ON SOME PROBLEMS OF THE RELATIONSHIP BETWEEN SCIENCE AND CONSERVATION

By António João Cruz

It is now common ground that Science (exact and natural sciences) is an important and indispensable support for Conservation. For example, any higher education degree of Conservation contains in its curriculum several courses on Chemistry, Physics, Materials and Biology, which help to understand the materiality of the works to be conserved, and Methods of Examination and Analysis that are fundamental for identification and characterisation of the materials that constitute the works of art. The importance that Science has for Conservation is also observed in many publications authored or co-authored by conservator-restorers where the knowledge of the exact and natural sciences is increasingly used and relied upon, as seen on several manuals [1-4].

However, as testified by any manual on methods of examination and analysis relevant for Conservation or dedicated to conservator-restorers, this relation between Science and Conservation has been developed within the wider context of the application of analytical methods to the resolution of problems in Archaeology, History and Art History and many of these studies have only indirect interest for Conservation (Table I). On this wider context, there are other research areas beyond Conservation Science such as Archaeological Chemistry, Archaeometry and Technical Art History, to cite some disciplines that have become important in the last years or decades. Obviously, all information about the object may be useful and important for its intervention since it is "impossible to treat what is not known" [5] but it should be borne in mind that there is not always a direct relationship between Science and Conservation.

In general, the wide relationship between Science and Conservation, developed since the second half of the XVIII century, has been achieved through three models (Table II).

Table I. General questions that laboratory studies try to answer.

Question	Aspects involved
What is it made of?	Identification of materials
How was it made?	Identification and characterisation of the techniques and technologies
When was it made?	Dating
Where was it made?	Determination of provenance
Who made it?	Determination of authorship
What purpose did it have?	Determination of function
What is its conservation condition?	Diagnosis of the conservation condition
How did it change?	Determination of the alteration mechanisms
How to preserve it?	Establishment of preventive conservation strategies

Table II. Models of the relation between Science and Conservation.

Parameter	Model		
	Request to laboratory	**Offer from laboratory**	**Collaboration**
Reason of study	Historical problem	Technology application	Conservation and restoration or historical problem
Occurrence	Moderate	Low to moderate	Low
Direct costs for the conservator-restorer	High	Low or none	Low
Direct implication in Conservation	Low	Variable, but frequently low	Variable
Main problem	Study inadequacy	Incomprehension of the historical and artistic aspects	Difficulty in communication
Dissemination type	Report	Paper on international journal	Article or book chapter

One of the models, the request to the laboratory, corresponds to the situation where someone contacts a laboratory to obtain information about an object. This model goes back at least to the 1770's, when Thomas Pownall asked the head of the Royal Mint for help for the identification of a metal alloy used in prehistoric swords [6], but it is still current nowadays. Typical cases are those in which a conservator-restorer uses the services of a laboratory, for example, to identify the constituent materials of the work to be treated and to improve the intervention report. Due to the cost of the services, the study is generally limited and the results have little impact, at least in the Conservation field.

Other model is the opposite, the offer from the laboratory, which occurs when someone from the Sciences proposes a project involving works of art or other cultural heritage objects. The underlining intention is to apply the knowledge and technology developed for other purposes to new domains and, thus, to enlarge its area of influence. An early example was the proposal of renowned chemist Humphry Davy on the 1810's to develop a chemical process to allow to unroll quickly the scrolls found during the archaeological excavations at Herculanum, in Italy, for which only a time-consuming mechanical method existed at the time [7]. More recently, the laboratory offer has increased significantly, specially since 1995, when the Molart (Molecular Aspects of Ageing in Painted Works of Art) project started [8]. This is probably due to the increase of competitiveness within the scientific fields and the consequent tendency of extend their areas of influence. This great offer is clearly revealed by the significant number of papers devoted to the study of the cultural heritage published in journals of Chemistry and Physics, often in thematic issues [9]. It is because of this that there are more papers concerning cultural heritage issues published in journals from other areas referenced on *ISI Web of Knowledge* than published in journals dedicated to cultural heritage (Table III). Looking for answers to particular problems of scientific disciplines rather than to conservation problems, the papers published in Chemistry and Physics journals frequently have little impact on the cultural heritage field, in particular on Conservation, despite the existence

Table III. Number of papers published between 2005 and 2011 on some topics related to Conservation found in ISI Web of Knowledge (search performed on 09.25.2011).

Topic	All journals	Cultural heritage related journals*	
	Nr.	Nr.	% **
Conservation AND Restoration AND Art	158	11	7
Painting AND Conservation	295	68	23
Painting AND Conservation AND Analysis	139	6	4
Painting AND Pigments	466	36	8

* *Archaeometry, International Journal of Architectural Heritage, Journal of Architectural Conservation, Journal of Cultural Heritage, Journal of the American Institute for Conservation, Restaurator, Studies in Conservation.*
** *Percentage of papers published in cultural heritage related journals in relation to the total number of papers related to the topic.*

of notable exceptions such as the studies from the Molart project. The exceptional situation of this project was certainly due to the fact that it started as an offer from the laboratory but it rapidly developed into other model.

This model, the third type of the relation between Science and Conservation, corresponds to the collaboration, in which the work is conceived, planned and developed by a multidisciplinary team working in consonance. This type and its advantages started to be discussed after the *First International Conference for the Study of Scientific Methods for Examination and Preservation of Works of Art* organised in Rome in 1930 by the predecessor of ICOM. From this conference resulted a manual on the conservation of paintings written by an international multidisciplinary group [10]. However, the first major study carried out in this way was the study of the *Adoration of the Mystic Lamb* by Jan van Eyck, coordinated by Paul Coremans in the early 1950's [11]. The team was composed of chemists, biologists, art historians, conservator-restorers and archivists.

This type of relation, certainly the most advantageous from the conservation point of view, is relatively uncommon due to the communication difficulties between the areas that need to be involved, which belong to two different cultures [12]. These difficulties not only undermine the development of studies but also create some conflicts and delicate situations. On this respect, J. R. J. van Asperen de Boer, the inventor of infrared reflectography, made in 1998 an important and clear statement based on his experience of many years about the impact of Sciences in Art History: "The *Oxford Dictionary* defines 'impact' as 'striking (on, against), collision, effect, influence'. The author has held a chair of 'scientific examination of works of art', being a physicist by training but operated professionally for more than twenty years within an institute for Art History, and would obviously prefer 'effect' or at least 'influence' as the accepted connotation. Unfortunately endeavours to use – or even better – integrate methods of scientific examination in art history are not infrequently seen as 'striking against' art historical views or traditions and may thus well lead to 'collisions'" [13].

The communication difficulties, which naturally also affect the other models, have been addressed and some progress has occurred in this regard in the last decades [14]. However, some recent technological developments oppose this trend. The same van Asperen de Boer also commented this fact when he stated, concerning the Molart project, that "the specialized language used by the participating scientists is not easily grasped

by restorers and art historians, not even by the present writer trained as an experimental physicist" [8].

The problems that derive from the existence of both cultures also manifest themselves in the publication of studies.

On the one hand, as already mentioned, many papers have appeared recently in international journals of Chemistry and Physics. However, they focused on the search of new areas of application of knowledge, techniques and technologies developed elsewhere and end up giving little importance to the works of art and their problems, besides being difficult to read for most conservator-restorers.

On the other hand, the most adequate journals to publish studies that address issues related to conservation problems, material history and technical characterisation of works of art are unattractive for chemists and physicists. This space is available in the Conservation journals, specially in those with circulation predominantly limited to a country or to a small set of countries, such as *Conservar Património* (published by ARP, Associação Profissional de Conservadores-Restauradores de Portugal) [15], *ECR - Estudos de Conservação e Restauro* (published by Escola das Artes of Universidade Católica Portuguesa) [16] or *Geconservación* (published by the Spanish Conservation Group of the International Institute for Conservation of Historic and Artistic Works) [17]. The problem is that chemists or physicists have little or no interest on such journals. Scientists have a publication dynamics very different from that of conservator-restorers: they almost limit themselves to publish in journals indexed on *ISI Web of Knowledge* and any other publication has a negligible impact on their curriculums. Because Conservation journals with national circulation are not part of this group, it is difficult for them to receive any study involving Science and Conservation.

Although this may not be evident at first sight, the problems related with publishing have equally important implications on another level, namely on the financing of institutions dedicated to Conservation and Restoration.

Despite these problems that derive from the existence of two cultures, and the ignorance that conservator-restorers often have of the details of the analytical processes, these professionals may have a fundamental role on the laboratory study. Indeed, contrary to what one might expect, questions that may be made based on direct and deep knowledge of the materials might influence the entire analytical process. This is particularly evident in the case of identification of the binding media used by Rembrandt, described in detail by Ernest van de Wetering [18]. Shortly, the case started with the idea, which had been gaining importance on mid-nineteenth century, that some effects found on Rembrandt's paintings resulted from the use of a mixture of oil and resin. Thus, as soon as the analytical techniques allowed it, in the 1980's several paintings by Rembrandt were analysed and the presence of resin in the binder was tested. However, according to the results obtained by gas chromatography - mass spectrometry (GC-MS), the binder consisted only of oil, since no trace of resin was detected. Given the experience and reputation of the laboratory, these results meant that the effects were only due to the excellence of Rembrandt's technique. The results were generally accepted by those working in the laboratories but were rejected, or at least, doubted by those who knew in detail the subjects regarding to the matter of the painting. For this attitude, the justification was that each material has its limits and, thus, as good as Rembrandt's technique was, the mixture of oil and resin could not allow

to obtain the diversity of the plastic effects observed on the surface of some works. It was then possible to conduct further analysis in other laboratories, this time using other techniques, namely high-performance liquid chromatography (HPLC), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM). These results showed the use of emulsions formed by oil, water and egg, which have rheological properties that may explain the variety of the effects. The differences between the results obtained in the two studies are not due to the technological development that occurred but mostly due to the fact that the analysis were oriented in different ways: in the first case for the detection of resins, in the second for the detection of other possible constituents. So, the analytical results were decisively determined by those who knew well the materials, as it is the case of conservator-restorers, ignoring even how the equipments operate. After all, this is merely an illustration of a general situation: there are no good answers without good questions.

Note

This text is the essence of the communication presented by invitation at the *I Encontro Luso-brasileiro de Conservação e Restauro* that took place on September 26, 2001 at the Universidade Católica Portuguesa, Porto. I would like to thank the welcome given to this communication, specially by the speakers that followed. I also thank Rui Bordalo for his invitation to address this issue and for the English translation.

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