for functional architectural lighting including task, display, architectural contours, and even ambient illumination (it will outlast the wiring powering it!). It is also extremely energy-efficient, requires minimal maintenance, and does not produce heat (which usually increases air conditioning loads). Depending upon the complexity of the design, payback from installation and operation can occur within a few years.

It is discreet and sophisticated—A fibre-optics system is COOL, and a pleasant environment increases personal comfort, attendance, sales, and productivity. The system can be miniaturized so as not to impact on any décor, and the light provided is silent, glare-proof, and EVEN. The flexibility of use also allows for changing applications.

It is safe—As no electricity flows through the light guides, a fibre-optics system is safe in water (even if touched), and is not affected by electromagnetic interference. Because it does not emit infrared and ultraviolet light (wavelengths that are especially destructive to fugitive organic materials like wood, paper, textiles, leather, ivory, and lacquer) efficiently, it delays the eventual fading and drying out caused by all light. [This feature is particularly useful for display/task purposes and for private collectors.] It can also be used in high, inaccessible, hazardous, or confined space locations.

Additional benefits—Period light levels, plus safe and realistic flickering candle- and gas-light, can be re-created (all types of motion, dimming, and colour are possible). This means that most antique lighting fixtures can be retrofit with glass fibre-optics for carefree and very energy-efficient illumination. As the light sources can be located elsewhere in a convenient accessible location, display or trafficked areas need not be disturbed to re-lamp. This reduces the cost of maintenance considerably because fewer lamps are required, those that are employed are much more energy-efficient, and the need for ladders or scaffolds to reach individual lamps is eliminated.

Decisions on the scope of work and designing for the Four Seasons went on from the spring of 1996 until the following October. There were many changes, often of escalating complexity, resulting in 22 different quotations. For each new permutation of lighting that developed, the fibre-optics consultant did mock-ups in the lab to decide which light guides could provide the light levels required, the number of projectors and tails needed, and type of adjustable fittings necessary. Finally, two demonstrations with actual equipment in the pool were requested: the first was for the lighting designer alone and the second for the architect and client. [The architect (Alan Ritchie) was already familiar with glass fibre-optics as used in the United Kingdom.] Both times, three people leaned over opposite sides of the pool holding different-size light guides under the water to see which was the most suitable. Various theatrical gels were cut to see the effect of different-coloured light for special occasions. [There is no substitute for mock-ups on a site or in a research lab: no standard table, photometric chart, or computerized calculations with ray tracing and radiosity can replace what the human eye actually sees. Such technical aids can only be the starting point. The client is always the ultimate judge of what the lighting should be.]

After the second 'show', glass fibre-optics was determined to be the illumination that could best satisfy all of the client's requirements, uppermost of which were that the new lighting last at least another 40 years, require minimal maintenance, and be unobtrusive. Flexibility of colour schemes was also desired so that cool, discreet illumination to suit the sophisticated décor could be provided for every occasion. Having made the decision to use fibre-optics, calm heads, common sense, a well-thought-out design, and guidance by an experienced consultant were now required to complete the job.

The restaurant was scheduled to close for 2 weeks after the celebration of New Year's Eve, 1997. The entire job had to be done within this 2-week period and everything had to end up looking exactly like the original design, which was sacrosanct. In addition to the pool and tree illumination, the final scope of work included replacing the entire large professional kitchen, providing new electric service, installing improved pool plumbing controls, and adding new marble pool cladding. Without sufficient storage space, much of the historic décor (including historic furnishings) had to be left in place throughout the project. The restaurant's reservation department was also to remain open during the construction so that the restaurant's regulars could be taken care of as soon as it reopened. Ironically, in spite of being in one of the most

famous dining places in the world, with all the water and gas off and the old kitchen ripped out, everyone had to go elsewhere for lunch!

This project was a textbook case to illustrate the need for extremely close coordination among all involved so that the construction could be compressed efficiently into the time allotted, while retaining architectural integrity. All the adjacent trades (floor, marble, plumber, carpenter, electrician) had to work together to conceal the glass light guides as they ran from the four planters, under the channelled floor, and up through the new double marble pool facing. Both the manufacturer's managing director and two representatives from the fibre-optics consultant were on site for most of the first week waiting for components for other trades to arrive, and showing everyone the easiest way to proceed. The consultant also returned the day before the reopening for a final check.

In addition to underwater lighting for the pool, adequate light for the 7.6-m-tall (25-ft.) signature trees (which changed in size and shape every season) had to be provided, and neither the lights in the pool nor those in the planters could throw heat or glare onto the poolside diners. As the restaurant is often the venue for important seasonal and special events, six-coloured wheels were added to each light source for greater variety. With the pool lights traversing different media (air and water), the dimming equipment specified was not needed and subsequently removed. The fibre-optics consultant also advised against using a 3000-K light source, because the theatrical filters were calibrated on 3200 K and would therefore appear off-colour. After seeing the initial unsatisfactory result, the lamps were then changed to the white 4000-K colour temperature.

Early on it became clear that several meetings with ALL members of team would be necessary. They were requested by the fibre-optics consultant, which was quite unusual. Discussions included the best way to accomplish the task (using input from each craft) as well as how to cope with unexpected surprises (like the custom stainless steel band arriving at the last minute, and then not fitting exactly). Much initial construction had already been done without this kind of interacting conversation, and this had resulted in new carpet being laid over the floor and having to be pulled up. [In any project where time and money are at a premium, it is important to maintain close and constant communication among the team to avoid this kind of unnecessary duplication of work.]

Historical research that is normally needed to replicate or retrofit period lighting fixtures was not required in this case because all of the illumination hardware was miniaturized and concealed. The first step at the Four Seasons was to open the large 136-kg (300-lb.) crate sitting on the loading dock. After counting the components, making sure everything was marked for its eventual location, and checking them for breakage in shipment (the consignee must make the freight claim as soon as possible), the projectors were plugged in to see if they worked after the long journey. Then each glass harness was inserted into a projector to see if all the tails carried light. An alert apprentice found the easiest way to straighten out the coiled harnesses. He stood on top of a 1.5-m (5-ft.) gang box and dangled them by the common end, letting gravity do the work quickly. Then he put protective covering over the tail ends and the common end of each harness, and re-wrapped them for storage until ready for use. To avoid using the wrong harness in the wrong location, only one was taken out at a time. [This kind of advance preparation by one of the junior crew can save expensive labour later. If missing or broken parts are not discovered until the time that installation is scheduled, a project can be delayed past the scheduled completion date.]

The next step was to introduce the fibre-optics system to every member of the team. Once on the job, the fibre-optics consultant insisted on the addition of dust covers and plywood, and prohibition of workers standing on the period furniture instead of on ladders. However, with a thick layer of wood shavings all over the floor, there still was no ban on smoking, making the site a game of Russian Roulette with the landmark in jeopardy from accidental fire. Luckily nothing happened.

The project happened to coincide with one of the coldest winters in New York, and almost everyone on the site caught cold (especially when the plumbers raised the heat to cure the mastic, creating a sauna-like atmosphere complete with frigid blasts). The many substitute workers brought in had to be acquainted with the vulnerability of the space and the unfamiliar glass fibre-optics.

The power and control wiring was done independent of fishing the glass tails. The location of the lighting controls had not been decided when installation started, so some time was spent making that decision. With only 2 weeks of construction, the restaurant kitchen obviously had priority on manpower, so the fibre-optics sometimes got the attention of only one electrician. Nevertheless, the contractor's subforeman cleverly figured out many of the items that had not been previously addressed, even how the float switch for the drain was to be handled. This was real working-by-the-seat-of-the-pants, with design problems often solved on site by the craftsmen. [Good mechanics are a joy to watch. They can easily be singled out by the way they care for their tools. A common remark from almost every electrician using fibre-optics is "It's a good thing the glass harnesses are all assembled. Trying to cut, polish and splice plastic on this dirty construction site would take three times as long to do." If the mechanic is not thoroughly expert in the complicated plastic process, it can take longer, increase labour costs, and jeopardize the quality of the final product.]

There were two light sources concealed in each of the four large planters around the pool: one for one-quarter of the pool and one for each tree. The floor men first created a trench from each planter to the pool, which was to hide the tails coming from the bottom of the planter. For protection while in the trench, six sets of three tails each were fished through six short pieces of 2.5-cm (1-in.) flexible plastic conduit. Meanwhile, the marble setters cut into the four corners of the original marble pool sides to make room for the light guides. They would later add new vertical cladding to cover these recesses. After considerable discussion about how to secure the glass tails under the water (adhesives would leach through the marble and stain it), the final the solution was to make a narrow stainless steel metal band, drilled with holes, to hold the tails in place.

A circle of custom-made adjustable eyeballs, 1.25 cm ($^1/_2$ in.) in diameter, eight for each planter, was used to light the trees. Their design was refined through discussions between the lighting designer and the manufacturer until a workable model was obtained. They were made out of bronze for durability to handle the constant seasonal adjusting, and certainly were an improvement over the 0.3-m (1-ft.) large holes for original lighting in the planters. [An 'archaeological dig' in the original holes revealed the most amazing cache, from silverware to suspenders!] The 68 pool fittings were made with tiny hoods to keep the underwater light from shining in the diners' eyes. A total of eight 150-W metal halide projectors with 6000-h life supplied the light. The suggestion to have all eight projectors synchronized to work colour changes simultaneously had been ignored, and the omission was soon noticed when one projector went green while another went red. This problem was quickly solved by the manufacturer, who was still on site.

The carpenters built four heavy wooden protective partitions to be inserted within the planters. These were to allow removal of the realistic seasonal plantings (which are set in heavy concrete bases) from the centre section without disturbing the projectors in the sides of the same containers. Electricians assembled slotted metal supports to keep the illuminators at a convenient height for re-lamping beneath the planter cover. The removable top, covered in wood chips to look like it held a live tree, had to be in small enough pieces to be handled easily. To keep the wood chips from falling down on the projectors and presenting a fire hazard, a fine metal mesh screen was put under them. Adequate space to dissipate the heat from the light sources within the planters also had to be allowed. Lenses of the eight miniaturized fittings at the outer edge of each planter were aimed alternately at the lower tree and at the top. Final focusing was by the lighting designer.

Once the installation started, the safest storage space for the harnesses once out of the crate and now partially encased in flexible conduit was in the empty pool (at least until the plumber worked with a blow torch, when the glass coils had to be moved out of his way as he progressed around the corners). It was a tense moment when the general contractor spied the floor men, who were making the trenches between planters and pool, JUMPING on the glass tails laid in them to even them out for the layer of sand and then concrete. Fortunately (and contrary to expectations), the glass fibre survived the handling and constant moving about (twisting is actually the most harmful treatment to the fibres).

An electrician's helper assembled the special hooded pool tail covers. The custom stainless steel metal retaining band, drilled with 68 holes, was attached under the lip of the pool to support the glass tails. Once the tails were pulled through, the fittings were ready to be added, production-line style. The marble setters worked right alongside the electricians so that as each end of the pool was fitted with the fibres, they inserted the new slabs. All the while the plumbers were also in the pool (dry) with their blow torches, putting in the new pipes and controls, as the floor men were covering up the four trenches.

As soon as one side of the pool lighting was ready, it was energized. That showed those who had been toiling almost around the clock that the fibre-optics really worked, and gave them renewed energy to carry on with the first large use of glass fibre-optics lighting in a major historic site in New York City. Famous patrons of the restaurant, hearing of this different type of lighting, flocked into the construction site to see the magical effect. In fact, one person had to be assigned as guide to explain the technology to all those 'power lunch' clients. Hearing that the light was really on, the sister of the Seagram Building's owner flew down for the day from Montreal to see for herself.

After the actual fibre-optics installation was completed, the restaurant's personnel were shown how to re-lamp (all eight lamps at the same time for uniformity) and activate the controls. They were taught how to dust the projector boss when re-lamping, and how to be sure that enough air was circulating around the projectors to dissipate the heat created. The importance of scheduled maintenance as the least expensive way to operate was also stressed (the words *deferred maintenance* usually mean that a large sum will be required later instead of small amounts spent regularly).

At the end of the second week, the entire team realized that this had been 'just another lighting project' rather than a 'space age' adventure that was foreign from what they had always been doing. The project proved that the same common-sense construction procedures can be used whether the historic project is 300 or 40 years old. The introduction to glass fibre-optics was a new challenge, and addressing it had given them great satisfaction. Some of the electricians could not wait to specialize in this newfound lighting tool; in fact, one electrician promptly went into business for himself.

The restaurant owners were so pleased that they featured the lighting in their quarterly half-page announcement of the new season in the *New York Times*. Patrons found the illumination brighter and more colourful, but seemingly otherwise unchanged in look from before. Perhaps this is the mark of a successful restoration—the space appears the same as it did when first built.

Appendix 1. General guidelines

As a general rule, no work on architecturally important projects should be undertaken without sufficient advance preparation. As much as possible should be thought out ahead of time to save the original design and fabric from being mutilated, and to get the job done on time and on budget. Even so, there will always be unexpected occurrences and the team will have to be flexible enough handle them.

The original crew and any personnel added later should be immediately acquainted with the historic value of the work site. Most will respect it if they feel they are contributing to its survival.

It is more economical to have lower-priced personnel do the groundwork than have high-priced mechanics standing around waiting for decisions. Having the walls, ceilings, and floors still open allows the easiest provision for this necessary system. 'Fast-track' is not a suitable process for use in building conservation. It is essential to have someone in charge who can monitor the work daily and make decisions. Under no circumstances should holes be made in decorative surfaces or any original building fabric or structural member without permission from the leader of the team. If such penetration is absolutely necessary, appropriate specialists to repair the openings should be on hand.

More than one historic building has been levelled by carelessness. Whether only one additional baseboard receptacle is required or an all new lighting scheme is contemplated, the existing electric service must be carefully checked for capacity and condition. [After 40 years, wiring need to be renewed!]. All original architectural components left in place should be properly covered and/or protected during construction. The National Trust in Great Britain forbids 'hot work' on site unless there is no other way to proceed; in that case, adequate fire protection must be on hand. It is a good idea to ban loud radio playing to ensure that a fire alarm can be heard throughout the site. Good housekeeping is critical to avoid fire and accidental personal injury. Safe places to store equipment and tools are also indispensable. Irreplaceable architectural components are often the target of theft-to-order, which means that the entire premises should be policed around the clock. Digging outside or inside should never be started before checking with gas, water, phone, and electricity utilities. To ignore the CALL BEFORE YOU DIG rule is to invite a hefty insurance claim.

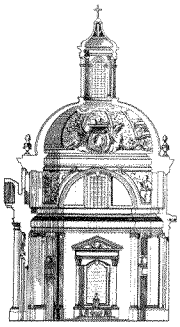
Existing chases, conduits, and other interstitial spaces should be employed first for the introduction of modern mechanical/electrical systems before considering other more obtrusive means.

It is too late to obtain the best results at the lowest price if the client waits for the smell of fresh paint before ordering lighting. In fact, this is often the last service to be considered, and the first to be cut during the budget crunch. Apparently many people forget that humans cannot see or do anything without light. Also, the same objects look completely dissimilar under different lighting methods. In historic buildings, light should not only allow close inspection where necessary, but also enhance the area and objects. However, it should not be forgotten that light, important as it is, is also one of the most destructive factors for fugitive organic materials. Illumination that protects against desiccation and fading should therefore be selected.

Résumé

Le restaurant Four Seasons de l'édifice Seagram : étude de cas

L'éclairage est essentiel, mais c'est également l'un des éléments les plus destructifs pour les matériaux organiques sensibles à la lumière que l'on trouve dans les édifices historiques. Cet article traite de la modernisation de l'éclairage d'origine du restaurant Four Seasons de l'édifice Seagram, à New York, un exemple d'un éclairage sûr et de longue durée, peu dispendieux et agréable. Les solutions d'éclairage établies pour les deux parties du restaurant (le Grill Room et le Pool Room, mis en place il y a environ 40 ans) ont satisfait de nombreux critères différents. L'un des critères clés était que tout devait ressembler exactement au sacro-saint décor d'origine, de sorte qu'il était essentiel de protéger tous les éléments architecturaux et décoratifs existants contre tout dommage. Ceci a exigé un contrôle central méticuleux et une coordination étroite entre de nombreux métiers et disciplines. L'article explique le concept de départ et la planification du projet ainsi que les fournitures et l'installation nécessaires.



The Paradox of Artificial Lighting in Historic Structures

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Abstract

When historic interiors are open to the public as museums, the usual intent is to present the interiors as they would have appeared when in use. Unfortunately, preserving the collections and providing good visibility for viewers looking into rooms both require that daylight coming through windows be reduced, and this is in sharp contrast to what would have occurred in original use (when activities would have centred around the windows because the incoming daylight was the most economical source of light). This, then, is the paradox of attempting to reproduce 'original' lighting schemes in historic interiors: museums try to create lighting for visitors that is better than what the original users would have had. Museum lighting is also of a lower colour temperature than daylight and lacks the variation of both daylight and flame sources.

Once the basic paradox created by conflicts among authenticity, viewing requirements, and conservation standards is acknowledged, finding appropriate solutions requires interdisciplinary discussions at a sophisticated level. Modern lighting controls and sophisticated light sources make it possible to create more than one lighting scheme for the same space.

Introduction

The 'historic interiors' that are being discussed in this conference were not intended to be historic interiors when they were created. It is only our current cultural views, working with the vagaries of time, that have deemed them somehow worthy of preservation and interpretation for contemporary society and for the future. Although some may have been considered important spaces at the time they were created, and some may even have been designed with posterity firmly in mind, our terminology already expresses a central paradox. We are working to present historic interiors in something resembling their original state when at that time they were not considered historic interiors at all.

The transformation of the inside of a building or room from its original or current state to that of an 'historic interior' involves physical changes that are tied to changes in use. This is true for both house museums and buildings (commonly government structures) that remain in their original use but have one or more rooms set aside for visitation. Major changes usually attempt to bring the space *closer* to its original state but sometimes (e.g. when changes are necessary to allow access to the interior by groups of visitors or to protect fragile objects or materials) move the interior *away* from its original appearance. Even as the planning group works toward greater authenticity, the act of exhibition requires measures that run counter to this intent.

Lighting is the aspect of interpretation where this paradox is most pronounced, whether for reasons related to preservation of collection material or to the improvement of visibility. Such changes are often made with the best intentions but, despite this, can make interpretation misleading. This paper discusses aspects of lighting (both daylight and electric light) that illustrate this paradox, and proposes methods to deal with them when planning lighting for historic interiors.

Original use

Most historic interiors were originally lit primarily by daylight entering the spaces through windows. Various window treatments (e.g. curtains and draperies, venetian blinds, and fixed and moveable shutters, both interior and exterior) were used to control the amount of daylight entering individual rooms. The original inhabitants of these interiors were well aware of the deteriorating effects of daylight on textiles and other light-sensitive materials, and they kept daylight out of interiors when they were not occupied. Because daylight was often restricted to an area immediately adjacent to the windows, especially during certain months or when trees and shrubs were in leaf, tasks requiring high light levels (such as reading and needlework) were accommodated by pulling furniture closer to the windows. The varied arrangement of furniture was dictated by the changing needs of the inhabitants rather than by a fixed plan suitable for a single activity or for decorative effect.

Until the advent of electric light at the end of the 19th century, lighting to supplement daylight came from the combustion of organic materials supplied as a solid (wax in candles), liquid (whale oil, kerosene, etc.), or gas (from coal, etc.). As daylight faded during the late afternoon and early evening, supplemental lighting was placed in appropriate locations within each room. These locations changed according to the need for task lighting or social illumination.

These changes made to accommodate shifts in natural light meant that the appearance of historic interiors in original use was dynamic rather than the fixed 'arrangement' of furniture we accept as authentic today, and one of the most dynamic aspects of the original appearance was certainly the changing light. One window might be opened to daylight for a single user, or all the windows of a room (or of the entire house) opened for a party. The daylight might be warm noonday sun or gray morning light. Artificial light sources provided warmer light, but would have been used in most cases only when daylight was insufficient. Wood or coal burning in fireplaces would also produce a distinctive colour, as well as adding movement.

Reproducing this original set of circumstances is impossible for many reasons: furniture cannot be moved constantly, light focused on only one area (as if for task lighting) will not give visitors an adequate view of the rest of the room, and lit fireplaces and candles require the participation of professional staff.

The change from house to museum: Viewing and preservation

When historic interiors are shifted from original use to display/exhibition, they undergo many changes. Often the shift will have occurred many years ago, perhaps without the participation of professional staff. In these cases, changes made to foster visitation may have included the alteration of furniture arrangements to allow visitors to view rooms more easily and to reduce the possibility of damage to decorative elements. To meet the perceived needs of viewers some of the original lighting fixtures may have been electrified and new ones added, perhaps over doorways into rooms where they cannot be seen or as 'neutral' torchères.

Another change that can occur during the transition from original use to museum is a shift in the expectations for preservation of the structure and its furnishings. All original fabric immediately assumes increased importance, and measures are needed to assure its preservation for the future. What was once considered acceptable (if unfortunate) deterioration of textiles and other light-sensitive materials becomes unacceptable, as do changes in furniture finishes due to light exposure.

In addition to the preservation of light-sensitive artifacts, the reduction of light infiltration from windows is also important to improve visibility for visitors. Visitors usually view historic interiors from a position opposite the windows. One common arrangement is to restrict access to a room to a small area near the door, so the room essentially becomes a large exhibition case with the viewer at the front end of the case and windows at the back wall. Another common mode of access is for visitors to be led through a series of rooms (often on a modern runner placed to protect period carpets), again usually in an area opposite the windows. As the windows have the highest apparent brightness of anything in the room, the visitor's gaze naturally falls on them first and all other objects in the room (most with an apparent brightness far below that of the windows) have to fight for attention. If the windows are the major source of light, objects in the room are primarily backlit and are seen mostly as profiles rather than in three dimensions. Therefore, visitors will find the contents of the interior much easier to view if light infiltration from the windows is diminished.

Many methods to reduce light infiltration through windows have been discussed and published. The simplest is to use shades, blinds, or draperies that can be kept shut when the room is not on display. Films adhered to glass are also common, but have several drawbacks (e.g. potential hazard to glass from removal, difficulty in application, and the later formation of bubbles). The films most often used are also (unfortunately) the ones that filter ultraviolet wavelengths only so they do nothing to reduce visible light infiltration. Tinted films can be useful in some applications although they have some of the same drawbacks as non-tinted films. Many types of films are available: different tints (neutral gray, bronze, etc.), different densities (85–10% transmittance), and different methods of filtration (short-lived dyes and long-lived particulate inclusions). Films made into roller shades eliminate most of the drawbacks.

Tinted Plexiglas can also be a useful method of filtration, and incorporates a similar variety of types as discussed above. It can be installed as small sheets cut to fit individual panes of historic sashes fixed in place with glaziers' points, or as large sheets that cover an entire window, either hanging from hooks at the top, screwed into the sash, or mounted in existing storm windows.

Whatever type of window covering is chosen, it is essential that all windows visible from locations within the room be treated with material of the same density, and that no unfiltered areas are visible around the edges or anywhere else in the visitor's visual field.

The elimination of ultraviolet light and the reduction of daylight make the addition of artificial light necessary. Electrified period fixtures, as noted above, are common

solutions. The use of fibre-optic lighting is a newer means of providing artificial lighting that gives more control over the distribution of light, as well as easing the problems of heat and the practical issues of re-lamping.

Whether changes are made for the purpose of protecting collections or aiding vision, the result is a loss of authenticity. If substantial natural light is excluded from a room, it must be lit by artificial light. When visitors view an historic interior during the day under artificial light, they are seeing something doubly false to original use, not only the existence of the artificial light but also its identity (an unchanging source of a colour different from natural light). If the light is from wired period fixtures, only those objects that happen to fall within the pools of light they supply will be seen. If the light is from added modern fixtures, the direction of the light, the shadows cast, and the colour temperature will all be different from original schemes. The fact that interior light levels provided by modern means can produce adequate viewing conditions on cloudy days or in late afternoons (when original visibility would have been unsatisfactory) is likewise false to original conditions. Visitors do not see objects as they would have looked, and also miss the educational opportunity of experiencing pre-industrial living conditions. Authenticity is out the window.

To sum it up, contemporary lighting schemes designed with appropriate regard for the preservation of original material and for the experience of visitors will always have the unintended consequence of compromising authenticity.

Possible solutions

What is to be done to light historic interiors accurately, preserve light-sensitive material, and still give visitors the chance to see individual objects? It would be gratifying to present a solution but, given the inherent contradictions, no one lighting scheme can possibly fulfill all the criteria at the same time. In addition, a solution satisfactory for one setting is unlikely to be appropriate to any other.

Arriving at a solution for a specific case requires that a process involving a variety of individuals working together as a team (not individual experts called in separately) be used.[1] Team members must be chosen to address the three primary issues: authenticity of interpretation, preservation of original material, and visibility. Such teams ordinarily include curators, conservators, educators, lighting designers, and experts in historic lighting and furnishings.

Reconsideration of the requirements

Even in view of the substantial injuries to authenticity posed by requirements for preservation and visibility, measures that provide for the welfare of collections and the enjoyment of visitors cannot be abandoned. We therefore have to re-examine absolute requirements and search for areas of leeway. One fundamental decision to be made by the team is the level of deterioration that is 'acceptable' to the guardians of an historic interior. This is obviously a difficult matter to discuss realistically, but some deterioration is inevitable if the interior is to be open to the public at all.[2,3,4]

One opportunity to protect objects from light that does not compromise interpretation is the complete elimination of daylight at times when the interior is closed to the public. Assuming normal 'museum' hours of opening (i.e. 10 a.m. to 5 p.m., 6 days a week), it has been estimated that approximately one-third of light exposure takes place during hours when the museum is not open to visitors. Thus, keeping exhibits dark during this time would result in an automatic one-third reduction in the deterioration of light-sensitive material. As many historic houses have visitation hours that are shorter than this, the savings may be even more significant.

This can be achieved in historic interiors in a number of ways. If shutters are already in place, they can be closed when visitors are not permitted in. If minor intrusion in the historic fabric around windows is allowable, pull-down opaque window shades can be installed (often in a manner that takes them out of the visitor's view when they are not in use). Venetian blinds or other window treatments can also be used to exclude light. All of these methods require some staff time each day to accomplish. If this staff time is not available, various types of electric window shades (that can be operated from remote locations) could be installed instead. These usually require hard wiring and can be expensive, but they are easy to use and do not require staff time each day. In simple interiors where no window treatments are appropriate, full window inserts of Fomecor or acid-free cardboard can be an effective (although labour-intensive) light-excluding mechanism.

The re-use of original light-excluding measures such as shutters or draperies should always be considered. There are obvious limitations to this approach: constant use of original shutters can in some cases put a strain on original structures, and any original fabric drapes or shades must be protected from light. Decisions must be made based on factual investigation of the original practices used, on the physical limitations of any still extant features, and on the costs and consequences of making new shutters or window treatments that copy old ones.

It should be remembered that the colour temperature of daylight, although it varies somewhat depending on the time of day and weather conditions, is generally much higher than that produced by burning organic materials or by incandescent lamps. Thus, when daylight is either filtered or excluded completely from interiors, and is

supplemented or replaced by incandescent lamps in wired historic fixtures or other fixtures, the interior is seen in a light very different from the original daytime conditions. In addition, sunlight is strongly directional and creates a contrast between shadows and areas of direct beams of light. No pre-20th-century light source could provide the overall wash of bright light that we accept as commonplace today.

The electrification of original fixtures creates light that is brighter and much more steady than candles or gas flames would have been in the same fixtures. Many historic houses make use of flame-shaped lamps, and a small number of companies manufacture sources that mimic the movement of flames (some flicker in intensity while others actually move the filament). None of them is a perfect substitute, but they are worth considering as even a suggestion of movement can be quite effective.

If the interior is shown with substantially filtered daylight, it is often more appealing to visitors if the light is 'warmed' by using a bronze-tinted material rather than using a neutral density filter that does not change the colour temperature. If supplemental light is required, it should probably be of a higher colour temperature than incandescent lamps. High-quality fibre-optic systems can be used to create a subtle supplemental light that will increase light levels on objects or surfaces seen by visitors without creating noticeable shadows. This light can be filtered at the source (projector) to raise the colour temperature to be closer to that of daylight, and can be controlled so that the shadows cast by the daylight still predominate.

As daylight fails during the day, especially during winter months, light from period or reproduction fixtures can be used to portray a more authentic, time-appropriate appearance. A second fibre-optic system, filtered to mimic the colour temperature of these 'warmer' fixtures, can provide suitable light levels for viewing specific objects or surfaces while again allowing cast shadows from the fixtures to predominate. The fibre-optic systems can be remotely controlled, and might function jointly during periods of mixed daylight and period fixture use. As the daylight fades entirely, the second 'scene' can take over completely. It is even possible to provide visitors with a variety of appearances during their visit, showing them a daylight scheme, followed quickly by a dusk interpretation, and then nighttime view.

This dual system of supplemental light with closely controlled focus and colour temperature, used in conjunction with carefully controlled daylight and period fixtures, can be very effective in reclaiming the authenticity of interior lighting that is so often sacrificed for reasons of preservation.

Light, and its effect on the appearance of historic interiors, is an aspect of interpretation that is often overlooked during the consideration of authenticity. However, it is crucial that lighting schemes be as carefully planned as other aspects of interpretation and display.

Endnotes

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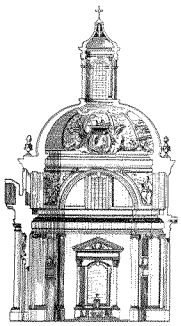
Résumé

Le paradoxe de l'éclairage artificiel dans les structures historiques

Lorsque des intérieurs historiques sont ouverts au public en tant que musées, l'intention est généralement de les présenter tels qu'ils seraient apparus lorsqu'ils étaient utilisés. Malheureusement, la préservation des collections et l'assurance d'une bonne visibilité pour les visiteurs qui veulent voir ces intérieurs exigent que la lumière du jour pénétrant par les fenêtres soit réduite, ce qui est en contradiction avec ce qui ce serait produit lors de l'utilisation originale (alors que les activités auraient été centrées autour des fenêtres, la lumière du jour étant la source la plus économique de lumière). Voilà donc le paradoxe d'essayer de reproduire l'éclairage « d'origine » des intérieurs historiques : les musées cherchent à mettre en place un éclairage qui est meilleur que ce que pouvaient avoir les utilisateurs d'origine. L'éclairage de musée se situe également à une température de couleur plus basse que la lumière du jour, et ne présente pas les variations tant de la lumière du jour que de l'éclairage à la flamme.

Lorsqu'on a reconnu ce paradoxe fondamental créé par les conflits entre l'authenticité, la visibilité et les normes de conservation, la recherche des solutions appropriées exige des discussions interdisciplinaires à un niveau de complexité élevé. Les contrôles d'éclairage moderne et les sources de lumière perfectionnées permettent de créer plus d'un agencement d'éclairage pour le même espace.



Implementation of Practical Climate Control Strategies at the Shelburne Museum

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Abstract

From 1992 to 1998, the Shelburne Museum implemented a variety of practical climate control strategies to mitigate relative humidity (RH) extremes in 15 historic buildings and five new or reproduction structures containing approximately 80 000 collection artifacts. The purpose of this paper is to evaluate the success of these strategies and to share the lessons learned.

Recent modification of RH guidelines for museums favours the use of practical climate control strategies. However, conservators employing these strategies must be thoroughly familiar with their collections so that artifacts that cannot tolerate wider humidity standards can be identified and protected. The Getty Conservation Institute quantified the success of these practical climate control methods in a study of environmental conditions in three selected buildings before and after improvements. Humidistatically controlled conservation heating was very successful, but the requirement to keep buildings cold during the winter can affect public programming and exhibit preparation and maintenance. Environmental improvements from humidistatically controlled conservation ventilation were positive but less dramatic. Use of conventional HVAC systems was modified to maintain safe environmental conditions for the historic structures and the objects they contain. Direct digital controls essential to operate HVAC systems and fans must be monitored and maintained, and good service from the vendor of the controls is crucial.

Introduction

The Shelburne Museum is a 'collection of collections' of fine and decorative arts, paintings, folk sculpture, weathervanes, decoys, quilts, toys, dolls, tools, circus memorabilia, and more. Established in 1947 by Electra Havemeyer Webb, it has grown to include more than 80 000 objects housed in 33 buildings on more than 16.2 ha (40 acres) in northwestern Vermont. Some of the buildings are historic structures that Mrs. Webb collected and used to house her expanding collection of artifacts; five of the buildings are reproductions of historic structures; and three galleries were newly constructed between 1964 and 1987. The buildings are very diverse and present many climate control challenges. In 1988, Ernest Conrad (President of Landmark Facilities Group) saw such diversity as an interesting challenge when he submitted a proposal for an environmental survey of the Shelburne Museum that would characterize the buildings and propose environmental improvements.

Working with Landmark Facilities Group over the next 2 years, a multi-year environmental improvement project was designed; it was to encompass all of the Shelburne Museum and focus on improving harmful conditions rather than attempting to achieve 'ideal' environmental conditions in collection buildings. Conventional and new technologies would be used to make practical, incremental improvements to the buildings and grounds that would reduce relative humidity (RH) extremes and narrow RH fluctuation within the buildings, thereby slowing the deterioration of collection artifacts. In 1991, the Shelburne Museum began implementation of this US$1.2 million, 6-year environmental improvement project with support from the National Endowment for the Humanities. [The practical climate control principles that formed the basis for this environmental improvement project are detailed in an earlier article "A Practical Approach to Environmental Requirements for Collections in Historic Buildings" (Kerschner 1992).]

Adopting broader RH standards and improving conditions

Environmental conditions previously established as safe for the majority of artifacts (50±5%RH) are not safe for historic structures in Vermont during the winter. Guided by principles that would later be articulated as the New Orleans Charter (Taylor 1996), the Shelburne Museum selected RH goals that were anticipated to be safe for both the buildings and the artifacts they contained. A goal of 35±5% was set as the minimum RH for cold, dry winter months, and a goal of 55±5% was set as the maximum RH for more humid portions of the spring, summer, and

fall seasons. Gradual seasonal changes between the maximum and minimum RH levels were anticipated. These broader standards had three advantages: (1) 35–55%RH would be a significant improvement over existing conditions at the Shelburne Museum [15±10%RH (winter) to 80±20%RH (summer)]; (2) 35–55%RH was probably attainable with reasonable expenditures of time and money, acceptable intrusion into the historic structures, and reasonable continuing maintenance costs; and (3) research and development conducted during the 1970's and 1980's, especially in Canada, indicated that these RH levels were relatively safe for both the artifacts and buildings, especially as both have been effectively 'proofed' by experiencing significantly higher and lower RH levels for extended periods of time.[1] More recent research conducted at the Canadian Conservation Institute (Michalski 1993, 1994) and by the Smithsonian's Conservation Analytical Lab (Erhardt and Mecklenburg 1994) have confirmed these empirically established guidelines of 35–55% RH as reasonably safe goals for mixed collections in use. This research also indicates that severe damage to museum artifacts (especially paintings) can occur when the RH drops below 20% or rises above 80%.

As a conservator who has been guided by this broader RH 'safe zone' for the past 10 years, I must emphasize the importance of being thoroughly familiar with the various RH and temperature requirements of the different materials and artifacts in your collection if you plan to control building environments to these standards. Some artifacts do require more stable RH conditions, i.e. 50±5% RH. As a trade-off for relaxing RH standards, building-by-building and artifact-by-artifact accommodations are required to ensure the preservation of sensitive objects. Examples of such accommodations that have been made at the Shelburne Museum include the transfer of paintings from buildings where conservation heating allows the temperature to drop as low as -18°C (0°F) during the winter to a controlled environment, and the exhibition of a corrosion-prone iron weathervane in a vitrine where the RH is maintained at 40% using silica gel to inhibit the corrosion process.

Practical climate control actions

The Shelburne Museum implemented four practical climate control actions identified at the beginning of the environmental improvement project and outlined previously (Kerschner 1992): reduction of environmental problems at the source; use of conservation heating; use of conservation ventilation; and modified use of conventional HVAC systems.

Reduction of environmental problems at the source (i.e. water, dust, heat)

Water — Rain gutters and downspouts were installed on buildings to reduce the amount of water entering basements. Initial concerns about the appearance of gutters on historic buildings were addressed by matching the colour of the aluminum gutters to the trim of the buildings. The gutters blended in very well with the building trim, but the downspouts were more obtrusive. Wooden gutters were used on buildings where aluminum gutters were inappropriate, and aesthetically pleasing patinated copper gutters were fashioned for two stone buildings. All the gutters can be easily removed from the structures. On the few buildings where gutters were inappropriate, drain pipe was imbedded in gravel in a plastic-lined trough 0.3–0.6 m (1–2 ft.) below ground level. As water collected and channeled by the gutters and downspouts cannot simply be deposited next to the foundation, the existing storm drain system was expanded to move the water off the site. Most, but not all, basement water problems were solved or significantly improved by the installation of these rain gutters and the storm drain system. Water in one building proved to be the result of a heightening water table due to the silting in of a pond adjacent to the building. Until the pond can be dredged, water entering the building has been channeled to a sump and pumped from the basement. Although heavy vegetation growing close to buildings was thinned or removed, a resulting decrease in building RH due to this action was difficult to quantify.

Dust — Original plans to pave the roads to decrease dust throughout the 16.2-ha (40-acre) site proved unfeasible due to the anticipated high cost of maintenance to repair frost heaves caused by repeated freeze–thaw cycles. Instead, the roadbeds were graded to improve water drainage, and calcium chloride was applied to the compacted road surface as a liquid spray. This method was recommended by the Vermont Agency of Transportation through its Local Roads Program which advises Vermont towns in their maintenance of thousands of miles of gravel roads. The hygroscopic calcium chloride draws moisture from the air, keeping the dirt surface slightly damp at all times. It does not leach from the soil to harm surrounding vegetation. Applied annually, it builds up in the soil, consolidating it into a hard, low-dust surface that even improves wheelchair accessibility. Collections care technicians responsible for dusting artifacts noticed a reduction in interior dust levels as soon as the roads were sprayed. A synthetic resin was used to consolidate the dirt footpaths leading into the buildings because of a concern about possible increases in corrosion of metal objects due to calcium chloride contamination. Close monitoring has not detected any increase in corrosion of metal objects.

Heat loss and gain — Attics were insulated and weather stripping was applied to doors to reduce heat loss, air movement, and moisture migration. Interior storm windows were installed to seal and insulate old, drafty windows and reduce ultraviolet and visible light entering exhibit areas. Tinted UF3 Plexiglas, 3.2 mm ($^1/_8$ in.) thick, was chosen over polycarbonate glazing for greater clarity

on aging. Bronze tinting was selected because it reduces visible light entering the buildings by 50% and imparts a warmer light than gray-tinted Plexiglas. The Plexiglas was mounted in plastic window moulding to allow for expansion and contraction with changes in temperature, an important consideration as temperatures inside some buildings can decrease to -18°C (0°F) during the winter. The interior storm windows were screwed in place through the plastic moulding and a neoprene gasket. After the plastic moulding was painted to match the window trim, these interior storm windows were very inconspicuous. The storm windows are also removable so the windows can be cleaned.

Use of conservation heating (humidistatically controlled heating)
When a building heating system is controlled to established parameters by a humidistat instead of a thermostat, conservation heating results. The high interior RH levels that are typical in temperate climates during the cool, damp periods in spring, fall, and winter can be significantly reduced by heating the building. The low humidity levels that are caused by heating a building during the coldest winter days can be significantly increased by allowing the building to cool down. Therefore, in temperate climates, conservation heating can eliminate the dangerous high and low RH levels for 8 months out of the year and significantly reduce seasonal RH fluctuation.

There are two ways to maintain RH levels above 30% in a New England building in the winter: (1) add humidity to the heated air using a humidifier, (2) reduce the heat in the building. If the building does not have insulation and a good vapour barrier installed in the walls and ceiling, introducing additional moisture could harm the building because water vapour might condense on windows and inside walls during cold weather. For historic house museums that are closed or have limited visitation during the winter, conservation heating is a safe, inexpensive RH control alternative. Most artifacts are not adversely affected by cold temperatures as long as they are not handled while cold and brittle, although conservators should specify any artifacts that need to be removed from cold buildings, e.g. paintings. In Vermont, it is necessary to allow the inside temperature to drop as low as -18°C (0°F) for the RH to remain above 30% during the coldest winter months.

Use of conservation ventilation (improving and humidistatically controlling summer ventilation)
Conservation ventilation was developed by the Shelburne Museum to decrease high RH levels inside historic buildings resulting from hot summer weather conditions. On a hot and humid summer day, interior RH can exceed exterior RH by 10%. If the outside temperature is above 21°C (70°F) and outside RH is lower than inside RH, ventilation fans are activated to exchange the drier outside air for the humid inside air at the rate of six air changes per hour. When the inside RH has been reduced to equal outside RH, the fans turn off. To filter the dust from the increased volume of air entering the building, intake fans mounted in basement windows draw air in through furnace filters at a slightly greater rate than the air is exhausted through attic fans. This over-pressure condition results in some exfiltration which limits the introduction of dust into the building. Air is circulated from the basement throughout the house and to the attic by the same duct system that moves heated air throughout the house in the spring and fall.

Although conservation ventilation cannot reduce inside RH below outside RH, it can reduce the number of excursions above 80%RH experienced inside collection buildings during the summer. The outside air moving into and through the building reduces the temperature and humidity gradients throughout the building, resulting in more uniform indoor environments throughout the house. It is anticipated that conservation ventilation may also reduce the total amount of moisture retained by wooden structures during the summer, thereby lowering peak humidity levels to some degree. The reduced peak RH levels, combined with significant air movement, prevents mould growth and makes the building more comfortable for visitors.

After 6 years of use in four collection buildings, we have concluded that a combination of conservation heating and ventilation works well to mitigate changes in RH throughout the year. The Getty Conservation Institute (GCI) conducted a 5-year study that measured temperature and humidity conditions in an historic building (the Prentis House) for 1 year before conservation heating and ventilation systems were installed, and for several years after the systems became operational. A report (Maekawa 1999) on that study indicates the following:

> *Before the improvements: (1st Floor) ...Annual averages of relative humidity ranged from 41% to 52% with a minimum of 5% in the winter and the maximum of 90% in the summer. The RH averaged about 70% in the summer and about 25% in the winter. Daily variations ranged from 5% in the winter to more than 30% in the summer. 2nd Floor - ...The maximum RH reached 82% in summer and the minimum RH of less than 10% was recorded in the winter. Daily variations ranged from less than 5% on a cold and cloudy winter day to more than 30% in the summer.*
>
> *After the Improvements: (Whole Building) The implementation of the environmental improvements has lessened both the extremely high summer relative humidity as well as the extremely dry winter environment that existed in the house, especially in the basement. Environments on the 1st and 2nd floors showed significant improvements in the form of the*

reduced summer RH and increased winter RH while allowing a larger temperature variation. On these floors seasonal RHs were 60±10% in the summer and 35±10% in the winter. However, spikes of the RH reached 20 and 80%RH several times a year....As a result of increased air movements in the building, the indoor environments became more uniform throughout the house.

Modified use of conventional HVAC systems
Conventional HVAC systems were installed in six exhibit buildings capable of safely containing calculated amounts of moisture during the cold winter months. Five of these buildings were only partially insulated and had plaster walls that acted as vapour retarders. Landmark Facilities Group engineers calculated that moisture could be introduced by a humidifier to maintain the RH at 35% during the coldest days without harming the building structure, if the interior temperature was maintained at 10°C (50°F). In the sixth building (the textile gallery, an improved barn structure), no additional moisture could be introduced because of the lack of any vapour barriers and minimal insulation in the walls. In this building, conservation heating was employed to maintain safe RH levels of 35±5% in the winter. In all six buildings, the temperature and RH are gradually raised through the spring to maximum summer setpoints of 21°C (74°F) and 55%RH. Using conventional air-conditioning equipment and reheat coils, these six buildings are dehumidified to maintain RH levels at 58±5%.

Results

As a result of this environmental improvement project, we are currently approaching our goal of improving environmental conditions at the Shelburne Museum to between 35±5% and 55±5%RH (Tables 1 and 2 summarize the general results). Monitoring data indicate that we have maintained RH levels between 35±5% and 58±5% for five of the six buildings where complete HVAC systems have been installed. We are confident that we can reach this goal for the sixth structure as soon as identified building envelope problems are solved and the system is tuned to reduce the upper RH limit to 55±5% RH.

In four additional buildings, conservation heating and ventilating generally maintains RH levels above 35% (in the winter) and below 55% (during the damp periods of the winter, spring, and fall) for 10 months of the year. However, for the other 2 months (the hottest and most humid months of summer), these buildings still experience short excursions above 55%RH. The GCI study of one such building (the Prentis House) concluded that "seasonal RHs were 60±10% in the summer and 35±10% in the winter. However, spikes of the RH reached 20 and 80%RH several times a year." This is a significant improvement over the RH levels (which ranged from 5 to 90±25%) in these buildings prior to environmental upgrades.

Table 1
Yearly average relative humidity

	Before improvements	After improvements	Target RH conditions
Conventional HVAC (modified use)	20–80% ±20%	35–58% ±5%	35–55% ±5%
Conservation heating and ventilation	25–70% ±30%	30–60% ±10%	35–55% ±5%
Conservation ventilation	60–80% ±30%	60–70% ±30%	Improvement

Table 2
Relative humidity extremes

	Before improvements	After improvements	Target RH conditions
Conventional HVAC (modified use)	10% Winter 100% Summer	30% Winter 62% Summer	30% Winter 65% Summer
Conservation heating and ventilation	5% Winter 90% Summer	20% Winter 80% Summer	20% Winter 80% Summer
Conservation ventilation	30% Winter 100% Summer	30% Winter 80% Summer	30% Winter 80% Summer

In the 10 unheated buildings where conservation ventilation is the only form of climate mitigation, RH levels stay well above 35% during the winter. As these wooden structures are not dried out by heat during the winter, RH remains high year-round due to the buffering effect of the wood. Conditions in these buildings exceed 75%RH for an estimated 30 days each year during the spring and summer months, and in some buildings reach 100% several times during the spring. Before environmental improvements were implemented, on such damp spring days moisture would condense on the horsedrawn vehicles exhibited in the Horseshoe Barn as warm, moist air infiltrating the barn came in contact with the cold objects. Such conditions can be very damaging, causing metals to flash rust, leather and textiles to mould, and paint to flake from wooden surfaces. This problem was solved by running the ventilation fans to move the air. These fans are activated as soon as the outside temperature warms to 4°C (40°F). Air moving around the vehicles warms them gradually as the outside air warms, maintaining object surfaces at the same temperature as the air, thus preventing condensation. This finding is significant for many historical societies that store and display artifacts in unheated barns and sheds.

The GCI study (Maekawa 1999) of a typical ventilated building (the Horseshoe Barn) concluded that

Prior to the installation of the ventilation system, significant spatial variations of both the temperature and relative humidity were documented throughout the

barn building. The variations were noticeably reduced after the installation, and it produced a more uniform environment throughout the building....Daily variations of the RH increased slightly while its seasonal variations were significantly reduced....Target values of the temperature and relative humidity were not used for the analysis of the barn's environment, since the environment has been strongly influenced by the climate of the site. However, 11°C and 60%RH seemed to be reasonable targets in 1997.

Lessons learned

Although many lessons were learned during the implementation of this environmental improvement project, the following four stand out.

Careful selection of a vendor for control systems
Direct digital controls are the heart of these practical climate control systems. Simply activating ventilation fans to exchange drier outside air for humid air inside the building requires digital controls, as do more sophisticated conventional HVAC systems. The choice of a reputable, responsive vendor for these control systems is critical. Because different manufacturers' controls are not yet interoperable, once a vendor is chosen the museum is locked into that system. In our experience, installation, programming, troubleshooting, and service of the controls are much more important than the actual hardware/software selected. Therefore, choose a vendor with a local reputation for good service. Seek advice from area hospitals and manufacturers that require humidity control and check references carefully.

Use of accurate RH sensors
Accurate humidity sensors are essential for practical climate control systems. Most manufacturers produce sensors that accurately measure RH at temperatures between 15°C (60°F) and 26°C (80°F). However, not all RH sensors are as reliable below -7°C (20°F). RH sensors manufactured by Vaisala have worked well in all temperature ranges where other sensors that claim to meet the same specifications have failed. In my opinion, these quality Vaisala controls are well worth their additional cost.

Adequate monitoring and maintenance of equipment
Any environmental equipment requires monitoring and maintenance. The larger and more complex the system, the higher the monitoring and maintenance cost. I spend 15% of my time monitoring and troubleshooting the systems at the Shelburne Museum, and a full-time system specialist has been hired to maintain the new equipment. In addition, the HVAC firm that installed most of the equipment has been contracted to provide preventive maintenance and technical assistance, and the local vendor of the control systems provides 24-h maintenance response. Although a single historic house or museum may not require a full-time system specialist, an appropriate level of preventive maintenance and reliable equipment support must be factored into the continuing operating cost for any system. Malfunctioning conservation heating or conventional HVAC systems can quickly damage the artifacts they were designed to protect.

Occasional use of cold buildings
In temperate climates, the use of conservation heating to prevent low winter RH levels results in cold, inhospitable buildings during winter months. Although the monetary savings in equipment installation and operating and maintenance costs can be attractive, these methods of environmental control should not be used if educational and public programming, and/or museum exhibition preparation and maintenance activities, require that the building be heated to comfort levels even occasionally during the winter.

Summary

The Shelburne Museum is pleased with the results of this environmental improvement project. RH extremes and fluctuations have been significantly reduced in collection buildings as a result of these practical climate control actions. Excursions into dangerous levels below 20% and above 80%RH have been nearly eliminated, and collection artifacts are no longer being subjected to mould growth or desiccation. The 'proofing' of artifacts to extreme RH conditions over the past 40 years makes additional deterioration unlikely as long as previous RH extremes are not surpassed. Now, objects with cracked wood, flaking paint, or corroding metals that are treated remain stable when returned to the improved exhibit buildings.

Endnotes

1. For an explanation of RH 'proofing' of artifacts, see "Relative Humidity and Temperature Guidelines: What's Happening?" (Michalski 1994).

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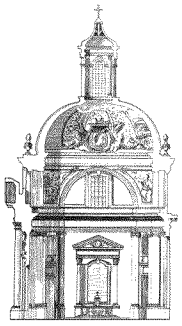
Résumé

Mise en œuvre de stratégies pratiques de régulation du climat au musée Shelburne

De 1992 à 1998, le musée Shelburne a mis en œuvre diverses stratégies pratiques de régulation du climat visant à atténuer les extrêmes d'humidité relative (HR) dans 15 édifices historiques et cinq structures nouvelles ou reproductions de structures renfermant quelque 80 000 objets de collection. Ce document vise à évaluer ces stratégies et à faire part des leçons apprises.

La récente modification des directives en matière d'HR dans les musées encourage le recours à des stratégies pratiques de régulation du climat. Cependant, les restaurateurs qui emploient ces stratégies doivent bien connaître leurs collections de façon à identifier et à protéger les objets incapables de tolérer ces normes étendues. Le Getty Conservation Institute a quantifié le succès de ces méthodes pratiques de régulation du climat en étudiant les conditions environnementales dans trois bâtiments avant et après les travaux. Le chauffage régulé par humidistat s'est avéré très efficace, mais l'obligation de garder les bâtiments à une température fraîche pendant l'hiver risque d'affecter les programmes destinés au public, de même que la préparation et l'entretien des expositions. La ventilation régulée par humidistat a aussi eu des effets positifs, mais moins spectaculaires. Les systèmes CVC conventionnels ont été modifiés afin d'assurer le maintien de conditions environnementales sûres pour les structures historiques et les objets qu'elles renferment. Les commandes numériques directes nécessaires pour faire fonctionner les systèmes CVC et les ventilateurs doivent être surveillées et entretenues, aussi doit-on s'assurer d'obtenir un bon service après-vente du fournisseur.

Assessing Salt Damage to the Interior Surfaces in the Attic of the Bank of Montreal Building in Ottawa



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Abstract

In this paper we describe the investigation program as well as the qualitative and quantitative techniques utilized for assessing salt damage to interior masonry in the attic of the Bank of Montreal building in Ottawa.

Our study indicated that the most severe salt damage was due to the action of sodium sulphate (thenardite). It is most likely that the pronounced efflorescence was generated by the indoor moisture migration through the walls and the resulting deposition of thenardite through evaporation. The chemical nature and physical structure of efflorescence, as revealed by XRD and SEM-EDX analysis, corroborated this conclusion. Moisture absorption into the matrix resulted from high indoor relative humidity. Water condensation at temperatures below dew point could also have been a significant triggering factor.

The results of this joint effort between conservation science and conservation architecture were used as a basic guide in the rehabilitation project of this significant 20th-century institutional building.

Introduction

The massive Bank of Montreal building was conceived in the classic temple style typically associated with financial institutions, and prominently sited on a corner lot facing Parliament Hill, in Ottawa (Appendix Figure A1). The newly completed structure received the Royal Architectural Institute of Canada gold medal for design excellence[1] in 1932. It was an elegant emissary of the modern movement which favoured simplified forms, executed in richly patterned, coloured, and textured construction materials. It was designated a classified building by the FHBRO[2] in 1986.

The exterior walls were built of solid masonry. The plinth consisted of reinforced concrete with facings of Stanstead granite. Above the plinth, the facings were of Queenston limestone, with a backing of brickwork. The walling was ashlar, with 0.635-cm (1/4 -in.) joints and a bushhammered finish. The internal support framework was of steel.

It is interesting to note that "the south section of the building was constructed and occupied before the north section was begun, to allow uninterrupted operation of the banking offices. The first section was begun in July 1930 and was completed in May 1931. The second section was completed in 1932. All materials were specified to be Canadian, as well as the contractors."[3]

As originally conceived, the banking hall was resplendent in a luxurious tapestry of lustrous polychromed metalwork, and richly coloured and polished marbles. Amber-coloured light filtered in through 7.62-m-high (25-ft.) bronze windows. The coffered plaster ceiling was magnificently decorated with geometric patterns, gilded and varnished (Appendix Figure A2).

The original treatment of what is termed today the 'building envelope' is of special note. The section taken through the banking hall illustrates the air cavity that was situated between the masonry outer shell of the building and the enclosure that defined the banking hall (Appendix Figure A3). Considering the impervious nature of the interior finishes, this arrangement could have limited the migration of internal air into the wall assemblies and into the attic space above the coffered ceiling.

The physical inspection of the exterior walls identified problems in the plinth stonework and in the stonework

located above the cornice. The problems included displaced blocks of stone, defective jointing, and surface decay (Appendix Figure A4). The attic face of the masonry walls was coated with efflorescence (Appendix Figure A5). During the site inspection, it was indicated that the appearance of this salt efflorescence in the attic was not new (it had apparently first developed several years previously).

The banking hall had lost some of its artistic treasures in response to changing operational requirements. The intense glare of spotlights emanated from the coffered ceiling which also contained a pattern of circular holes inherited from a previous lighting scheme. The investigation conducted by the building envelope specialist[4] revealed that the first series of lights had been installed in 1963 and replaced in 1972 by the current fixtures, but the holes had not been plugged. The original HVAC system was modified in 1968 and a large steam humidifier incorporated; the humidifier had been disconnected.

Experimental work

Sampling

Different sampling techniques were applied, including scraping, extracting, and drilling. Each sample was sequentially numbered in the order in which it was collected. Location of the samples was noted on the floor plans as shown in Appendix Figure A6. Samples of efflorescence adhering to the surface of the mortar, brick, and stone were collected from more than 20 locations inside the attic.

To determine the salt distribution within the walls and to help identify the source of the salts, two areas opened up by Public Works[5] were sampled, including bedding mortar, bricks, and Queenston stone. Mortar samples were taken from the first and second layer of brick, as well as from stone bedding mortar (grout). The stone was drilled out in situ at depth increments of 2.54 cm, thus representing the full thickness of the stone (west side 10.16 cm and east side 17.78 cm). Bricks were drilled out in the laboratory, after their removal from the walls. A powder dry drilling method was applied, i.e. a drill without water as a coolant was used.

To estimate the initial salt content in the original mortar, two samples that were not associated with the walls but were found on the metal supporting members on the west side were collected.

Methods of analysis

The following investigations were carried out.

Optical microscopy—Microscopical examination of all samples was performed using a reflected light microscope (Nikon stereoscope).

Chemical microscopy—Specific microchemical tests with barium sulphate and silver nitrate reagent were carried out to detect sulphate and chloride, respectively (Arnold 1984).

Qualitative determination of colours—Qualitative determination of overall colour of the drilled samples of Queenston stone was accomplished through colour matching according to ASTM colour matching standards using the Munsell system of colour notation. Blue-filtered illumination was applied.

Infrared spectroscopy—Infrared spectra were recorded and processed using Perkin-Elmer's model 1725x Fourier transform infrared (FT-IR) spectrophotometer with Spectrum 1700 FT-IR software. The samples were ground with KBr, pressed into a micropellet, and the spectra were collected.

X-ray diffraction analysis—Diffraction patterns were obtained in a Rigaku diffractometer using Fe-filtered Co-radiation, tube conditions: 40 kV and 15 mA, exposure time 6–7 h. Powder photographs from samples mounted with silicone grease on a glass fibre were obtained using a Gandolfi camera (diameter 114.6 mm).

SEM based X-ray microanalysis—X-ray spectra were obtained using an Amray 1810 scanning electron microscope with the Kevex Delta Plus-2 energy dispersive X-ray spectrometer (SEM-EDX). X-ray microanalysis was performed on carbon-coated samples, whereas gold was used to coat samples for morphological observations.

Ion chromatography—Ion analysis[6] was applied to determine the levels of sulphate, chloride, and iron in samples collected from bricks, stone walls, and bedding mortars.

Results

Salts on the interior wall surfaces: Chemical nature and physical structure of efflorescence

Preliminary qualitative microchemical tests of deposits of salts on the interior wall surfaces, including mortar, brick, and the stone cornice, indicated a strong presence of sulphates as well as the absence of chlorides.

Table 1
X-ray diffraction: Identified mineral salts in the efflorescence

Sample no.	Substrate	Na_2So_4 Thernardite	$MgSO_4 \cdot 6H_2O$ Hexahydrite	$CaSO_4 \cdot 1/2H_2O$ Hemihydrate/ gypsum	JCPDS[7]	Lab. film no.
4	mortar	+++	–	–	5-63	1771/72
36	brick	+++	+	–	5-63 24-719	1765
1	stone cornice	–	–	+++	24-1067	1767/68
(+++) major phase; (+) minor phase; (–) absent						

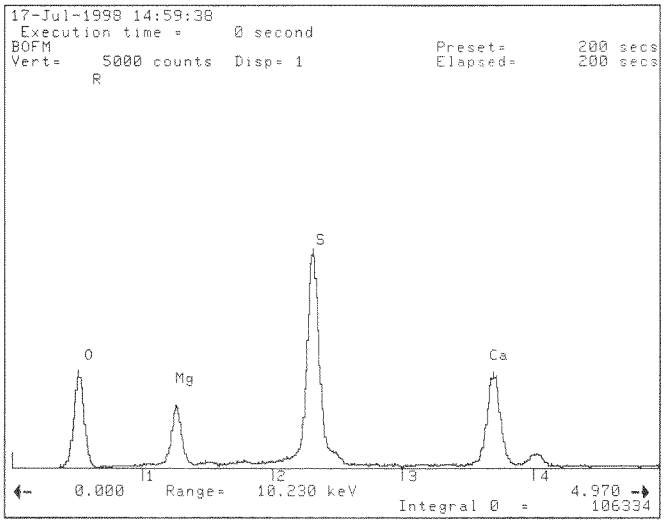


Figure 1. X-ray spectra of efflorescence on the stone cornice showing the presence of both calcium and sulphur. Sample no. 1.

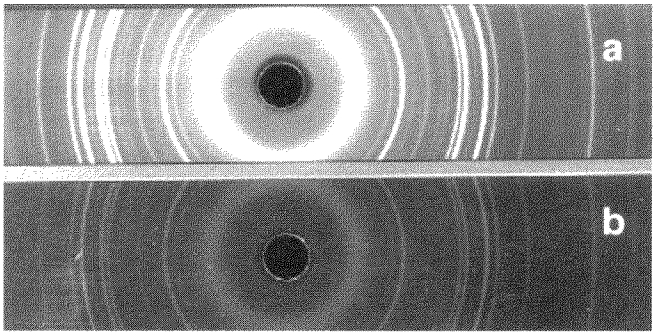
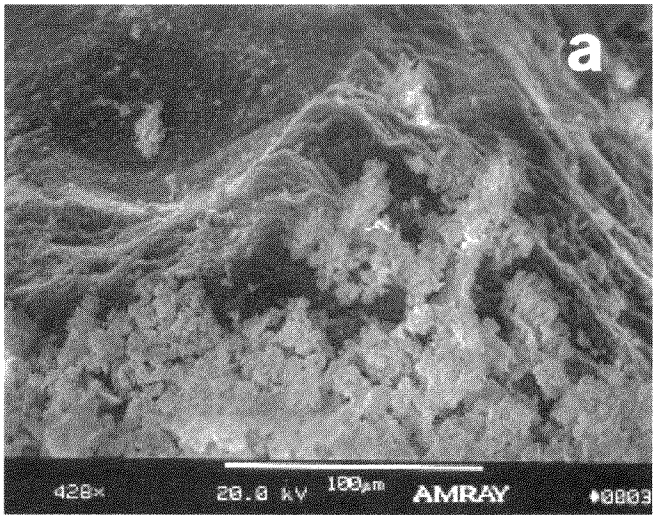


Figure 2. X-ray diffraction powder patterns for (a) thenardite, as identified in efflorescence on mortar joint (sample no. 4), and (b) standard sodium sulphate dry powder (Anachemia) shown for comparison.



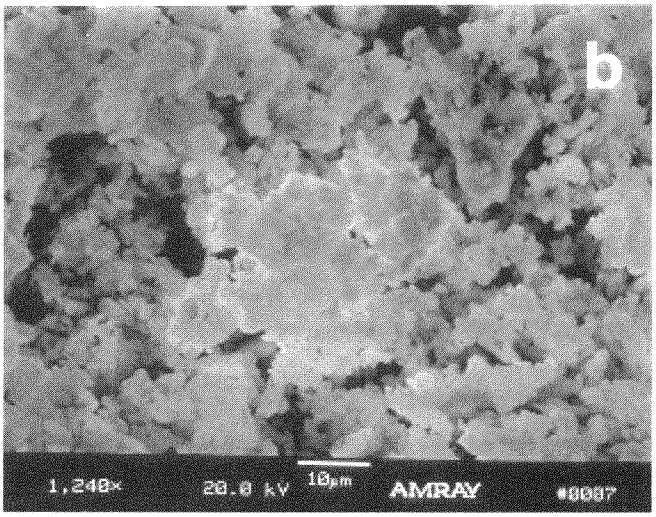


Figure 3. Efflorescence on mortar, identified as sodium sulphate (sample no. 4), at magnifications of (a) 428× and (b) 1240×.

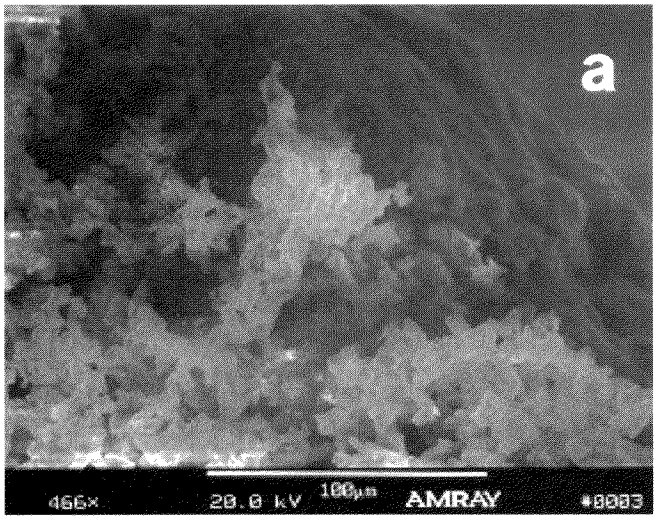
To identify crystalline salts and to estimate their purity, samples nos. 1, 4, and 36 were further characterized by X-ray powder diffraction. Samples nos. 4 and 36 were identified as anhydrous sodium sulphate, thenardite (Na_2SO_4). As listed in Table 1, the efflorescence on the mortar and brick was found to be chemically similar in composition to the major sodium sulphate phase. However, the additional presence of magnesium sulphate, as a minor component, was detected in sample no. 36.

Sample no. 1 from the efflorescence on the stone surface was identified as a calcium sulphate (gypsum and/or hemihydrate). This agreed with the microprobe results, which showed the presence of both calcium and sulphur (Figure 1).

Figure 2a shows the X-ray diffraction powder pattern of sample no. 4 identified as sodium sulphate. A diffraction pattern of the standard sodium sulphate (dry powder, Anachemia) is presented side-by-side for comparison (Figure 2b).

Scanning electron microscopy of efflorescence found on mortar, brick, and stone revealed in fine detail surface topography of the deposits, their cross-sectional development as well as the morphology of the salt crystals. This is illustrated in SEM micrographs in Figures 3–5.

Top layers of mortar, brick, and stone specimens and the crystal deposits at the substrate-to-efflorescence interface are shown in Figures 3a, 4a, and 5a. Salt deposits that were 1 mm or more in thickness showed that the deposit development had been from the substrate to the external surface, with the new crystals pushing the previously formed crystals outward. They were composed of agglomerates of minute sulphate salt particles. It is most likely that the sulphate salts found on mortar came from the alkali sulphates present in the Portland cement, where they were generated during the firing process (Charola and Lewin 1979). It also appears that the sulphate salts found on bricks originated from the bricks themselves. This is



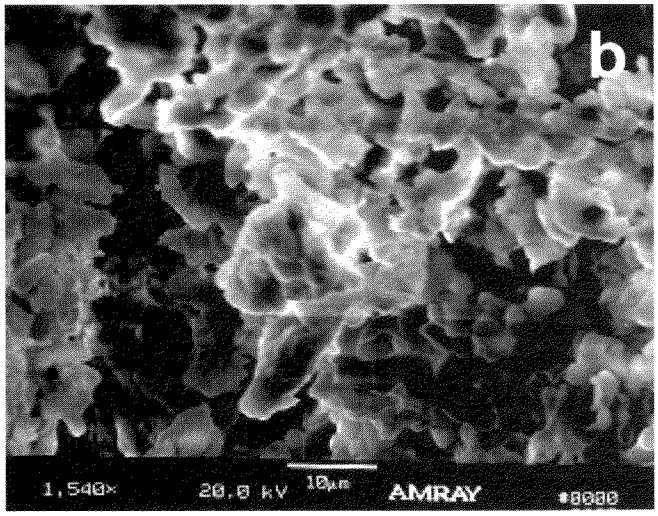
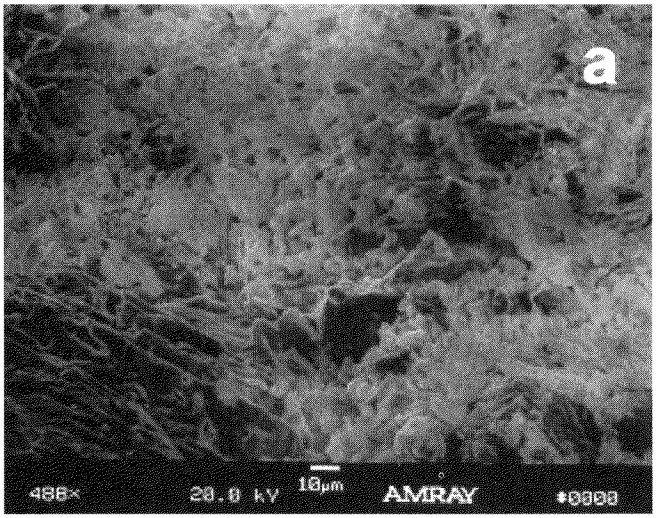


Figure 4. Efflorescence on brick, identified as sodium sulphate; scattered through the mass of the deposit are the crystals of a minor component identified as magnesium sulphate (sample no. 36), at magnifications of (a) 466x and (b) 1540x.



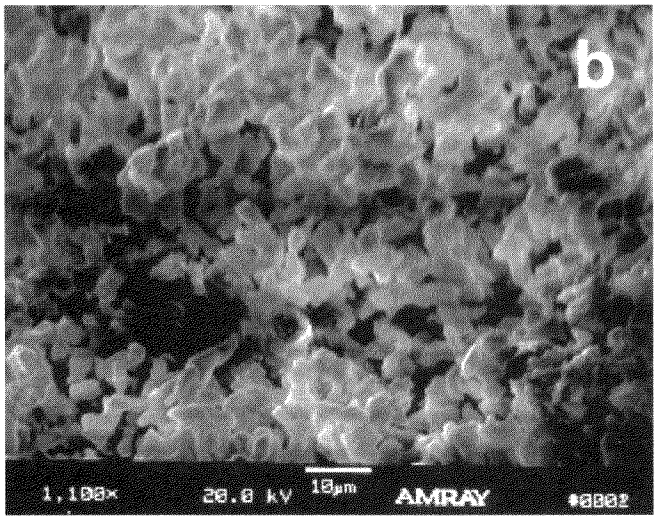


Figure 5. Efflorescence on stone cornice, identified as calcium sulphate (sample no. 1), at magnifications of (a) 488x and (b) 1100x.

common for bricks that have been fired at insufficiently high temperatures. Condensed water passing through cement mortar and bricks leaches out their alkali sulphates, and deposits them on the surface as efflorescence and beneath the surface in the pores of the stone as subflorescence.

As shown in Figures 3b, 4b, and 5b, all examined deposits exhibited similar layering structure. This probably occurred as a consequence of the related crystal growth mechanism accompanied by crystallization pressure, which promoted formation of sequential layers. The force generated by the crystal growth produced the main damage. This was most evident on the brick surfaces with deposits of salts about 1 mm or more beneath the external surface. Several examples of bricks that exfoliated in thin sheets were observed in examined west and east walls. A thorough SEM study of the composition and characteristics of efflorescence and subflorescence on masonry can be found in the work of other authors (Charola and Lewin 1979; Doehne 1994).

Salts within the walls

The presence of sulphate salts on the surface of the mortar, brick, and stone was an indication that the walls could contain the same mineral salts in their matrix. To determine the salt distribution within the walls, and to help identify the source of the salts, samples were quantitatively analysed to determine their sulphate content. Table 2 lists the percentage weight of soluble salts determined in the examined samples, and Figure 6 illustrates the sulphate content plotted against wall thickness of the west (a) and east (b) walls.

a) West wall—Elevated concentrations of sulphates were noted on both exposed surfaces. The exposed surface

of the outside stone wall contained twice as much sulphate as the inner wall surface (mortar and brick). Within the wall, excluding the outer first 5–10 cm, the sulphate level dropped to a constant low level of 0.01% in mortar, brick, and stone.

b) East wall—Elevated concentrations of sulphates were noted on both exposed surfaces. Within the wall, the sulphate levels varied from 0.01 to 1.5%. The sulphate content of mortars in the east wall was seven times higher than in the west wall mortars (0.2% compared with 0.03%).

It is most likely that the higher level of sulphate in the outside stone wall was due to the influence of the outdoor environment. As indicated by Weaver (1985), Ottawa suffered from extensive industrial pollution.[8]

The iron content was also determined in the Queenston limestone samples (Table 3). Higher concentrations of SO_4^{2-} generally corresponded to higher concentrations of iron (Fe) when the same stone samples were compared. It is interesting that a significant colour change was noted in weathered stone.

Table 2
Level of salts within west and east walls

Sample no.	Sample location	Drilling distance (cm)	Sulphate (%)	Iron (%)
	West side opened area			
9	1st mortar layer	1.00	0.440	
66	1st brick layer	3.20	0.105	
64	1st brick layer	9.40	0.011	
65	1st brick layer	15.40	0.007	
15	mortar between 1st and 2nd brick layer	22.00	0.028	
67	2nd brick layer	25.00	0.005	
26	mortar/grout between 2nd brick layer and stone	35.00	0.032	
27	stone	39.54	0.024	0.336
28	stone	42.08	0.026	0.406
29	stone	44.62	0.325	0.713
30	stone	47.16	1.050	0.724
	East side opened area			
37	1st mortar layer	1.00	0.225	
68	1st brick layer	4.80	0.205	
39	mortar between 1st and 2nd brick layer	11.00	0.265	
69	2nd brick layer	16.50	0.012	
70	2nd brick layer	22.20	0.011	
71	2nd brick layer	29.00	0.110	
40	mortar between 2nd brick layer and stone	34.00	0.150	
44	stone	37.54	0.041	0.302
45	stone	40.08	0.042	0.301
46	stone	42.62	0.075	0.350
47	stone	45.16	0.510	0.484
48	stone	47.70	1.510	0.958
49	stone	50.24	0.540	0.410
50	stone	52.78	0.370	0.331

The colour of samples drilled out from Queenston stone changed dramatically from yellowish white (5Y 8.5/1) to pale pink (5YR 9/1; 5YR 8/2). Table 4 summarizes the findings related to the colour analysis. Colour names are assigned according to universal colour language (Kelly and Judd 1976).

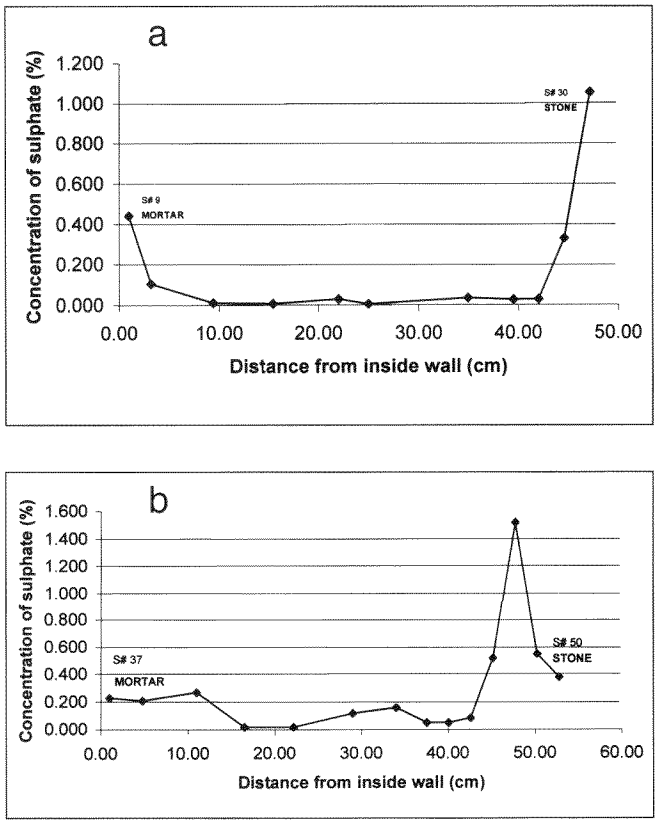


Figure 6. Level of sulphate within (a) west wall and (b) east wall.

Table 3
Ion chromatography: Iron content in Queenston limestone

Sample no.	Iron (%)
West wall	
27	0.336
28	0.406
29	0.713
30	0.724
East wall	
44	0.302
45	0.301
46	0.350
47	0.484
48	0.958
49	0.410
50	0.331

Table 4
Munsell colour matches: Queenston limestone

Sample no.	Drilling distance (cm)	Colour name	Munsell colour match
	West side opened area		
27	0-2.54	Yellowish white (buff)	5Y 8.5/1
28	2.54-5.08	Yellowish white (buff)	5Y 8.5/1
29	5.08-7.62	Pale yellowish pink (shell pink)	5YR 8/2
30	7.62-10.16	Pale yellowish pink (shell pink)	5YR 8/2
	East side opened area		
40	0-2.54	Yellowish white (buff)	5Y 8.5/1
45	2.54-5.08	Yellowish white (buff)	5Y 8.5/1
46	5.08-7.62	Pinkish white	5YR 9/1
47	7.62-10.16	Pinkish white	5YR 9/1
48	10.16-12.7	Pale yellowish pink (shell pink)	5YR 8/2
49	12.7-15.24	Pinkish white	5YR 9/1
50	15.24-17.78	Pinkish white	5YR 9/1

To estimate the initial salt content in the original mortar, two samples (nos. 18 and 19) collected from the metal construction on the west side were analysed. It was presumed that those samples had not been subjected to the salt damage process occurring in the walls. Based on the mortar composition analysis it was found that sample no. 19 (0.122%) was indicative of the initial salt content in mortars.

Discussion and conclusions

Chemical nature of salts and the environmental conditions
A range of salts was identified, including sulphates of sodium, calcium, and magnesium, and they all contained crystallization water as part of their structure. At particular critical relative humidities (RH), these salts can crystallize and hydrate within the pores of the stone, brick, or mortar substrate, and the expansion associated with this process can disrupt the internal structure. This was the major cause of the powdering and loss of surface observed on the masonry in the attic.

The two main salts present in the walls were sodium sulphate (thenardite) and calcium sulphate (gypsum). Magnesium sulphate (hexahydrite) was detected in a mixture with sodium sulphate, as a minor component in the efflorescence on bricks.

Gypsum (found on the Queenston stone cornice), though capable of causing a similar kind of surface deterioration as sodium sulphate, does not produce it to the same degree. Interior stone surfaces that contained gypsum seemed to be more stable.

Our study of the brick walls in the attic indicated that the most severe salt damage was due to the action of sodium sulphate. In all areas where sodium sulphate was present, extreme deterioration was also found. This was evidenced by severe powdering and/or flaking of the brick and mortar. This was due to the nature of this salt which can crystallize and recrystallize, upon changes of thermo-hygrometric conditions, as a hydrate or an anhydrate. A similar damaging process by sodium sulphate to ashlar stone was identified on the East Block of the Parliament Buildings in Ottawa (Blades and Stewart 1990). Recently, an acoustic emission monitoring was applied to interpret complex decay mechanism in stone deterioration (Grossi et al. 1997). It was shown that sodium sulphate crystallization is dependent on environmental conditions (T, RH) and pore space characteristics of the host stone.

Depending on RH, at 20°C there can be two stable forms of sodium sulphate: the anhydrous form, Na_2SO_4 (thenardite), which is stable below 71% RH; and the decahydrate, $Na_2SO_4 \cdot 10H_2O$ (mirabilite), which is stable between 71% and 93% RH. Above 93% RH, the decahydrate absorbs moisture from the air and dissolves. When a porous material is contaminated with sodium sulphate, it may sustain damage at two points: hydration damage can occur when RH rises above 71%, in which case the hydrated salt occupies 314% more volume than the anhydrous salt; and crystallization damage can occur as the RH falls below 93% (Price and Brimblecombe 1994). It appears that if the ambient temperature and RH in the Bank of Montreal building were kept below these critical values the damage could be prevented.

However, it should be noted that the masonry was not contaminated with a single salt but rather with salt mixtures. In such cases, the exact values of critical RH are a function of mixture composition and can be determined using suitable methods (Price and Brimblecombe 1994).

Salt distribution within the walls
Our study showed that the salt contamination was not localized on the surface; instead it was distributed beneath the exposed surfaces at a depth of 5–10 cm, in both the east and the west area. This means that although the spalling was a surface phenomenon, the salt causing it was located within the walls.

The average level of sulphate within the walls could be considered low, except for Queenston limestone which contained levels of sulphates higher than 1%. In this case it is quite possible that ferruginous sulphates were formed by outdoor environmental agents reacting with iron-bearing accessory minerals present in the stone. A similar problem of iron-staining on a limestone heritage building was recently reported, along with a detailed explanation of the reaction mechanism of this complex phenomenon (Matero and Tagle 1995).

Source of moisture
Efflorescence on masonry results from the transport of dissolved material from the bricks and adjacent mortar to their exposed surfaces. We found pronounced efflorescence on all samples of the masonry surface in the attic, independent of their substrate. As no evidence of an external source of moisture was found, it is unlikely that this caused the salt contamination. It is most likely that the efflorescence was generated by indoor moisture rising up in the heated humidified air from the bank's main hall below, through the holes in the false ceiling, and into the cool walls of the unheated attic, where it dissolved salts already in the walls. Seasonal heating and cooling effects then resulted in migration of these solutions through the walls and deposition of thenardite by surface evaporation. The chemical nature and physical structure of this efflorescence and subflorescence, as revealed by XRD and SEM-EDX analysis, corroborated this conclusion.

Constant or periodic high indoor RH contributed to moisture absorption into the matrix. Water condensation at temperatures below dew point could also have been a significant triggering factor. Therefore, the rate of decay could be reduced by cutting off sources of heated, humidified air, thereby minimizing the passage of water to the attic.

In conclusion it should be noted that our study of the salt damage to the interior surfaces in the attic of the Bank of Montreal building offered a new insight into the causes and mechanisms of deterioration of porous building materials applied to this significant 20th-century institutional building. The analytical examination of the attic walls established the nature and extent of salt contamination, the potential for damage to continue following remedial work, and, therefore, the necessity of replacing or desalinating severely contaminated brickwork.

This study also provided an excellent opportunity to integrate a modern scientific approach and methodology into the practice of architectural conservation. The results of chemical examination of material properties and deteriorations were used as a guide in the rehabilitation project to direct the course of intervention. The knowledge gained through this investigation assisted in developing the most appropriate methods for the preservation of interior wall and ceiling decorations and also helped in developing specifications for the building's indoor environment.

Acknowledgements

The authors acknowledge the participation and assistance of the following institutions: Heritage Conservation Program and Parliamentary Precinct Directorate of Public Works and Government Services, Canada; and Research and Analysis, Ontario Service Centre, Parks Canada, Ottawa. Special thanks also to Jean-Pierre Landry (B.Arch., M.Arch, OAQ, team leader, Heritage Conservation Program, Public Works and Government Services Canada) for his valuable support and insight as well as for provision of photographs and architectural drawings of the Bank of Montreal building.

Endnotes

1. The Bank of Montreal building was designed by Ernest Barott of Barott and Blackader, Architects, of Montreal.

2. Federal Heritage Buildings Review Office.

3. Bank of Montreal, Building Exterior Upgrade Investigation Report, Heritage Conservation Program Real Property Services for Canadian Heritage and Environment Canada, Public Works and Government Services Canada, 1977.

4. C.J. Shirtliffe & Associates.

5. This study was initiated by the Heritage Conservation Program, Public Works and Government Services Canada.

6. Ion analysis was performed by Seprotech Laboratories, Ottawa.

7. JCPDS - International Centre for Diffraction Data, Pennsylvania, 1996.

8. Some of the major pollution sources were situated in the vicinity of Parliament Hill, including the E.B. Eddy paper and sulphite pulp mill. This mill, which was located north of the Bank of Montreal building, was demolished in the 1970's.

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Appendix

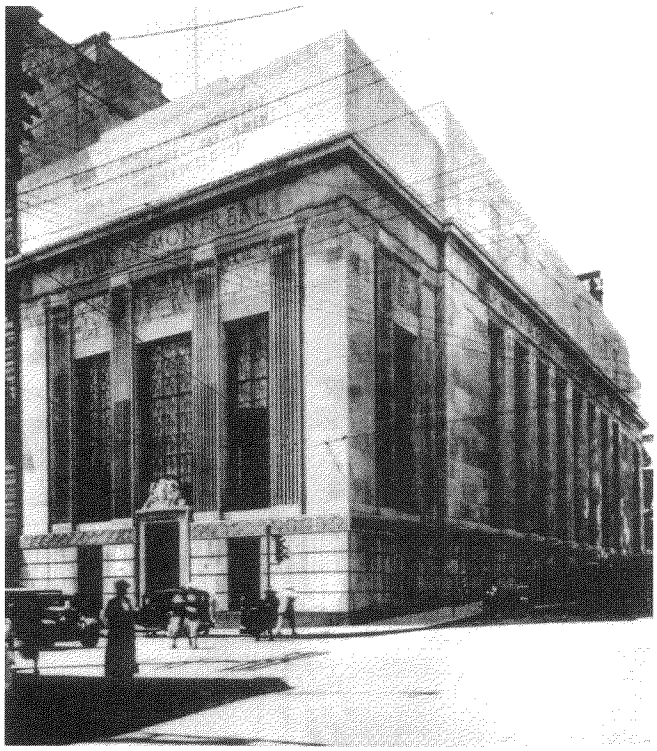


Figure A1. Bank of Montreal Building, Ottawa, corner of Sparks and O'Connor streets, shortly after construction was completed. Source: "The New Bank of Montreal Building, Ottawa, Ontario." Journal of the Royal Architectural Institute of Canada *IX, 9 (1932), pp. 200–207.*

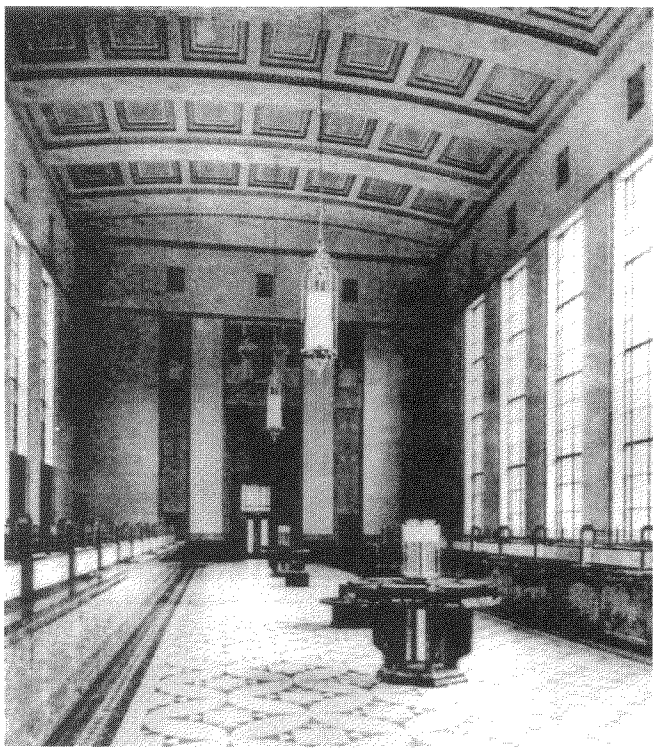


Figure A2. Banking hall, looking north, shortly after construction. Note the total absence of apertures in the coffered ceiling. Source: "The New Bank of Montreal Building, Ottawa, Ontario." Journal of the Royal Architectural Institute of Canada *IX, 9 (1932), pp. 200–207.*

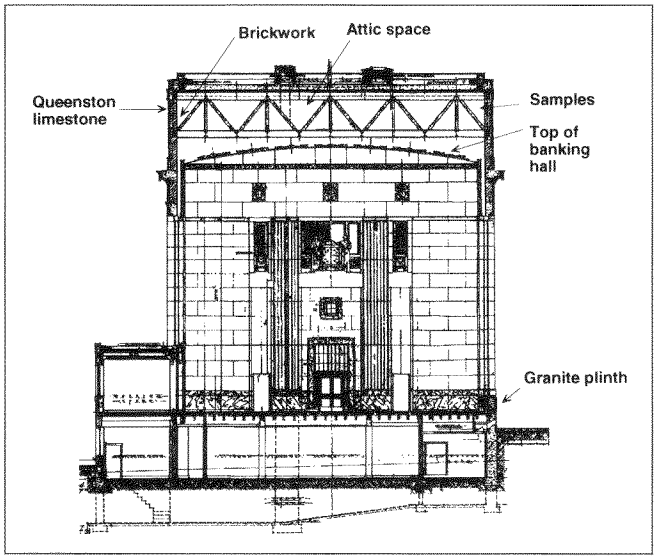


Figure A3. Transverse section through banking hall and west annex, looking north. Original drawing. Source: Canadian Centre for Architecture (CCA), Montreal.

Figure A4. West facade. Typical conditions at the top of the upper parapet walls: heaved stone blocks, empty mortar joints, and pronounced surface deterioration. Photo: Anna Kozlowski.

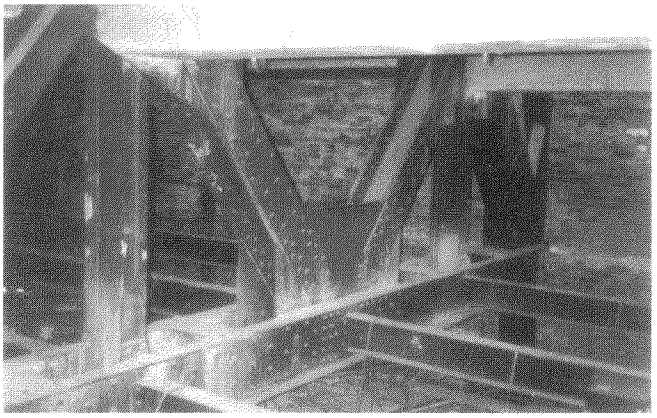


Figure A5. Detail of steel roof truss. The brick casing of the parapet walls, covered in efflorescence, appears in the background. Photo: Khaled Ibrahim.

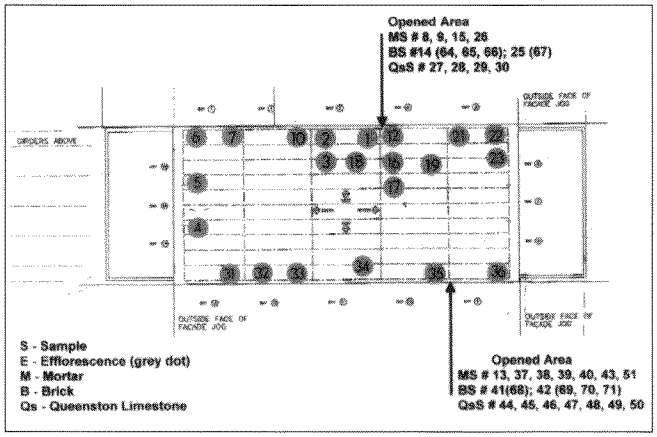


Figure A6. Documentation of sample location. Attic floor plan.

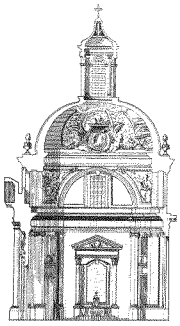
Résumé

Évaluation des dommages causés par le sel aux surfaces intérieures dans le grenier de l'édifice de la Banque de Montréal à Ottawa

Dans cet article, nous décrivons le programme d'investigation ainsi que les techniques qualitatives et quantitatives utilisées pour évaluer les dommages causés par le sel à la maçonnerie intérieure dans le grenier de l'édifice de la Banque de Montréal à Ottawa.

Notre étude a montré que les dommages les plus graves causés par le sel étaient dus à l'action du sulfate de sodium (thénardite). Il est très probable que l'efflorescence prononcée a été produite par la migration de l'humidité, à l'intérieur, dans les murs, et le dépôt de thénardite qui en a résulté par évaporation. La nature chimique et la structure physique de l'efflorescence, telles que révélées par l'analyse diffractométrique et l'analyse au microscope électronique à balayage, viennent appuyer cette conclusion. L'absorption d'humidité dans le liant est le produit de l'humidité relative élevée de l'intérieur. La condensation de l'eau à des températures sous le point de rosée peut également avoir été un facteur déclenchant important.

Les résultats de cet effort combiné de la science de la conservation et de l'architecture de conservation ont servi de guide de base dans le projet de restauration de cet important édifice institutionnel du XX^e^ siècle.



Damp Problems in the Chapel at Cliveden

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Abstract

Damp problems in the Chapel at *Cliveden* were only partially solved by building repairs. Data from a 4-year campaign of surface and air temperature and relative humidity monitoring have been used to calculate absolute humidity and dew point temperature, using standard psychrometric equations and a Microsoft Excel spreadsheet, to show that condensation may occur on the internal surfaces of the Chapel when the building is opened to the public. Trials have been carried out to investigate the effectiveness of dehumidification and conservation (humidistatically controlled) heating as a means of reducing the probability of condensation events. Conservation heating has been shown to be more effective.

Figure 1. An exterior view of the Chapel at Cliveden *looking up from the bank on which the building stands. One of the two side chapels can be seen with its roof formed by the parterre.*

Introduction

In the gardens of *Cliveden*, home of the Earls of Orkney through the 18th century, was an Octagon Temple designed by Italian architect Giacomo Leoni in 1735. After changing hands several times during the 19th century, *Cliveden* was bought by William Waldorf (later 1st Viscount) Astor in 1893. He commissioned J.L. Pearson to convert the Temple into a Chapel, its walls and dome encrusted with mosaics by Clayton and Bell. The 1st Viscount and many other members of the Astor family have since been buried there.

The interior of the Chapel has been damaged by water infiltrating from the chalk bank in which it is set, rainwater penetrating through the paving at parterre level (which forms the roof of the two side chapels), and damp rising up the walls at ground floor level. The mosaics and the thin marble revetments, which make up the inside surfaces, have been damaged by the passage of this water causing efflorescence of salts[1] and falls of tesserae. Building works have tackled a number of these sources of damp, but, interestingly, revealed that there is no evidence of damp penetration through the copper-clad roof, although there are significant falls of tesserae from the ceiling of the dome. There are clearly other decay mechanisms at work.

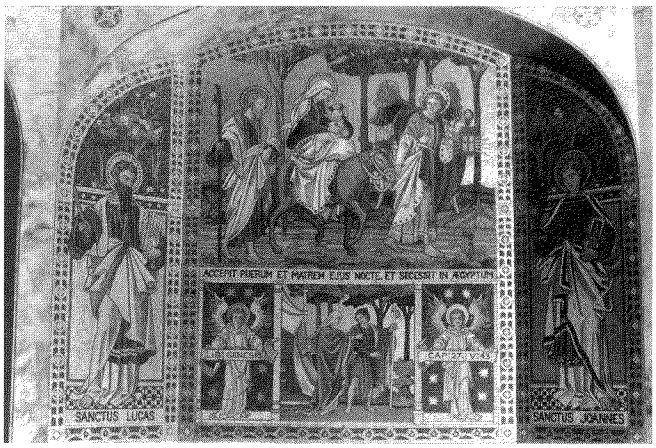

Figure 2. An interior view of one of the mosaic panels, Flight into Egypt.

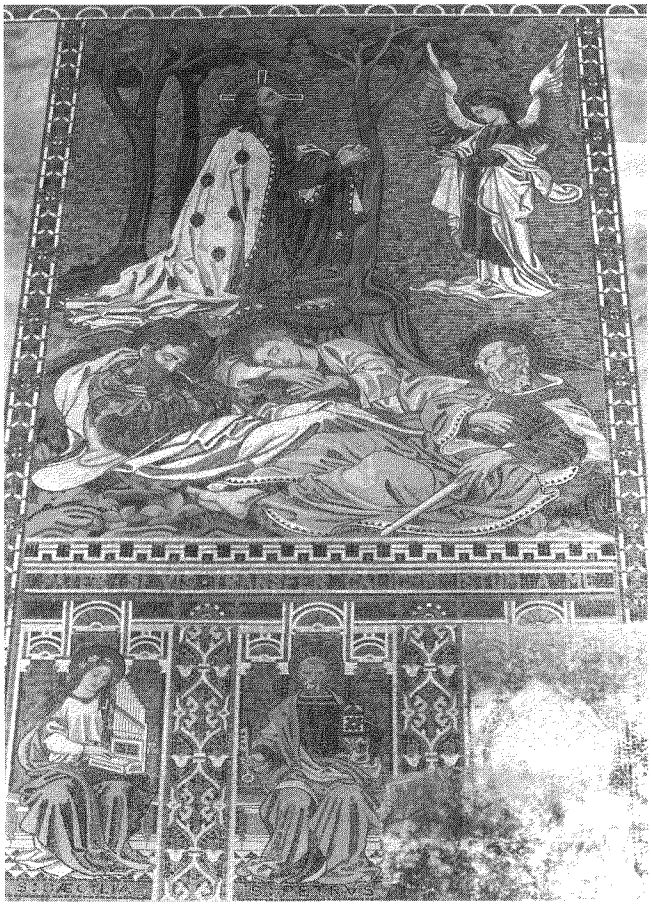

Figure 3. The mosaic panel of Garden of Gethsemane *showing significant damage from salt efflorescence at the lower right.*

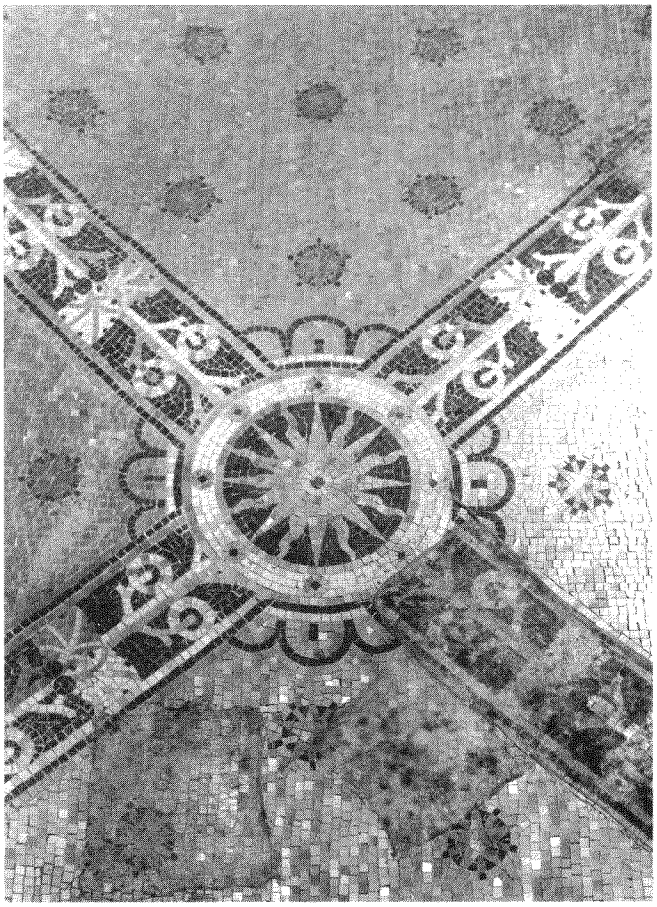

Figure 4. The ceiling showing facing to secure loose tesserae.

The subject of this paper is the diagnosis of these decay mechanisms through environmental monitoring and an investigation into the most effective means of preventing or reducing the rate of deterioration through environmental control.

History of environmental monitoring and control

Until the 1980's, the evidence for damp penetration was primarily anecdotal, though it is likely to have occurred since the beginning of the 20th century. Leoni had designed the Chapel to cope with the possibility of water infiltration from its setting into the chalk bank. A cavity wall with ample air circulation was built behind the altar recess to prevent water penetration, but over time this cavity filled with debris allowing water to move directly into the walls. There was also evidence of rising damp through the walls at the front of the Chapel where flowerbeds adjoin the walls either side of the door. The other significant damage that was attributed to damp penetration was in the dome, where large areas of tesserae became detached. It was assumed, wrongly as it turns out, that this was caused by water penetration through the roof.

Cliveden Conservation Ltd., who were then the National Trust Statuary Workshop, carried out emergency first aid in the early 1980's to secure loose tesserae by applying a protective facing. In the ceiling of the dome the tesserae losses were not accompanied by salt efflorescence. The bedding mortar for the mosaics is of unknown composition in this location. The 19th century was a period of innovation and experimentation with proprietary mortars and it is possible that in addition to inorganic components there may by organic additives that are particularly susceptible to moisture.

The National Trust's environmental control advisers were called in to begin environmental monitoring and to advise on how to reduce the damp in the Chapel. At that stage, there were no plans for building works to address the structural problems although these began to be formulated while the emergency conservation measures were put in place. After initial problems with draft-proofing, a refrigerant dehumidifier combined with a small electric heater (to prevent the dehumidifier frosting up in the winter) was used to limit high relative humidity (RH) for several years (desiccant dehumidifiers are now used in unheated spaces). Dehumidification was chosen as the means of control rather than heating because of the limited power supply

to the Chapel [dehumidification uses only one-third of the electricity of conservation heating for the same level of RH control (Staniforth and Hayes 1987)].

Plans were subsequently drawn up to address the building problems, and repairs began in 1995. The damp-proof membrane under the paved terrace at parterre level, which forms the roof of the two side chapels, was renewed. The cavity behind the altar recess was cleared of debris to allow air once again to circulate behind the walls in the chalk bank and prevent water penetrating directly into the Chapel walls. The terrace at the front of the building, including the flowerbeds, was dug up and the ground level was adjusted and consolidated to allow rainwater to run away from the walls. Hoggin (graded gravel) was laid on top to promote drainage of surface water. The roof was opened up and the copper replaced, but no evidence of damp penetration which could have resulted in the loosening of the mortar holding the tesserae in place was discovered.

Environmental monitoring

Confronted with the evidence that tesserae falls had not been caused by direct water penetration, there was one other environmental factor to which the damage could be attributed. Condensation had been reported for many years and it was possible that this could continue to occur even though building repairs had controlled the principal sources of water infiltration, and thus reduced the air moisture content of the interior. A monitoring campaign was now needed to diagnose environmental conditions that could lead to condensation.

The Wall Paintings Department of the Courtauld Institute of Art had been involved with similar situations in their work with wall paintings in churches, and we adopted their methodology for the prediction of condensation events (Cather 1993; Cather and Howard 1994; Nason and Lithgow 1999).

A number of locations were selected throughout the Chapel at low and high levels, and clusters of sensors connected to a data logger[2] were installed. Each cluster consisted of an ambient temperature and RH sensor and a surface temperature sensor. The surface temperature sensor was held in position with cotton gauze secured to the surface of the marble revetments or mosaics with Paraloid B72 and covered with a block of Plastazote (polyethylene foam) to act as a thermal insulator, ensuring that the sensor measured the temperature of the wall and not the temperature of the air (Pender 1996). The data logger was set to record every hour and was downloaded by laptop every 3 months. External temperature and RH were recorded from a sensor placed in a small Stevenson screen on the north side of the building.

The temperature and RH data were used to calculate absolute humidity and dew point temperature using standard psychometric equations in a Microsoft Excel spreadsheet (Wexler and Hyland 1980; Stewart et al. 1983). The difference between surface temperature and dew point temperature (dew point margin) was calculated.

When the surface temperature is the same as or below the dew point temperature, condensation will occur. Graphs were plotted month by month for each location and showed internal and external temperature and RH, internal and external absolute humidity, and surface temperature minus dew point temperature.

Environmental control

The refrigerant dehumidifier was removed in 1995 for servicing and was not replaced for over a year. This enabled monitoring to evaluate the likelihood of condensation events occurring with no environmental control over all seasons. The dehumidifier was replaced in 1997 and was operated under humidistatic control with a setpoint of 80%. This unusually high setpoint was chosen as the inside of the Chapel had acclimatized to high RH for the previous year or more.

Conservation (humidistatically controlled) heating has been widely used in National Trust houses for the effective reduction of high RH (Staniforth and Hayes 1987; Staniforth et al. 1994). This was an obvious method of control to evaluate in the Chapel. A 2-kW oil-filled radiator was installed in early summer 1999 and it was switched using a humidistat[3] set at 70% (the RH setpoint was being gradually reduced as the building and its contents became acclimatized to lower levels). The size of heater that could be used was limited by the electrical power supply to the Chapel.

During the three phases of this trial, the opening arrangements for the Chapel continued as usual. The Chapel was open to the public twice a week (on Thursdays and Sundays from 3 to 6 p.m.) from April to October (except in October 1995 when it was open only on Sundays), and the door was left open for 3 h. Otherwise the door was kept closed except for visits by members of staff or for private ceremonies.

Results of monitored trials

Results with no environmental control
Data were collected from June 1995 until June 1997, and graphs were printed out for each month for each of the four locations with clusters of sensors. The graphs for October 1995 are illustrated in Figures 5a, 5b, and 5c.

Figure 5a shows the internal and external ambient temperature and RH. The temperature is quite constant except for slight increases on Sundays (October 1, 8, 15, 22, and 29) when the custodian switched on an electric heater during

opening hours. The RH outside is close to 100% (problems were encountered with vegetation growing inside the Stevenson screen!) and inside is between 80 and 90% most of the time. This high level of internal RH is typical for unheated buildings in the United Kingdom.

Figure 5b plots internal and external absolute humidity. The internal absolute humidity is the same or slightly lower than the external, showing that water penetration is not a significant problem.

Figure 5c shows the difference in surface and dew point temperature. It is small for much of the time, and given experimental errors in measurement of temperature and RH (and therefore in the calculated figure for dew point temperature), it is possible that condensation could occur at any time when the calculated difference is 1°C or smaller (Nason and Lithgow 1999). It is very probable that on October 8 there was a condensation event, as the difference falls to zero. The data for the year of monitoring show many such incidences, which occur at any time of the year, summer or winter, and invariably coincide with the times that the Chapel was open to the public.

The mechanism is clear. The building has a high thermal mass, not only because of its solid construction but also because of its partial burial in the chalk bank. This results in a high degree of thermal stability which can be seen in the internal temperature trace. The absolute humidity is also reasonably constant except when the doors are opened. At these times the absolute humidity may rapidly increase or decrease as external air infiltrates. If the absolute humidity of the external air is lower than that of the internal air, as it was on October 1, 1995, then the dew point temperature of the air increases when the door is opened, increasing the difference between surface and dew point temperature and decreasing the likelihood of condensation. However, on October 8 the absolute humidity of the external air was higher than that of the internal, and condensation probably occurred on the cool internal surfaces.

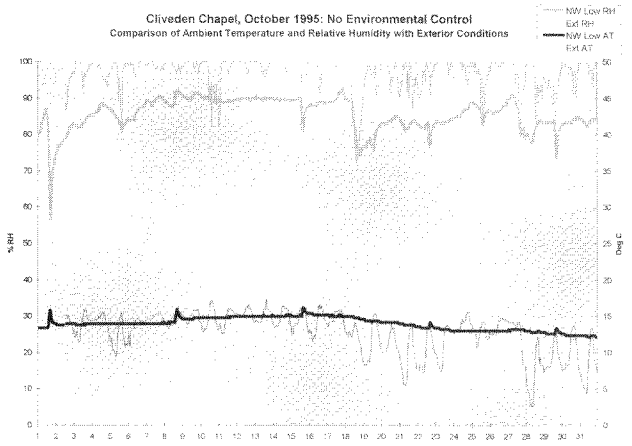

Figure 5a. The Chapel at Cliveden, *October 1995, no environmental control. Comparison of ambient temperature and RH with exterior conditions.*

Results with dehumidification

Figure 6a shows internal and external temperature and RH recorded during August 1997 while the internal environment was controlled with the refrigerant dehumidifier switched by a humidistat set at 80%. Both temperature and RH are reasonably constant. The internal temperature trace shows small daily rises caused by solar gain, with larger rises on most of the days when the Chapel was open to the public. The evidence of the effect of infiltrating external air is clearer on the internal RH trace, where every third or fourth day (coinciding with days when the building was open to the public) there is either a rapid rise or fall in RH depending on external weather conditions.

Figure 6b shows the comparison of internal absolute humidity with exterior conditions. The internal absolute humidity is slightly lower on average than the external, which is the result of the effective removal of some

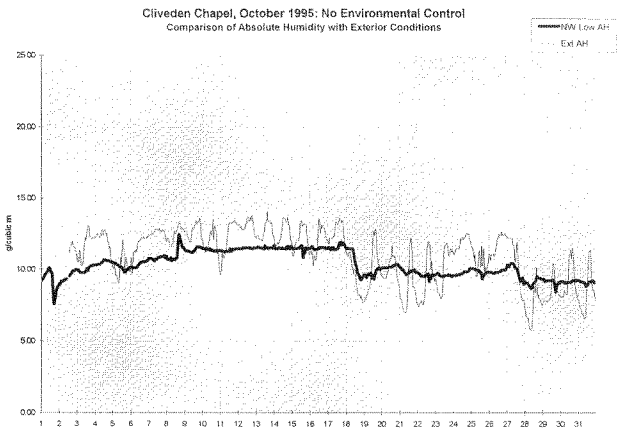

Figure 5b. The Chapel at Cliveden, *October 1995, no environmental control. Comparison of absolute humidity with exterior conditions.*

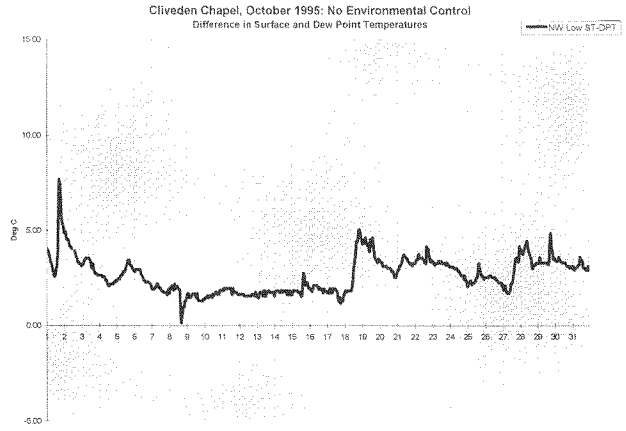

Figure 5c. The Chapel at Cliveden, *October 1995, no environmental control. Difference in surface and dew point temperatures.*

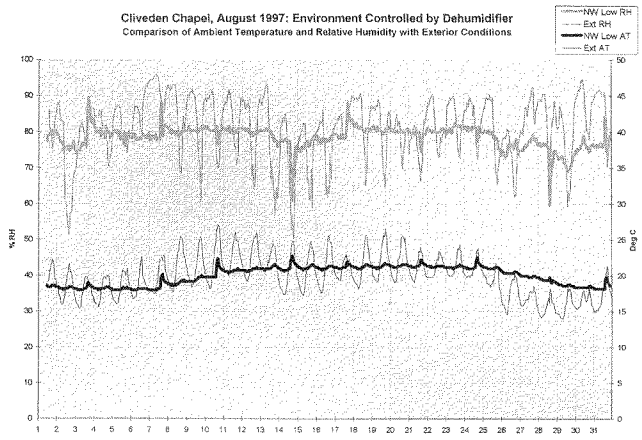

Figure 6a. The Chapel at Cliveden, *August 1997, environment controlled by dehumidifier. Comparison of ambient temperature and RH with exterior conditions.*

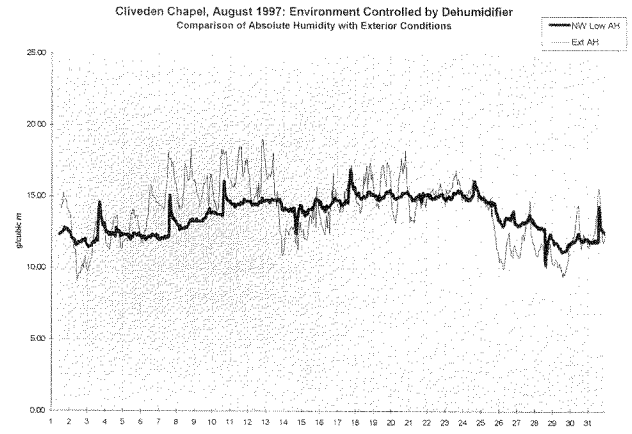

Figure 6b. The Chapel at Cliveden, *August 1997, environment controlled by dehumidifier. Comparison of absolute humidity and exterior conditions.*

moisture from the air by the dehumidifier. Rapid changes in internal absolute humidity can be seen on most third or fourth days (coinciding with days when the building was open to the public).

These changes in internal absolute humidity are mirrored in Figure 6c which shows the difference in surface and dew point temperatures. On days when the infiltrating exterior air causes the absolute humidity in the Chapel to rise (August 3, 7, 10, 17, 24, and 31, 1997) the difference falls, in some cases close to zero, increasing the probability of condensation. On one or two dry days (August 14 and 28) the absolute humidity of the exterior air is lower than the internal air and condensation becomes less likely.

Although August 1997 was not the most dramatic month for condensation events, some spring months showed surface temperature below the dew point. August is an interesting period to consider as many assume that even in the United Kingdom the summer months are warm enough

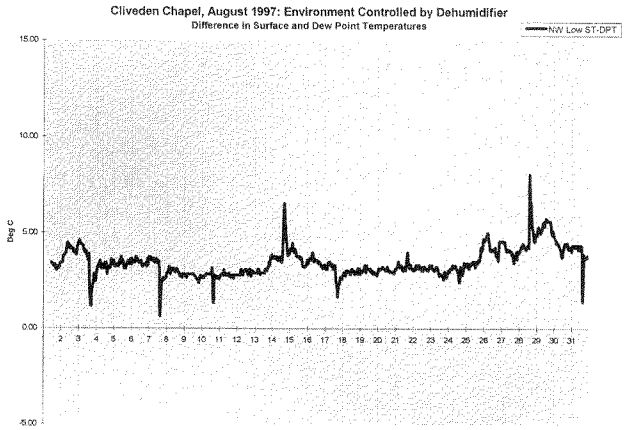

Figure 6c. The Chapel at Cliveden, *August 1997, environment controlled by dehumidifier. Difference in surface and dew point temperatures.*

for solar gain to raise internal temperatures above the threshold for condensation to occur. This is clearly not the case at the Chapel.

Results with conservation heating

The conservation heating trial started in early summer 1999, so only a few months of data were available at the time of writing. However, August 1999 provided an interesting comparison with August 1997, described in the previous section.

Figure 7a shows internal temperature and RH compared with exterior conditions. The internal temperature is reasonably constant but shows some daily temperature rises caused by solar gain. As with the dehumidifier trace, there are some fluctuations in temperature, downwards as well as upwards, that can be related to the infiltration of external air on open days. The RH trace shows a level of control at 70% except on open days when the infiltration of outside air causes the RH to fall.

Figure 7b shows the comparison of internal and external absolute humidity. On every occasion that the Chapel door was opened, the absolute humidity falls. It should be noted that in addition to the regular days of opening on Thursdays and Sundays, there were a few other days on which the door was opened (August 9 and 10).

These falls in absolute humidity when the Chapel was opened resulted in the increases in the differences in surface and dew point temperatures shown in Figure 7c. However, it can also be seen that the effect of the conservation heating is to increase the difference in surface and dew point temperature to more than 5°C throughout the month, which is more than enough to counteract the effect of infiltrating air of higher absolute humidity.

The key to the prevention of condensation is the raising of the temperature of internal surfaces (Massari and Massari

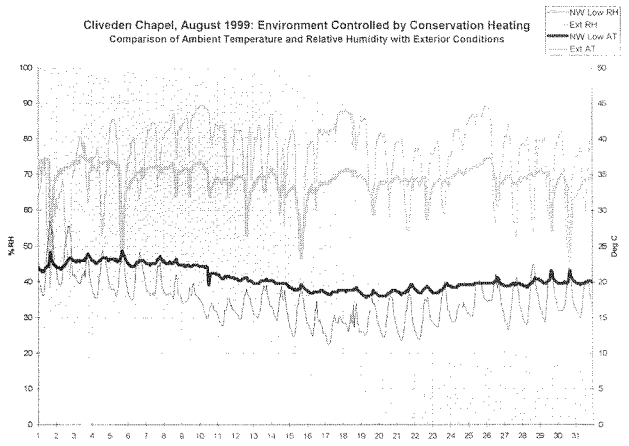

Figure 7a. The Chapel at Cliveden, *August 1999, environment controlled by conservation heating. Comparison of ambient temperature and RH with exterior conditions.*

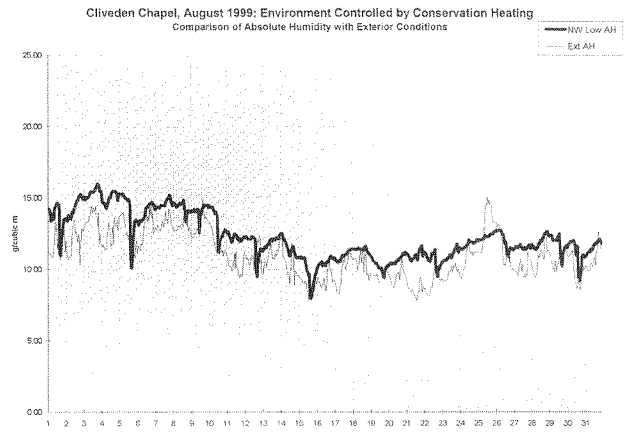

Figure 7b. The Chapel at Cliveden, *August 1999, environment controlled by conservation heating. Comparison of absolute humidity with exterior conditions.*

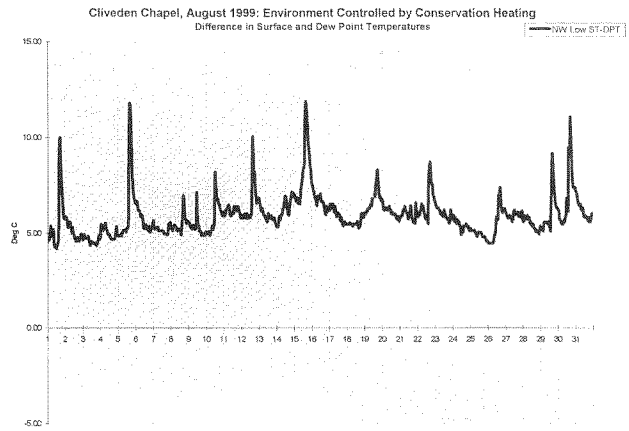

Figure 7c. The Chapel at Cliveden, *August 1999, environment controlled by conservation heating. Difference in surface and dew point temperatures.*

1993), in the case of the Chapel at *Cliveden* to above the dew point of infiltrating external air when the door is open. Experience in other National Trust properties has shown that radiant heat is more effective at raising the temperature of the building fabric than convected heat, and this will guide our choice of heaters for the permanent solution.

Monitoring will continue to evaluate the effectiveness of conservation heating at preventing environmental conditions that are likely to cause condensation until there is more than a year's worth of data.

Conclusions

The use of surface and air temperature and RH monitoring has been shown to be helpful in the diagnosis of environmental conditions that are likely to give rise to condensation while trials were carried out to determine the most effective means of environmental control. Had this type of analysis been available to us in the 1980's, some parts of an expensive building repair could have avoided. We now take for granted the fast processors and large memories of modern computers that make spreadsheet calculations using psychrometric equations a realistic proposition, even on a laptop. There are, of course, other ways of detecting condensation, such as on-off condensation event indicators, and time-of-wetness detectors. However, the use of surface and air temperature and RH measurements gives additional information which helps with the understanding of the underlying mechanisms operating within the building. The authors of *Damp Buildings Old and New* say "There are construction workers, restorers, architects, landlords, tenants, monument or church curators all over the world who, guided by common sense, mistake this [condensation] for rainwater entering the wall" (Massari and Massari 1993). The roof of the Chapel need not have been opened, if it had been realized that condensation was responsible for the tesserae falls (although the copper cladding was corroding and needed replacing as a preventive maintenance measure).

It is also interesting to reflect on other characteristics of conservation heating and dehumidification that are relevant in damp buildings. Common sense may tell us that a dehumidifier, which removes moisture from the air, is more likely to draw water through the fabric of the building. If that water carries dissolved salts, then efflorescence may be encouraged. However, in a well-ventilated and heated building, there may also be considerable water evaporation at the wall surfaces which results in moisture, possibly carrying dissolved salts, moving through the fabric in order to buffer the boundary layer of air (Padfield et al. 1994). It cannot be assumed that conservation heating is less likely to cause salt efflorescence than dehumidification in well-ventilated buildings. However, the Chapel at *Cliveden* is not well-ventilated, and when the door is closed the air is static, so the moisture content of the air in the boundary

layer will stay in equilibrium with the fabric of the wall, discouraging evaporation and thus salt efflorescence.

The future

Now that it has been established by trial that conservation heating is effective at preventing condensation, a permanent heating installation is being designed. The great irony is that in one of the antechambers is an antique solid-fuel boiler that supplied circulating hot water that ran in pipes in ducts under the floor of the Chapel (the chimney for this boiler can be seen in Figure 1). This is yet another example of modern technology identifying a solution that turns out to have been the traditional practice. Having said that, we need to interpret the original heating system in the context of the 21st century. Our staff are too few to permit the restoration of the solid-fuel boiler and the subsequent stoking that would involve! Instead we are likely to use the underfloor ducts as a position for tubular radiant electric heaters. They will be controlled by a humidistat located within the Chapel.

An energetic mathematician or computer enthusiast could use the large amount of data that has been collected since 1995 to undertake a theoretical study of the precise relationship between internal and external conditions, to work out air change rates, the RH setpoint that is needed to prevent condensation throughout the year, and many other fascinating insights into the atmospheric science of the Chapel at *Cliveden*. It could keep an M.Sc. or even a Ph.D. student happy for many months! The National Trust will take its usual pragmatic approach, which is to install the control equipment and to monitor its effectiveness, making adjustments to setpoints, locations of heaters, and their power output, as informed by the monitoring data. The monitoring data will be turned into information which in its turn will be translated into management practice.

Once the preservation of the internal surfaces of the Chapel is assured through good preventive conservation, the remedial treatment of the damaged marble revetments and re-attachment of fallen tesserae can be considered. A project is being developed that will be executed once we are sure that there will be no further condensation events. It will doubtless be the subject of a further paper.

Acknowledgements

This project has extended for a long time, and many (too numerous to mention all of them) people have been involved: in the 1980's David Winfield, Bob Hayes, and Trevor Proudfoot, and more recently architects Julian Harrap and Robert Sandford, and Bernard Collins, the National Trust Building Manager at *Cliveden*; David Park, Sharon Cather, and Robyn Pender of the Courtauld Institute of Art have been the inspiration for the monitoring campaign; Katy Lithgow has undertaken the most recent condition survey and has helped considerably with the preparation of this paper; and Robyn Pender, Sarah Hollis, and Janet Berry have spent hours number crunching. We are grateful to all of them for their contributions, and to the staff at *Cliveden* for coping with the trials.

Endnotes

1. X-ray diffraction of samples of salt from *Cliveden* show predominantly calcite with minor amounts of mica, gypsum, birnessite, and chlorite (clay). It is likely that the mortar is the source of the salts.

2. Sensors and data logger supplied by Eltek, 35 Barton Road, Haslingfield, Cambridge CB3 7LL, United Kingdom.

3. Humidistat supplied by Hanwell Instruments Limited, The Old Stables, 85 Barrack Road, Exeter EX2 5AB, United Kingdom.

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Résumé

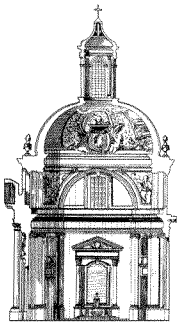
Problèmes d'humidité à la chapelle de Cliveden

Les problèmes d'humidité qui se posent dans la chapelle de Cliveden n'ont été résolus qu'en partie par les réparations apportées au bâtiment. Des données obtenues au cours d'une campagne de quatre ans de vérification de la température de surface et de l'air et de l'humidité relative ont été utilisées pour calculer l'humidité absolue et la température du point de rosée, à l'aide d'équations psychométriques standard et d'un tableur Microsoft Excel, et montrent que la condensation peut se produire sur les surfaces internes de la chapelle de Cliveden lorsque le bâtiment est ouvert au public. Des essais ont été faits pour étudier l'efficacité de la déshumidification et du chauffage régulé par humidistat comme moyen de réduire la probabilité des occurrences de condensation. C'est le chauffage régulé qui s'est avéré le plus efficace.

8

Panel Discussion

Discussion de groupe



The New Orleans Charter for Joint Preservation of Historic Structures and Artifacts

The New Orleans Charter is the product resulting from the two symposia *Museums in Historic Buildings* held in Montreal, Quebec (1990) and New Orleans, Louisiana (1991) which were co-sponsored by the American Institute for Conservation of Historic and Artistic Works (AIC) and the Association for Preservation Technology International (APTI). This Charter has been officially adopted by the Board of Directors of both AIC and APTI.

Arising from a concern for the coexistence of historic structures and the artifacts housed within them;

Recognizing our responsibility as stewards to provide the highest levels of care for the structures and other artifacts placed in our care;

Recognizing that many significant structures are used to house, display and interpret artifacts;

Recognizing that historic structures and the contents placed within them deserve equal consideration in planning for their care;

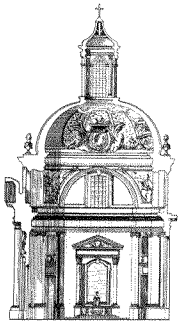
Recognizing that technologies and approaches will continue to change; and

Recognizing that those involved in preservation are part of a continuum, and are neither the first nor the last to affect the preservation of historic structures and artifacts;

We, therefore, adopt these principles as governing the preservation of historic structures and the artifacts housed in them:

1. Institutions' statements of mission should recognize the need to preserve the unique character of both the historic structure and artifacts.
2. The preservation needs of the historic structure and of the artifacts should be defined only after study adequate to serve as the foundation for the preservation of both.
3. Requisite levels of care should be established through the interdisciplinary collaboration of all qualified professionals with potential to contribute.
4. Appropriate preservation must reflect application of recognized preservation practices, including assessment of risk before and after intervention, and the expectation of future intervention.
5. Measures which promote the preservation of either the historic structure or the artifacts, at the expense of the other, should not be considered.
6. Regarding public use, the right of future generations to access and enjoyment must outweigh immediate needs.
7. Appropriate preservation strategies should be guided by the specific needs and characteristics of the historic structure and artifacts.
8. Appropriate documentation of all stages of a project is essential, and should be readily accessible and preserved for the future.
9. The most appropriate action in a particular case is one which attains the desired goal with the least intervention to the historic structure and the artifacts.
10. Proposed preservation strategies should be appropriate to the ability of the institution to implement and maintain them.

- *APT Communique* 21(2): May 1992



APT/AIC Charte de la Nouvelle-Orléans pour la conservation conjuguée des bâtiments historiques et des artefacts

La Charte de la Nouvelle-Orléans est le produit de deux symposiums— «Loger un musée dans un bâtiment historique» de Montréal, Québec (1990), et la Nouvelle-Orléans, Lousianne (1991)—commandités conjointement par l'American Institute for the Conservation of Historic and Artistic Works (AIC) et l'Association internationale pour la préservation et ses techniques (APTI). Cette charte a été officiellement adoptée par les conseils d'administration de l'AIC et de l'APTI.

Découlant de notre préoccupation pour la coexistence des bâtiments historiques et des artefacts qu'ils contiennent;

Reconnaissant notre responsabilité d'assurer le plus haut niveau de protection aux bâtiments historiques et aux artefacts placés sous notre garde;

Reconnaissant que plusieurs bâtiments significatifs sont utilisés pour loger, exposer, et interpréter des artefacts;

Reconnaissant que les bâtiments historiques et les collections qu'ils contiennent méritent une attention égale lorsqu'il s'agit de leur conservation;

Reconnaissant que les techniques et les approches en matière de conservation sont sujettes à changement;

Reconnaissant que les personnes impliquées dans la conservation forment un continuum et qu'elles ne sont pas les premières ni les dernières à intervenir sur les bâtiments historiques et sur les artefacts qu'ils contiennent;

Par conséquent, nous adoptons les principes suivants pour régir la conservation des bâtiments historiques et des artefacts qu'ils contiennent :

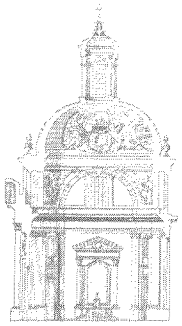
1. La définition de la mission de l'institution devrait reconnaître la nécessité de préserver le caractère unique du bâtiment de même que celui des artefacts.
2. Le plan de conservation du bâtiment historique et des artefacts ne devrait être établi qu'après avoir effectué une étude permettant de définir les exigences de conservation des deux entités.
3. Les degrés d'intervention devraient être définis par des équipes interdisciplinaires composées de tous les spécialistes pouvant apporter une contribution.
4. Une préservation adéquate doit refléter la mise en œuvre des pratiques reconnues de conservation, incluant l'évaluation des risques avant et après l'intervention, et prévoyant les interventions futures.
5. Les mesures qui favoriseraient la conservation du bâtiment historique au détriment des artefacts ou inversement ne devraient pas être envisagées.
6. Quant à l'accessibilité du public, le droit des générations futures à la connaissance et à la jouissance du bien doit primer sur les besoins immédiats.
7. L'élaboration de stratégies appropriées de conservation devrait tenir compte des besoins spécifiques et des caractéristiques du bâtiment historique ainsi que de ceux des artefacts.
8. Une documentation adéquate de toutes les étapes d'un projet est essentielle; elle devrait être facilement accessible et préservée pour les générations futures.
9. La meilleure intervention donnée est celle qui atteint son objectif avec un minimum d'impact sur le bâtiment historique ou sur les artefacts.
10. Les stratégies de conservation proposées devraient être pensées en fonction de la capacité de l'institution de les implanter et de les maintenir en vigueur.

APT Bulletin, vol. 27, n° 3, 1996, p. 57-60.

9

Posters

Affiches



Quand les murs parlent

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Résumé

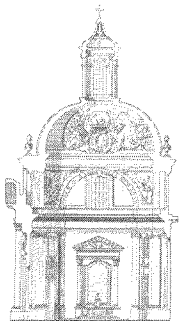
Une formation personnelle m'a permis de constituer, depuis une vingtaine d'années, une collection de plus de 700 modèles de papiers peints datant des années 1800 aux années 1920. Ce fonds peu connu de documents cueillis sur le terrain réunit du papier peint provenant aussi bien des milieux aisés que de la classe ouvrière. Tous ces documents témoignent de la coloration des intérieurs, surtout au XIX^{e} siècle.

Cette recherche constitue un apport de premier ordre à l'archéologie du décor. Elle permet d'évoquer ce cadre disparu de la vie quotidienne, par l'extrême variété des motifs, ses diverses influences et la vigueur des coloris. Chaque échantillon d'un modèle est archivé et daté. Le type de support sur lequel il a été prélevé dans la maison y est également précisé.

Cette compilation nous apprend, par exemple, que la majorité des papiers peints de maisons d'ouvriers de 1830 à 1900 étaient collés directement sur les pièces de charpente de bois brut de la maison. Rustique, n'est-ce pas? On apprendra aussi qu'une fois posés, les papiers peints de qualité et venant de milieux aisés peuvent durer de 25 à 75 ans (p. ex. Manoir Papineau).

L'affiche présente les tendances de la mode par périodes de 10 ans, de 1800 à 1920. Chaque image regroupe plusieurs modèles de papiers peints afin de mieux faire ressortir les tendances qui marquent de façon évidente le passage des styles.

Plusieurs sujets sont abordés tels que : l'analyse, la documentation, la conservation et la reproduction de papiers peints. Le tout ponctué par des observations et des mises en garde.



When the Walls Talk

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Abstract

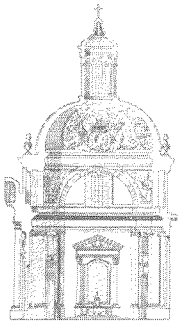
Thanks to my educational background, I have been able (over the last 20 or so years) to collect more than 700 wallpaper patterns dating from the 1800's to the 1920's. This little-known assemblage of samples gathered in the field includes wallpaper from both the well-to-do strata of society and the working class. These examples illustrate the colours used for interiors, especially during the 19th century.

This research represents a first-rate contribution to decoration archaeology. The great variety of designs, their varied influences, and the vigour of the colours conjure up a now vanished backdrop of everyday life. Each sample is archived and dated, and the type of support from which it was taken is also mentioned.

From this collection we can learn, for example, that between 1830 and 1900 most wallpaper in working class homes was pasted directly onto the structural wood components of the house. Rustic, wasn't it? We also learn that, once installed, quality wallpapers that were used in the more affluent houses could last from 25 to 75 years (e.g. *Manoir Papineau*).

This poster shows fashion trends in 10-year periods between 1800 and 1920. Each picture groups together several wallpapers to bring out more effectively the clearly changing trends as one style gave way to the next.

Several subjects are dealt with, including the analysis, documentation, conservation, and reproduction of wallpaper. All this is interspersed with comments and cautionary advice.



Conservation des peintures murales in situ *et patrimoine religieux : étude de cas*

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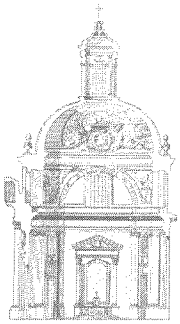
Résumé

La conservation des peintures murales pose un problème : ces œuvres sont indissociables de l'architecture qui leur sert de support. Leur restauration *in situ* est donc bien différente de celle de tableaux de chevalet sur le plan de l'organisation du chantier. Celui-ci est plus difficile à contrôler pour le restaurateur, il diffère à chaque fois, tout comme les intervenants (propriétaire de l'édifice, comité de restauration, architecte, personnel des différents corps de métier).

Nous allons montrer que le partage d'information et la prise de décisions conjointes entre le restaurateur et les intervenants sont essentiels, ainsi que l'établissement avec tous les participants d'un plan d'action préventive pendant et après les travaux, sans quoi, malgré la bonne volonté de sauvegarder les œuvres, on risque de nuire à leur intégrité, voir même de provoquer leur disparition. Un tableau de mesures préventives, réalisé à la suite d'une étude sur trois sites religieux, sera présenté.



In Situ Conservation of Wall Paintings and Religious Heritage: Case Studies

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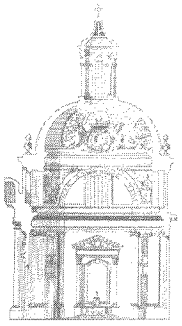
Abstract

The conservation of wall paintings presents a problem: these works are inseparable from the architecture that provides their support. Their in situ restoration is therefore very different from that of easel paintings insofar as organization of the work site is concerned. The conservator has little control over the site; it differs each time, just like the individuals involved (owner of the building, restoration committee, architect, various tradesmen).

Information sharing and joint decision-making between the conservator and all other persons involved are essential. The establishment with all those involved of a preventive plan of action during and after the work is also necessary. Without such a plan, despite all the best intentions to safeguard the works, there is a risk of damaging their integrity or even bringing about their disappearance. A table of preventive measures prepared following studies at three religious sites is presented.



The Removal of Multiple Layers of Overpaint Without the Use of Toxic Solvents

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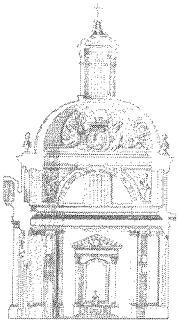
Abstract

During a recent treatment at the Detroit Athletic Club, non-toxic methods were used successfully to remove overpaint on large surface areas. The Italian method of strappo was used to remove multiple layers of overpaint (including a lead white layer) on more than 93 m^2 (1000 sq. ft.) of beamed ceiling, and water poultices were used to remove four layers of overpaint which had hidden original artist designs in a vaulted entryway. Had it not been for these two safe, fast, and inexpensive methods to remove the overpaint, the original artwork might have remained hidden forever.



Enlèvement de couches multiples de surpeint sans solvants toxiques

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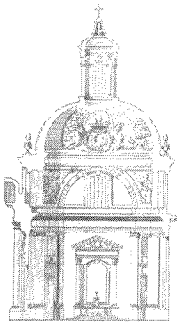
Résumé

Pendant de récents travaux de traitement au Detroit Athletic Club, on a utilisé avec succès des méthodes non toxiques pour enlever des surpeints sur de grandes surfaces. La méthode italienne du strappo a permis d'enlever des couches multiples de surpeint (y compris une couche de blanc de plomb) sur plus de 93 m^2 (1000 pi^2) de plafond à poutres apparentes, et des cataplasmes à base d'eau ont servi à enlever quatre couches de surpeint dissimulant les dessins originaux d'une entrée voûtée. Sans ces deux méthodes sûres, rapides et peu coûteuses, les œuvres originales auraient pu demeurer cachées à jamais.



Oversized Storage Cabinets for Altar Frontals

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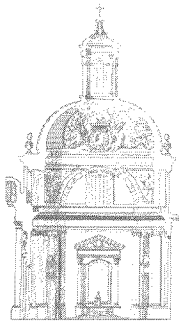
Abstract

The long-term preservation of 'functional' textiles (of both historical and contemporary nature) located in religious institutions throughout the province of Quebec involves many aspects: most textiles require various types of conservation treatment; adjustments and modifications are often needed for both temporary and long-term display installations; and improvements are usually required on existing storage cabinets. The large dimensions of religious textiles frequently necessitate the fabrication of unique oversized storage/exhibition cabinets, which may even render the textiles more accessible to the ever-growing tourist population. The simultaneous development of conservation maintenance programs for the individual religious institutions and a systematic implementation of these programs are crucial in determining the longevity of religious heritage collections.

In 1994, the Cathedral of the Holy Trinity consulted the textile conservation laboratory of the Centre de conservation du Québec on the manufacture of an oversized storage cabinet. This project resulted in the development of a unique prototype which acted as a catalyst for the development of similar types of cabinets in three other institutions in Quebec.

This unique prototype might also prove to be invaluable for the storage of repatriated objects, which require the museological features of a metal cabinet combined with the aesthetics of an outer shell designed to meet the specific needs of clients.



Armoires de rangement surdimensionnées pour les devants d'autel

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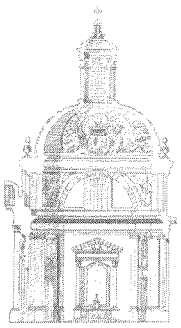
Canada

Résumé

La préservation à long terme des textiles « fonctionnels » (historiques ou contemporains) gardés dans les établissements religieux du Québec comporte plusieurs volets : la plupart des textiles ont besoin de différents types de traitement de conservation; il faut souvent ajuster et modifier les installations d'exposition temporaires et à long terme; et il faut généralement améliorer les meubles de rangement existants. En raison de leur grandes dimensions, les textiles religieux nécessitent souvent des armoires de rangement ou d'exposition surdimensionnées qui les rendent parfois plus accessibles à un nombre croissant de touristes. On doit simultanément assurer l'élaboration et la mise en œuvre systématique de programmes d'entretien de conservation dans les établissements religieux si on veut assurer la longévité des collections du patrimoine religieux.

En 1994, la cathédrale de la Sainte trinité a consulté le laboratoire de restauration des textiles du Centre de conservation du Québec au sujet de la construction d'une armoire de rangement surdimensionnée. Le prototype créé dans le cadre de ce projet a servi de modèle pour la production d'armoires similaires dans trois autres établissements québécois.

Ce prototype pourrait également être utile pour l'entreposage des objets rapatriés qui exigent une armoire métallique de type muséal, cependant dotée d'un extérieur plus esthétique répondant aux besoins du client.



Air-conditioning the Sistine Chapel: The Challenges of HVAC Installation in a 15th-Century Religious Edifice with 7000 Daily Visitors

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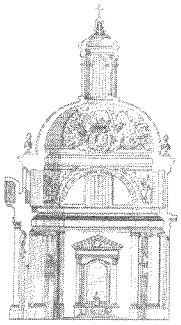
Abstract

One of the major components in the recent conservation treatment of the Sistine Chapel was the installation of an HVAC system that not only preserves the renowned frescoes but also moderates the environmental impact of visitors.

Carrier Corporation of the United States and Italy designed the HVAC system. Nearly a decade of research, as well as careful monitoring of the chapel's environment, preceded the actual construction. Working with historians, curators, conservators, engineers, scientists, and church leaders, the firm devised a complex system that creates two zones of clean air: one near the frescoes and the other at visitor level. The system includes 26 km of ducting, cooling towers, pumps, and valves; a 54.4-t (60-ton) chiller placed in a room far from the chapel; and a double-walled modular air-handling unit with a capacity of 283 161 L/min (10 000 cfm) situated on a terrace near the chapel, out of public sight. Soundproofing and vibration reductions are also major components. Climate conditions within the chapel are stabilized at 55±5% RH, and 25°C (77°F) in summer and 20°C (68°F) in winter. The entire system is automated, with 92 sensors located throughout the chapel, and temperature and humidity are controlled at all times. As a further innovation, visitors are cleaned with gentle blasts of air before they enter the chapel in an effort to reduce mould and bacteria contamination.

Although the system has only been in operation since 1995, the results are encouraging and seem to indicate that the chapel's environment is now more stable. The total cost of the project, to which Carrier Corporation donated a portion, was approximately US$800,000. The masterpieces found in the chapel can now be safely monitored and preserved without having to reduce the number of visitors.



Climatisation de la chapelle Sixtine : Les problèmes liés à l'installation d'un système CVC dans un édifice religieux du XV^e siècle accueillant chaque jour 7000 visiteurs

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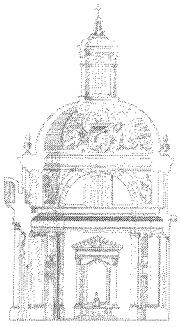
Résumé

Un des principaux volets des récents travaux de restauration menés dans la chapelle Sixtine avait trait à l'installation d'un système CVC visant non seulement à préserver les fresques célèbres, mais aussi à modérer l'impact environnemental des visiteurs.

C'est la Carrier Corporation des États-Unis et d'Italie qui a conçu le système CVC, dont la fabrication a exigé près de dix années de recherche, de même qu'une surveillance attentive de l'environnement de la chapelle. Travaillant de concert avec des historiens, des conservateurs, des restaurateurs, des ingénieurs, des scientifiques et des dirigeants religieux, l'entreprise a conçu un système complexe créant deux zones d'air pur : une près des fresques, l'autre au niveau des visiteurs. Le système comprend 26 km de conduits, des refroidisseurs atmosphériques, des pompes et des soupapes; un réfrigérant de 54,4 tonnes courtes (60 tonnes longues) placé dans une pièce loin de la chapelle; et un dispositif de traitement de l'air modulaire à double paroi d'une capacité de 283 161 L/mn (10 000 pi^3/mn) situé sur une terrasse près de la chapelle, hors de la vue. L'insonorisation et la réduction des vibrations ont aussi été assurées. Les conditions climatiques à l'intérieur de la chapelle sont stables à 55±5% HR et 25° C (77° F) l'été, et à 20° C (68° F) l'hiver. Le système est entièrement automatisé (92 détecteurs ont été installés dans la chapelle) et la température et l'humidité sont contrôlées en tout temps. De plus, avant d'entrer dans la chapelle, les visiteurs sont « nettoyés » par des jets d'air doux afin de réduire la contamination due aux moisissures et aux bactéries.

Même si le système fonctionne depuis 1995 seulement, les résultats sont encourageants et semblent indiquer que l'environnement de la chapelle est à présent plus stable. Le coût total du projet, que la Carrier Corporation a assumé en partie, s'élève à quelque 800 000 $US. Les chefs-d'œuvre de la chapelle Sixtine sont désormais surveillés et préservés de façon sûre, sans qu'on ait à réduire le nombre des visiteurs.



The Octagonal Drawing Room, Raby Castle*, County Durham: A Collaboration*

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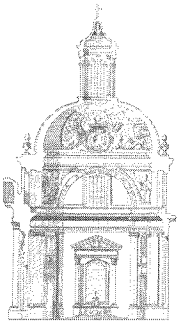
United Kingdom

Abstract

Raby Castle, the family home of Lord Barnard, features architecture from the mid-14th through to the 19th century. The Octagonal Drawing Room was commissioned by the 2nd Duke of Cleveland in the 1840's from architect William Burn (who designed the room) and George Morant (who was responsible for the decoration). The resultant interior was a sumptuous mix of gilded surfaces, walls hung with yellow damask (in the French style), gilded furniture covered with rococo-influenced damask, and curtains trimmed with extravagant passementerie, the whole reflected in a pair of vast pier glasses.

By the 1990's the interior of the room was in poor condition; the textiles had suffered from the effect of light and general wear and tear, the gilded areas were chipped, and the paint surfaces were dull. In 1992, the architectural firm of Donald Insall Associates put forward proposals for the revival of the interior using conservation and restoration approaches.

Over the following 6 years a complex project was organized. It began by evaluating the various features of the interior to establish which elements could be satisfactorily conserved, which it would be undesirable to restore, and which would require restoration. The work then proceeded, always keeping to the fore the need for the room to read as a whole without any imbalances. The final stage of conservation was completed in 1998.



Le salon octogonal de Raby Castle du comté de Durham : Une collaboration

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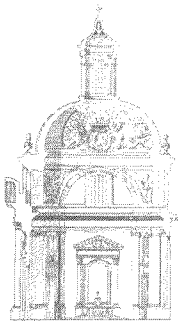
Résumé

Raby Castle, la demeure familiale de lord Barnard, présente une architecture qui a évolué du milieu du XIV^{e} siècle au XIX^{e} siècle. C'est le deuxième duc de Cleveland qui a commandé le salon octogonal, dans les années 1840, à l'architecte William Burn (qui a conçu la pièce) et à George Morant (responsable de la décoration). Le salon présente une somptueuse combinaison de surfaces dorées, de murs tendus de damas jaune (à la française), de meubles dorés recouverts de damas d'influence rococo et de rideaux bordés d'une passementerie extravagante, le tout se reflétant dans deux immenses miroirs d'applique.

Dans les années 1990, la pièce était en mauvais état : les textiles avaient souffert des effets de la lumière et de l'usure; les dorures étaient écaillées et les surfaces peintes avaient perdu leur lustre. En 1992, la firme d'architectes Donald Insall Associates présenta un projet visant à rendre à la pièce tout son éclat grâce à des techniques de conservation et de restauration.

Au cours des six années suivantes, un projet complexe fut mis sur pied. On commença par évaluer l'ameublement afin d'établir quels éléments devaient être conservés, restaurés ou laissés tels quels, avant de passer aux travaux proprement dits sans jamais perdre de vue la nécessité de conserver à la pièce son harmonie. Les travaux ont été achevés en 1998.



Burton Constable Hall, *Yorkshire: Uncovering the Layers*

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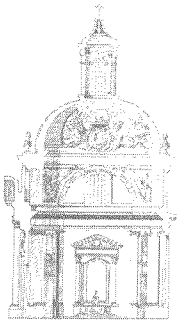
Abstract

Burton Constable Hall was threatened with demolition 50 years ago, but today its future is secure thanks to the creation of the Constable Foundation who now own the house and its grounds; the contents, which have remained in situ, are under the guardianship of Leeds City Museums.

The house began as an early medieval defensive peel tower, and was expanded and altered during the 18th and 19th centuries. The Georgian contribution included a virtual reconstruction of the interior by 1840 (historian George Poulson described the interior redecoration as overwhelmingly 'dazzling'). This was *Burton Constable Hall*'s heyday and a fusion of styles and craftsmanship took place during this period, with contents and decoration being supplied by craftsmen from Hull and London. Over the succeeding decades the main body of the house was neglected and the interiors and their contents became vulnerable to decay.

Soon after the creation of the Constable Foundation, I was asked to assess the textile contents, prioritize the requirements for conservation, and suggest ways to stabilize the condition of the collection without disturbing the 'precious' atmosphere of the house. I also embarked on a project with volunteers to catalogue, clean, and store the vast collection of passementerie.



Burton Constable Hall, Yorkshire : Dévoiler les couches

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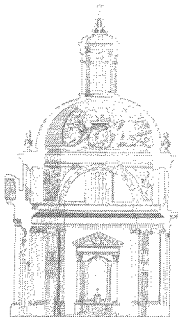
Royaume-Uni

Résumé

Menacé de démolition il y a 50 ans, Burton Constable Hall voit aujourd'hui son avenir assuré grâce à la création de la Constable Foundation, propriétaire de la maison et du terrain. Le contenu de la maison, demeuré sur place, a été confié aux musées de Leeds.

À l'origine une tour de guet du haut moyen-âge, la maison fut agrandie et modifiée aux XVIII[e] et XIX[e] siècles. À l'époque classique, plus précisément dans les années 1840, l'intérieur fut presque entièrement reconstruit (l'historien George Poulson a dit de l'intérieur redécoré qu'il était absolument « éblouissant »). Fusionnant divers styles et techniques, et faisant appel à des artisans de Hull et de Londres pour son contenu et sa décoration, Burton Constable Hall connut alors son apogée. Au cours des décennies suivantes, le corps principal de la maison fut négligé, son intérieur et son contenu, laissés à l'abandon.

Peu après la création de la Constable Foundation, on m'a demandé d'évaluer les textiles de la maison, d'établir les priorités concernant les besoins de conservation et de suggérer des moyens de stabiliser la collection sans nuire à l'atmosphère « précieuse » de la maison. En compagnie de bénévoles, j'ai également participé à un projet visant à cataloguer, nettoyer et entreposer la vaste collection d'ouvrages de passementerie.



The Restoration, Preservation, and Reinterpretation of the Steamboat Ticonderoga

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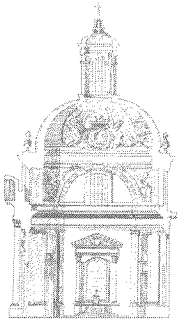
Abstract

The 1906 Lake Champlain steamboat *Ticonderoga* recently underwent an extensive 5 1/2-year restoration. As the last remaining side-wheel steamboat of its type, the 67-m (220-ft.) *Ticonderoga* (now in permanent dry dock at the Shelburne Museum in northern Vermont) was declared a National Historic Landmark in 1963. The demands of the restoration project necessitated extensive background information, including physical evidence discovered through sampling surface coatings and structural details, archival (written and photographic) evidence, and oral histories (people who worked and traveled on the *Ticonderoga*). The findings of this research guided decisions regarding the significant structural restoration work for the preservation and treatment of interior elements. A careful examination of archival records reflecting the 1920's era of operation led to the determination of a specific date for reinterpretation — October 3, 1923; it is this period that is reflected in the refurnished historic interior, exhibitions, publications, and programming. The collaboration and interdependence of the Shelburne Museum's educators, curators, conservators, and preservation shipwrights contributed greatly to accuracy and success in preserving the steamboat's interior.



La restauration, la préservation et la réinterprétation du vapeur Ticonderoga

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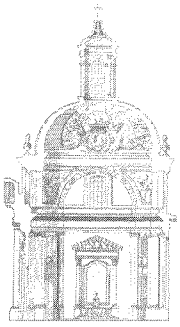
Résumé

Le vapeur *Ticonderoga*, lancé sur le lac Champlain en 1906, a récemment fait l'objet d'une restauration étendue qui a duré cinq ans et demi. Dernier vapeur à roues latérales de ce type qui subsiste, le *Ticonderoga* de 67 m (220 pi) se trouve maintenant en cale sèche permanente au Shelburne Museum, dans le nord du Vermont. Il a été déclaré monument historique national en 1963. La restauration a nécessité la collecte de nombreux renseignements de base, y compris sur les matériaux découverts par l'échantillonnage des revêtements et des détails structuraux, des documents d'archives (écrits et photographiques), et des éléments d'histoire orale (recueillis auprès de personnes qui ont travaillé et voyagé sur le *Ticonderoga*). Les résultats de ces recherches ont orienté les décisions prises pour les travaux importants de restauration structurelle visant la préservation et le traitement d'éléments intérieurs. Un examen attentif des archives ayant trait à la période d'exploitation des années 1920 a conduit à déterminer une date précise de réinterprétation, soit le 3 octobre 1923; c'est à cette période que correspondent l'intérieur historique remeublé, les expositions, les publications et la programmation. La collaboration et l'interdépendance des éducateurs, des conservateurs, des restaurateurs et des charpentiers de marine spécialisés en préservation ont contribué énormément à l'exactitude et au succès de la préservation de l'intérieur du vapeur.



The Preparation of Cross Sections using the Patented EasySections

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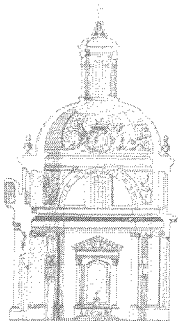
Abstract

Cross sections are used in paintings conservation to study materials, technique, and conservation history. In architectural conservation, they can assist in documentation, condition assessment, and the formulation of suitable treatments, as well as give a history of colour treatments. But their use is not as widespread as expected due to difficulties that have been experienced using the existing systems of preparation. However, an independent paintings conservator has developed a system for making this important analytical tool more accessible to conservators. This new method (EasySections) is equally suitable for museum or laboratory professionals, and will especially benefit those who have no access to laboratory equipment, who wish to prepare samples on site, who find the current methods too time-consuming to be justifiable, or who have not been trained to make cross sections.

This poster demonstrates the benefits of this new system over existing methods, and the ease of preparing cross sections using the patented EasySections.



La préparation de coupes transversales à l'aide de la méthode brevetée EasySections

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Résumé

Les coupes transversales sont utilisées dans la restauration des tableaux pour étudier les matériaux, la technique et l'historique de restauration. En conservation architecturale, elles contribuent à la documentation, à l'évaluation de l'état et à la formulation des traitements appropriés, tout en donnant un historique des applications de couleurs. Toutefois, leur utilisation n'est pas aussi répandue qu'on pourrait supposer, à cause des difficultés rencontrées avec les systèmes existants de préparation.

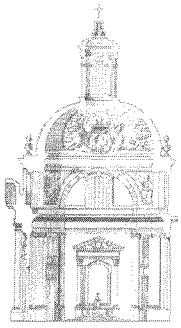
Un restaurateur indépendant de tableaux a mis au point un système permettant de rendre cet important outil analytique plus accessible aux restaurateurs. Cette nouvelle méthode (EasySections) convient également aux professionnels des musées et des laboratoires, et sera particulièrement utile pour ceux qui n'ont pas accès à un équipement de laboratoire, qui désirent préparer des échantillons sur place, qui considèrent que les méthodes actuelles prennent trop de temps pour qu'on puisse les justifier, ou simplement qui n'ont pas été formés à faire des coupes transversales.

Cette affiche montre les avantages du nouveau système par rapport aux méthodes existantes, et la facilité de la préparation de coupes transversales à l'aide de la méthode brevetée EasySections.

10

Demonstrations

Démonstrations



Demonstration of CCI's On-site Scientific Testing Services

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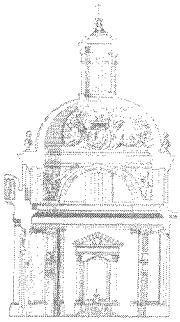
A variety of CCI's on-site scientific testing services and their applications will be demonstrated.

Technique	Information provided
Colorimetric and gloss measurement	Documentation of absolute colour and gloss on reflective surfaces; long-term monitoring for change; colour and gloss matching
Coating thickness measurement on metallic substrates by eddy current or magnetic induction	Quality control after application; deterioration during aging
Infrared reflectance spectroscopy	Chemical composition of non-metallic objects
Light microscopy	Identification of fibres, textiles, paper, and wood

Conducting scientific testing on site has several advantages over sending objects or samples to laboratories: there is no cost or damage incurred during shipping; face-to-face consultation between analyst and client can result in a more relevant selection of objects, samples, or sampling locations for analysis; selection of objects can be revised as new information is revealed during the analysis; more objects can be analysed because time, energy, and money are not expended to ship samples; the analyst is available for expert discussion on conservation problems and related issues.

CCI's on-site testing services are a valuable source of information that can effectively and efficiently assist the long-term preservation of artifacts and collections through monitoring and analysis. Visits to perform on-site testing can usually be arranged on short notice, and 150–300 objects can be tested in a typical 3-day visit.



Démonstration des services d'essais scientifiques in situ *de l'ICC*

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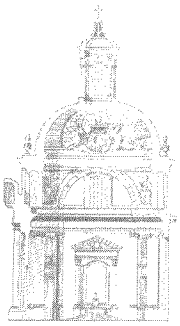
Divers services d'essais scientifiques *in situ* de l'ICC et leurs applications font l'objet d'une démonstration.

Technique	**Renseignements fournis**
Mesure colorimétrique et mesure du brillant	Documentation de la couleur absolue sur des surfaces réfléchissantes; surveillance à long terme des changements; appariement des couleurs et du brillant
Mesure de l'épaisseur des enduits sur des substrats métalliques par courant de Foucault ou par induction magnétique	Contrôle de la qualité après application; détérioration pendant le vieillissement
Spectroscopie par réflectance dans l'infrarouge	Composition chimique d'objets non métalliques
Microscopie à lumière	Identification de fibres, de textiles, de papier et de bois

Les essais scientifiques *in situ* comportent plusieurs avantages sur l'envoi des objets ou des échantillons à des laboratoires : il n'y a pas de coûts d'expédition ni de risques de dommages pendant le transport; la consultation directe entre analyste et client peut conduire à un choix plus pertinent d'objets, d'échantillons ou d'endroits d'échantillonnage pour l'analyse; le choix des objets peut être revu lorsque de nouveaux renseignements apparaissent pendant l'analyse; plus d'objets peuvent être analysés parce qu'on ne dépense pas de temps, d'énergie et d'argent pour expédier les échantillons; l'analyste est disponible pour discussions sur des problèmes de conservation et des sujets connexes.

Les services d'essais *in situ* de l'ICC sont une source précieuse de renseignements qui peuvent aider de façon efficace et efficiente à la préservation à long terme des artefacts et des collections grâce à la surveillance et à l'analyse. Les visites pour effectuer les essais *in situ* peuvent généralement être arrangées dans un bref délai et entre 150 et 300 objets peuvent être mis à l'essai lors d'une visite typique de trois jours.



The Multi Spectral Imaging System (MuSIS 2007)

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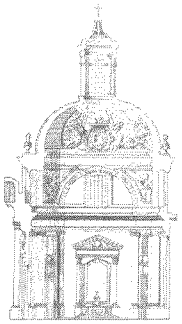
Art Innovation provides innovative products internationally for use in the conservation of cultural heritage.

The Multi Spectral Imaging System (MuSIS 2007) is helpful during the restoration process. It operates in a spectral range from 320 nm (ultraviolet) up to 1550 nm (infrared), and can be used to perform analyses on the structure of the paint layer, the varnish, and possible retouches and underdrawings.

The MuSIS 2007 is also very valuable in the documentation of painted surfaces. Because the images are in a digital format, they can be stored in a computer; the images can then be processed in various image-processing programs, e.g. to stitch images together and create an infrared reflectogram.

The Camera Positioning Systems (CPS 100 & 200) have been developed especially for art conservation, where fast and accurate positioning of a camera is essential in paintings research and for producing an infrared reflectogram.



Système d'imagerie multispectrale MuSIS 2007

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Art Innovation œuvre sur la scène internationale et offre des produits innovateurs pour la conservation du patrimoine culturel.

Le système d'imagerie multispectrale MuSIS 2007 est utile durant le processus de restauration. Il fonctionne dans une bande spectrale allant de 320 nm (ultraviolet) à 1550 nm (infrarouge) et peut servir à analyser la structure de la couche picturale, du vernis, des retouches et des dessins de fond.

Le MuSIS 2007 est aussi très utile pour documenter les surfaces peintes. Comme les images sont produites sous forme numérique, elles peuvent être mises en mémoire en ordinateur et ensuite traitées grâce à divers logiciels de traitement des images, par exemple pour mailler des images et créer un réflectogramme infrarouge.

Les systèmes d'alignement de l'appareil photographique CPS 100 et 200 ont été mis au point spécialement aux fins de la conservation des œuvres d'art. Ils sont utiles lorsque l'alignement rapide et précis de l'appareil est nécessaire pour étudier un tableau ou pour produire un réflectogramme infrarouge.

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