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Original article

Paper conservation methods: An international survey

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ABSTRACT

This research aims to determine the degree of implementation at the international level of the various paper conservation methods found in the literature. Participating organizations in the survey mainly include national libraries, archives and museums, practicing paper conservation. The results of the survey indicate that the types of objects treated by the majority of the participating organizations consist mainly of manuscripts, archival material, books, maps, topographical drawings and photographic material. The vast majority of the organizations implement at least one of the methods associated with every distinct category of paper conservation methods. Nevertheless, only a limited number of methods per category/step are popular and are implemented to a noteworthy degree. Organizations tend to avoid the extensive usage of chemicals, and apply simple and well-established methods, such as dry cleaning, washing in water, deacidification with calcium hydroxide and paper mending with Japanese paper and paste, instead of complex conservation methods. The results indicate that several deprecated methods are still in use, especially for bleaching. Finally, the wide implementation of many methods that appear to be in use according to the literature review is not documented by the survey results. The three answers with the highest percentages per paper conservation category/subcategory are presented in table form.

1. Research aims

To determine the degree of implementation at the international level of the various paper conservation methods found in the literature. Complementary aims include:

- identification of the most widely implemented paper conservation methods per category/subcategory worldwide;
- verification of the results of the literature survey, concerning the adoption and importance of the various methods;
- the possible identification of new, unpublished and/or experimental methods, not fully documented in the literature;
- collection of information regarding the operation of the workshops and the availability of equipment.

2. Introduction

Amongst the various fields of conservation, paper conservation is one of the most prolific, regarding scientific publications. A search in Google Scholar with terms pertaining to various conservation fields returned the following results (Table 1):

Paper conservation returned 5380 results, less than the generic term “art conservation” but more than the other conservation fields, clearly suggesting that a lot of research revolves around paper conservation. All this research has introduced a plethora of methods, techniques and materials on the subject of paper conservation, published in relevant scientific journals over the years.

In a previous article entitled “Paper conservation methods: A literature review” [1], we have presented a comprehensive literature review on paper conservation methods. The methods were classified in eight general categories/steps (Table 2), further subdivided to include approximately 150 distinct paper conservation methods[2] (methods for paper and decay characterization of step 1 excluded). This literature review revealed that many new methods have emerged lately, and a good number of widely practiced methods have become deprecated. Nevertheless, the degree of implementation of those methods in contemporary everyday conservation practice is largely unknown. Thereafter, the basic scope

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[2] We consider two methods distinct from each other if they have different aims, utilize different chemicals or use different procedures. To this rule, some subjectivity may interfere as to when a modification, for example in an adhesive, of an existing method constitutes a new method.

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Table 1
Number of returned results from searches in Google Scholar with terms pertaining to various conservation fields. The searches were performed on September 17, 2015.

Term	Number of returned results
"Art conservation"	7990
"Paper conservation"	5380
"Stone conservation"	3280
"Painting conservation"	3060
"Book conservation"	2430
"Leather conservation"	780
"Ceramic conservation"	218
"Parchment conservation"	199

of the research presented here is to determine the degree of implementation at the international level of the various paper conservation methods found in the literature. Complementary targets include:

- identification of the most widely implemented paper conservation methods per category/subcategory worldwide;
- verification of the results of the literature survey, concerning the adoption and importance of the various methods;
- the possible identification of new, unpublished and/or experimental methods, not fully documented in the literature;
- collection of information regarding the operation of the workshops and the availability of equipment.

In the present paper, the results of a survey concerning the degree of implementation of paper conservation methods at the international level are presented and discussed. Surprisingly, no similar surveys in aims and scope were found in the relevant literature. There exist a few surveys on book conservation methods incorporating some questions on paper conservation, but with a limited scope in context, methods surveyed and geographical reach. A recent survey by Baker and Dube [2] focuses mainly on book conservation with some questions on deacidification and paper repairs in the context of research libraries. It presents data collected form 73 USA-located libraries, and includes a short literature review on surveys on book conservation methods. Interestingly, several surveys exist on bookbinding and leather conservation methods and materials, though with few if any references to paper repairs [3–6]. Several other surveys incorporate some questions on paper and book conservation, such as basic paper repairs and deacidification, but focus mainly on preservation and address only institutions of a specific type (for example, archives only), mainly in one country [7–10]. Few surveys on treatments of specific issues pertaining to paper were found in the literature, including the ones by Van Gulik and Kersten-Pampiglione [11] on the possible treatments of iron-gall ink corrosion, and by Sequeira et al. [12] on the methods of treating paper infected by fungi. The present research aims at filling this gap.

3. Methodology

In order to determine which paper conservation methods are implemented in practical conservation work, a survey was conducted by use of an online structured questionnaire. Apart from the targets mentioned in the introduction, several other complementary details about the participating paper conservation workshops were of interest, namely the number, the experience and studies of their personnel, their technical infrastructure and their subscriptions in the relevant scientific journals. The latter was included in an attempt to obtain an objective indicator of the organizations' effort to remain current with new methods and trends, and pursuit innovation.

The questionnaire has three sections. The first section consists of 4 questions about the organization and the staff of the conservation workshop/laboratory (number of employees, their training, experience and specialties, results not presented here). The second section comprises 20 closed-ended questions regarding various paper conservation options. These questions aim at determining which of the methods and chemicals presented in the literature are actually implemented [1]. The third section consists of 4 questions about the operation of the laboratory and the availability of equipment. For questions regarding various paper conservation options, respondents were allowed to select more than one answer.

In defining the survey population (that is, the list of organizations from which a part was to be invited to participate), we faced a two-fold problem: what type of organization to include and how to locate the necessary email address in order to contact them. Concerning the type of organization, we decided to address the central official organizations of as many countries/states as possible, and all the major conservation centers we could locate. In most countries, national/state archives, libraries and museums, are supervised by government agencies, which circulate directives and best practice guides, thus expressing the official policy on conservation. Conservators in private practice were excluded for two reasons. First, there was no way to estimate the number of paper conservators in private practice worldwide, let alone

Table 2
Categories/steps, subcategories and number of methods in paper conservation, as discussed by Zervos and Alexopoulou [1]. The number of distinct methods does not exhaust all possible variations in chemicals or adhesives that may be utilized in a certain method.

	Category/step	Subcategories	Distinct methods
1	Preparation of the intervention	Materials and decay characterization Treatment planning and documentation Isolation of the artefact, separation from other materials	
2	Disinfestation and disinfection/sterilization		18
3	Surface/dry cleaning	Mechanical cleaning Laser cleaning	10
4	Wet cleaning	Washing in water/organic solvents Enzymes treatment Bleaching	40
5	Chemical stabilization	Deacidification (aqueous, in organic solvents, gaseous, mass deacidification) Other chemical stabilization methods (reduction with borohydride, transition metal deactivation, iron-gall ink stabilization)	54
6	Paper repairs	Lacunae filling, tears stabilization, filling missing material, vacuum table, leaf-casting	10
7	Consolidation/strengthening	Lamination, impregnation, paper splitting, mass strengthening methods	15
8	Treatment documentation		
		Total methods	147

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