

Intrinsic Data Obfuscation as the Result of Book and Paper Conservation Interventions

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Abstract: *The effects of book and paper conservation treatments on the intrinsic data of the artifacts are examined. The tangible data present in an object are grouped in three layers, with the third layer being associated with the object's material properties. The wealth of information that can be drawn from the data of the third layer and their significance is discussed. The obfuscation of critical data or their complete loss after specific treatments is a possible outcome, and conservators, stakeholders and the public should be aware of what may be lost after a conservation intervention.*

Keywords: *Paper conservation, Intrinsic data loss, Reversibility.*

I. INTRODUCTION

There has been much controversy and discussion over the ethical aspects of conservation in general and specifically of paper and book conservation, but although the principles are shared among the various disciplines of conservation, the implementations seem to differ (Richmond and Bracker, 2009). For example, it is easily accepted that as far as a historic building is concerned, the safety of the users must precede the need to preserve the original building technology. This is one of the main reasons that in architectural constructions conservation, the principle of reversibility applies only to the form and not to the materials used - that is, contemporary conservation materials may not be reversible (as is the case with grouts), but the form of the structure can be restored to the condition previous to the conservation intervention. Contrariwise, in artifact conservation, reversibility of the materials is in theory still a revered principle, albeit most often not a proven one in practice. For example, in practical paper conservation, reversibility is mentioned only when adhesives are used, and the potential user is reassured that there exists a solvent that can remove the adhesive. Reversibility tends to be replaced by the more contemporary terms removability and retreatability, in recognition that true reversibility cannot exist (Appelbaum, 1987; Oddy and Carroll, 1999; Muñoz Viñas, 2005)

In the Archival and Library communities, a book or a manuscript is mainly understood as the substrate of the printed or inscribed information, and secondly as an artifact of the cultural heritage. Consequently, conservation treatments predominantly aim at preserving the printed or inscribed information, and

secondarily the integrity of the artifact. Much research has been devoted to validate the methods and the techniques of paper conservation, mainly in regard to the long term effects on the useful properties of the substrate. Strength, chemical stability, colour and other important and tangible paper properties are examined with the aid of accelerated ageing in order to proclaim a paper conservation technique to be safe and effective (Zervos and Moropoulou, 2006).

A review of the main paper conservation techniques though, indicates that all of them induce irreversible changes to the artifacts, with some of them being desirable, some just acceptable and others unwanted but yet unavoidable. Not all of the changes are readily discernible, but a part of them, such as the changes in the chemical composition, can be determined by instrumental analysis. The fact that changes are induced by a conservation treatment is generally accepted and in fact, desirable irreversible changes (such as improved resistance to ageing) are actually the aim of a conservation intervention.

Although it is not explicitly stated, many conservation treatments aim at undoing a part of the detrimental effect of ageing, that is, of the effect of time. Admitting that, though, leads to an interesting contradiction, since the passage of time is one of the main contributors to the added value of a historical artifact. This contradiction has been recognized and seems to have been - at least partially - resolved by the modern theory of conservation (Muñoz Viñas, 2005). Nevertheless, however commonplace the previous discussion may seem, it indicates that the aims of conservation are still ill-defined and that the integrity of the artifact and the notion of damage must be reconsidered in order to understand the aspects that need to be preserved. The significance of reversibility or lack thereof should also be reexamined under the revised principle of the integrity of the artifact.

We argue that irreversible changes due to various well established paper conservation treatments may reduce and/or obscure the information content of an artifact⁸⁸. And let us not fool ourselves, the changes caused by (paper or other) conservation treatments are almost in all cases irreversible (Appelbaum, 1987; Oddy and Carroll, 1999; Muñoz Viñas, 2005). We will deliberate on this later on when discussing specific

⁸⁸ In this discussion, whenever it is used in the context of paper and book conservation, the term artifact stands for paper artifacts, books and related archival material.

treatments, but for now, it should be stated that the notion of the integrity of an artifact should also include all the potential (hidden) information that it bears and can be revealed by means of instrumental analysis. Although this principle is generally recognized, it very rarely takes precedence over other contrary objectives in conservation practice.

II. INTRINSIC DATA AND INFORMATION CONTENT

Concerning books and archival materials, there exist three main tangible data layers: The obvious one includes all the inscribed, printed or drawn data, which also comprise the deliberately recorded information (primary data). The second layer of data exists in the form of the artifact and the characteristics of its components, that is, in the binding construction and technology, the characteristics of the paper (watermark, line pattern), the characteristics of the handwriting or of the printing, the tooling of the leather etc. This layer can provide invaluable information on the aesthetics, the technology, the bookbinding techniques etc. of the era that the artifact was created. These data were unintentionally incorporated into the artifact, and as a total they comprise its physical form and characteristics that can be perceived without instrumental analysis. The third layer of data resides in the materials themselves, and can provide information of critical importance. Organic materials can be used for carbon dating, elemental content can serve as the fingerprint of paper, ink and leather and can be used for dating, attribution and authenticity examination, decay indices (such as the degree of polymerization of cellulose, the carbonyl and carboxyl content, etc.) provide information about the ageing rate and mechanisms of the materials and so on. For most of the data of the third layer to be revealed, instrumental analysis is necessary, and there seems to be no limit as to how far archaeometry can reach, especially when considering the future development of science and technology.

III. THE INTEGRITY OF THE ARTIFACT – THE NOTION OF DAMAGE

According to the previous discussion, all three data layers should be considered when defining the integrity of the artifact. In theory, they probably are. In practice, almost all conservation treatments disregard the third data layer, or implicitly consider it irrelevant. As far as the second layer is concerned, more and more experts believe that book conservation treatments have often destroyed invaluable evidence concerning bookbinding techniques (Pickwood, 2011).

Paper and book conservation interventions aim primarily in preserving the first data layer, respecting at the same time the second at various degrees (Bromm, 2008). In the relevant literature, with very few exceptions, there is neither provision nor even any discussion about the preservation - or at least of the possibility of the messing up - of the third data layer.

Although we may run the risk of being characterized

as extremists, we believe that another notion that may need to be revised or at least rediscussed is that of damage. The term damage is very rarely precisely defined, obviously being understood intuitively by everyone and thus its content is taken for granted. Damage is associated with the effects of ageing, and with alterations that are unwanted. Nevertheless, damage is a part of the history of the artifact. By trying to rectify damage, we interfere with the object's history and deliberately obfuscate critical information. We understand that other values or interpretations of the object may take precedence over the historical and scientific value. We would like to see that written in the conservation documentation of the artifact! Because if it is not, then someone ignored this aspect, and arbitrary proceeded to a treatment without having it properly justified.

IV. EFFECTS OF VARIOUS TREATMENTS ON THE INTRINSIC DATA

In this chapter, the reversibility of various paper conservation interventions and their effects on the third data layer will be discussed. A part of the discussion will take place at the theoretical level, since real studies concerning this subject are scarce.

Chemical stabilization (by washing and deacidification), cleaning and strengthening comprise the most important and widely practiced paper conservation interventions (Zervos and Moropoulou, 2006). Washing with water was considered a little intervening and innocuous method for cleaning, chemical stabilization and strength restoration of paper. Recent studies indicate that washing may clean and in case of acidic paper stabilize paper chemically, but it interferes with paper microstructure and reduces strength (Moropoulou and Zervos, 2003; Zervos and Barmpa, 2011). Washing extracts at various degrees the sizing agents, the soluble salts of calcium, magnesium and other metals that mostly originate from the water used in the processing of the raw materials, the paper degradation compounds and other water soluble compounds present in paper. To start with, washing is obviously a non reversible operation: no method exists that could return the extracted chemicals back to the washed paper. The changes in the microstructure and their effect on strength properties cannot be reversed also. Here, removability and retreatability are obviously irrelevant. Now, let us consider what the possible effects of washing are on the third data layer. The gelatin size content has been correlated with specific metals content and strength (Barrett, 1989; Waterhouse and Barrett, 1991). Such correlation must be disturbed by the effects of washing on those properties, and any further relevant research is hindered. The ionic content of paper could act as a fingerprint, which can be used for attribution, dating and provenance determination. Differential extraction of the ionic components of paper (and probably absorption of new ions from the washing water) disturbs their proportion and destroys the fingerprint. The partial removal of the ageing products

of the paper components (cellulose, lignin, hemicelluloses, sizing agents, etc.) makes the study of the chemistry of ageing impossible. Even the effects on the strength properties, favorable or unfavorable, alter the effect of ageing and cannot be used in relevant studies. A recent study (one of very few) indicates that washing alters the proportion of the metal ions content of iron-gall ink, thus altering the ink fingerprint (Hahn *et al.*, 2008). Such an alteration makes the attribution, dating and provenance determination of the writing impossible. All other aqueous treatments such as aqueous deacidification, aqueous consolidation etc. must have at least the same effects as washing, since water extraction also occurs in parallel with the intended effects.

Deacidification is a method of chemical stabilization, which first neutralizes the acidity of paper and then introduces an alkaline chemical that is usually a calcium or magnesium compound. Deacidification, aqueous or otherwise, must as well have similar effects with those discussed above, since new metals are introduced, and probably new organic compounds. Organic compounds are often used in non-aqueous deacidification, which among other implications contaminate the historical carbon content and render carbon dating inaccurate.

Strengthening is achieved by impregnation with an adhesive, and in some cases with the lamination of the original with Japanese paper. A method of strengthening is paper splitting, which is a highly invasive and controversial technique. Whatever the method of strengthening is, they are all irreversible at the materials level, and all of them introduce new chemicals which cause the implications discussed above.

The introduction of new organic compounds such as adhesives (from consolidation), calcium and magnesium carbonate and other additives of deacidification, phytic acid from iron-gall ink stabilization treatments etc. may have another very important implication: the possible contamination of the historic carbon with newer carbon, which renders radiocarbon dating inaccurate and shifts the determined ages forward.

A search in google scholar with the terms "paper conservation carbon dating contamination" rendered only one non-entirely relevant paper concerning the Dead Sea scrolls, which indicated that our fear that contamination during treatments may affect carbon dating is well-founded (Rasmussen *et al.*, 2001).

Invasive and harsh cleaning may also cause loss of data. Various stains may contain DNA material, which can be analyzed and offer valuable information. As Powledge and Rose (1996) put it: *DNA can be used to understand the evolution of modern humans, trace migrations of people, identify individuals, and determine the origins of domestic plants and animals. DNA analysis, as one scholar put it, is "the greatest archaeological excavation of all time"*.

There are quite a few paper conservation treatments together with their variations, and their superficial study

plainly indicates that for the majority of them the above remarks are valid.

V. DISCUSSION AND OUTLOOK

Several issues emerge after the previous discussion. We will first deal with the theoretical one: it seems that contemporary theory of conservation has resolved the issues concerning the controversy between material and ethical aspects of conservation (Muñoz Viñas, 2005), so why bring such matters up again? Well, in very few words, we believe that the contemporary theory of conservation just states the obvious, that is, that conservation is and has always been subject to politics, but does not help much in deciding how to resolve ethical issues. An extended discussion on that subject is out of the scope of this paper, so we will not elaborate further. It suffices to say that among scholars interested in old papers and books are scientists who seek information from the third data layer discussed above, that are involved in interpreting the "meaning" of these data and are also part of the "stakeholders". If this fact is acknowledged, one has to admit that paper conservation treatments are insensitive to their needs.

The complete lack of reversibility of most paper conservation treatments and the possible threat they represent for the third data layer must be openly acknowledged, and caution should be advised before applying a conservation treatment. Studies should be implemented to research their impact on the third data layer. A new, broader understanding of the principle of the object's integrity should prevail not only at the theoretical level (where it probably exists), but on the practical level too.

So, do we suggest that paper artifacts and books should not be conserved? Well, in some cases our answer is definitely yes, and we believe that an increasing number of our colleagues would agree (Pickwoad, 2011). There are some alternative strategies, but this discussion will resume in a follow-up paper. What we suggest though as a general rule is that conservators, stakeholders and the public should be aware of what may be lost after a conservation intervention, and that the final decisions should be taken with that in mind.

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