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COST D42 – ENVIART: A EUROPEAN NETWORK IN CONSERVATION RESEARCH

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ABSTRACT
COST stands for Cooperation in Science and Technology and is the longest running network funding organisation in Europe. Within the COST networks, Action D42 is dedicated to the role of the indoor environment on the behaviour of the materials present in archives, libraries and museums. Under storage, use and or exhibition. The indoor environment consists of many components able to deteriorate our cultural artefacts. Components coming from both the outdoor and indoor air. Networking in this field is therefore very important, in order to exchange knowledge, to cooperate and not to duplicate research. This paper gives a overview of EU networks and give in more detail the role of COST Action D42 in networking and research.

INTRODUCTION
The conservation of cultural heritage is a duty for all nations, due to ethical reasons. Only very slowly decision makers start to understand that caring about cultural heritage and especially about museum, library and archival collections is also a valuable long-term investment for their economy and in the interest of their citizens. The accessibility of movable heritage depends not only on the direct conservation of it but also on the preventive conservation actions as the quality of the indoor environment is decisive for the preservation of a collection. Sensitive materials, displayed in an aggressive environment may suffer from chemical attack of pollutants, leading to irreversible damage within only a few weeks of inappropriate exposure. The interpretation of results on the impact of pollutants on the degradation of the artefacts (in combination with other environmental parameters, such as humidity and temperature) and consequently, any appropriate measure to prevent damage requires a close collaboration between multidisciplinary key players: chemists concerned with environmental effects and material degradation, conservators, conservation scientists, art historians, curators, environmental engineers, show case manufacturers, and even politicians and decision makers concerned with international standards.

Within the EU Research Initiatives (from PF2, 1986 till PF6, 2006) 106 projects have been dedicated to cultural heritage. Among these projects, 20 years of European Research Initiatives are being carried out in the field of Cultural Heritage [1]. The main goal is to reinforce the scientific basis for the establishment of measures and methodologies for the protection and rehabilitation of the European Cultural Heritage. But how we reach the stakeholders?

One of the instruments is networking. Networking activities can be found in the European Framework programmes but also in COST actions. COST, European Cooperation in the field of Scientific and Technical Research, is one of the longest-running instrument supporting co-operations among scientist and researchers across Europe [2]. Within COST there is the COST Cultural Heritage Interest Group an umbrella covering COST actions 625, A27, C17, C20, G1, G7, G8 and D42. Within these COST actions, not only topics are discussed on researching the materials of our cultural heritage in art, archaeology, the built environment and conservation but also on how take the correct precautions to have our heritage accessible

for the future. Action G1 'Application of Ion Beam Analysis to Art or Archaeological Objects' was launched in 1995 and is the first COST Action specifically devoted to cultural heritage research. The action ran for 5 years aiming for example to promote exchanges between the various laboratories or scientists involved in this activity throughout Europe.

Other actions dedicated to the aim of this conference are for example: COST G7 was dedicated to Artwork Conservation by Laser and has been set up to address challenges in three main areas: Laser systems for investigation and diagnosis; Laser systems for real-time monitoring of environmental pollution and Laser Systems for cleaning applications.

The main objective of the COST Action G8 is to achieve a better preservation and conservation of our cultural heritage by increasing the knowledge in museum objects through non-destructive analysis and testing. Close related to this network is the COST D42.

COST D42 - ENVIART

On June 28, 2006, COST Action D42 'Chemical Interactions between Cultural Artefacts and Indoor Environment (EnviArt)' was accepted. Aim of COST D42 is to explore chemical interactions between cultural artefacts and typical indoor environmental conditions through field studies and laboratory experiments and transfer the results into preventive conservation practice. This COST Action D42 shall establish the links between the Old and New European Research Initiatives and broadens it with new sections and co-operation initiatives. Within this action there 3 working groups have been established. WG 1 on Preservation (with task group 1 'degradation and stabilization' and task group 2 'Prevention'), WG 2: Analysis (with task group 1 'materials' and task group 2 'environment') and WG 3: Guidelines (with task group 1 'methods' and task group 2 'storage and health'). Members of the Management committee of COST D42 can be found at:
http://www.cost.esf.org/index.php?id=188&action_number=D4.

The structure of the full network, where at present 24 countries belong to, is presented in Figure 1.

COST D42 Structure & Focus					
WG-1 Preservation		**WG-2** Analyses		**WG-3** Guidelines	
TG1: Degradation & Stabilisation		TG1: Materials		TG 1: methods	
TG2: Prevention		TG2: Environment		TG 2: storage & health	
Focus 1.1: • Effects air pollution on degradation • Strategies for stabilisation • Field and lab studies	**Focus 1.2:** • Pollutants and artefact • (Chemical) air purification • Development new strategies & Innovative methods	**Focus 2.1:** • Analyses object • Analyses environment • Non-destructive tools • Building materials	**Focus 2.2:** • Assessment VOC • Endogenous and exogenous emissions • Particulate matter • Sampling	**Focus 3.1:** • Development new standards • Assessment (and) • Evaluation current methods and standards	**Focus 3.2:** • Healthy storage guidelines • Handling •Exhibition
Common focus: • Fundamental Research, Dissemination and Education					

Fig 1. Cost D42 structure

WG 1 – Degradation and Stabilization

Within our working group 1, discussions are on going for the application of sensitive techniques such as AFM, HPLC and synchrotron FTIR and XRD in order to improve our understanding of the chemical changes occurring to e.g. proteinaceous materials in different environments. Based on the knowledge of deterioration processes, and influences of environment on the material, strategies can be set for preventive actions. Furthermore strategies are discussed for the active prevention of our cultural properties. Correlations have been made between the microscopic and physical properties of such materials, dramatically improving our early assessment of damage and allowing an artefacts vulnerability to catastrophic environmental changes to be assessed. Questions raised as 'what will happen if 10 years encapsulated into Stabiltex fabric Dead Sea Scrolls are reopened [3]. Aging experiments are fundamental in this area of interest of COST D42 and the results are heavily influenced by the methodology [4]. The combined WG meetings developed this important area and improved experimental technique. The base of these discussions and improvements in research and application was initiated from the discussion around the COST strategic conference, 'Past, Present, Prediction' in Ohrid.

WG 2 – Analyses

Analyses play an overall role within D42. Destructive and non-destructive ones. And application of newly developed tools. Based on the three principal meetings, in Ohrid (FYROM, June 6), Padova (Italy, October 4th) and in Copenhagen (Denmark, November 24), the topics could roughly be divided to analysis of artefacts and analysis of the environment. Considering the lively activity within this WG, we foresee that rising areas of research are the use of spectroscopic methods in combination with chemometrics, the use of chromatographic methods for both environmental analysis and polymeric materials (natural and synthetic), and environmental monitoring [5-7].

WG 3 – Guidelines

The input of WG1 and WG2 forms the motor behind the work of WG3. There is also a strong synergism between D42 WG3 with the European standardization body CEN, TC346 WG4 [8]. Recently this resulted in a first discussion on the harmonized application of simple industrial devices measuring the relative humidity. Here standardized sensors are applied, however the housing design made the sensors not responding adequately. Items as: 'new specification for light and lighting for exhibitions of art and artworks'; 'harmonization of indoor environmental conditions'; scientific differences between current methods for artificial pollution'; 'RH in cultural heritage and interaction of moisture with historic materials '; and 'the role of a historical climate' were frequently discussed. Based on scientific discussions advice was given for the development of new CEN Documents e.g. 'N129 on recommendations for showcases'; and 'N127 on guidelines of environmental conditions' [9].

Short Term Scientific Missions

STSM is an instrument which can be applied for exchanging researchers from one institute to another institute in order to e.g. learn new techniques or to solve certain problems. There are some restrictions. The Home and Host institution must be a so called COST member state, the duration should be preferable 5 days and there is a maximum grant per mission. For this purpose COST D42 has STSM four calls per year which are evaluated. A STSM proposal must address to the aim of D42. More information can be found at the COST general website and at www.enviart.org.

CASE STUDIES

Following, three case studies will be described, showing the technical working areas of D42.

Study on Preventive Conservation – The Indoor Environment

Many literature is available on the best storage conditions for materials. It is nice if one can affort an installation keeping the indoor environment at such conditions that the deterioration of the materials will be as less as possible. Let us have a look at different examples.

The first example is found in Romenia, The ASTRA National Museum complex [10]. This work was presented by Marta Guttmann We all know; the aim of a museum is not collecting items, but to keep the items in such condition that they can be accesses by our childern childrens children. This museum is an open air museum and takes care over 70,000 objects stored over 300 ethnograpic buildings. The objects are located in two permanent exhibitions, three temporary exhibitions, in the houses of the open air museum and in eight different storage areas (6 in the historic center, 2 in the open air museum). The depots are overcrowded, they have no climate control of any kind, and even one of them is not heated in winter. The temperature and RH are occasionally measured while no pollution level was ever determined. This example shows how complex it can be, to keep a collection in a good condition.

For the second example, the Trinity College in Dublin is taken [11]. This work is based on presentations at D42 meetings by Susie Bioletti. The old library at Trinity is located in the hearth of Dublin, Ireland. It is surrounded by a green area; however main roads are located fully around that area. Also, and this is without any doubt, this city is alive for 24 hours a day. The old collection has not been moved for many years and to keep the unique collection in a reasonable condition a conservation plan was established. The main problem of the collection is dust. Enormous amount of dust deposit on the books coming from outside as the building performance can be seen as not one of the best. Dust produced by the traffic, industry and other sources is able to enter freely into the building. Furthermore, dust was brought into the building by the many visitors and due to deterioration of the collection. Based on the conservation plan, funding was approved to clean the whole collection, which sounds easy but is really not an easy job. One of the instruments that will be used is the “Depulvera”, a semi automatic dust cleaner. Besides cleaning, serious discussions are going in within D42 to give assistance to the project by exchanging knowledge on analyses, prevention and building performance.

The third example is taken from an Archive. In the Netherlands a national research program was dedicated to investigate the positive effects of air purification in Het Nationaal Archief (The Hague, Netherlands). Within this project, it was demonstrated that the role of outdoor air was excluded by developing the so called Delta Class 1 filter system. It was also found in these studies, that the role of NO and NO2 was more severe than previously was suggested. The study took 10 years and it was well demonstrated that materials deteriorated less when stored under purified conditions that under non-purified conditions [12]. However, maintain the performance of the installation cost a lot and therefore new developments in purification are welcome to reduce both maintenance costs and energy costs.

Study on Analysis – Examples of Non Destructive Techniques

In the field of analysis two examples will be mentioned here. One based on Near Infrared Spectroscopy and one on Spectral imaging. Both systems can be seen as non-destructive and can be applied for e.g. the identification of the origin and quality of objects in paper for those cases the eye of the master fails [13]. For example the fibre origin determination of paper and

the determination, especially the determination of inks. Studies showed that the combination of NIR and chemometrics is a powerful tool for the determination of paper fibres origin non-destructively. Furthermore, and this will shown more extensively at the International Event on Paper and Writing event in Slovenia (see http://www.paperdurability.org) as within the European Research Project SurveNir dedicated correlations are made with the NIR signal and paper performances including natural ageing [7].

The other interesting tool is based on Multispectral Imaging and False colour infrared photography (FCIR). Researchers concluded during the MIP Network (2002-2005) time and after, that this methods can be applied non-destructively for the determination of the origin of inks[14, 15]. And even more, latest developments turned out into the so called Hyper Spectral Imaging, able to measure at different wavelengths simultaneously and that the method can be applied for e.g. determining the origin of smaller parts coming from the Dead Sea Scrolls and thus it will be helpful in making the puzzle [16].

Study on Harmonization – The Indoor Environment

As mentioned previously, harmonization is an important step in conservation and conservation research. It is well know, that contra-arguments are given as 'each object is unique, so why should we standardize?'. However, there are more arguments to found proving the need for harmonization, and only one will be mentioned here. During one of the work group meetings of D42, Prof. Camuffo showed in his presentation different methods/sensors for the determination of the relative humidity in indoor air. If we measure the RH in the air, it is a close proximity to the target artefacts surface as well in the free air in an undisturbed position [17]. For this purpose many sensors are developed and designed for example the hair hygrometer, the capacitive sensor and the resistive sensor. Looking at the capacitive or resistive RH sensor, than it is obvious that the manufacturing such sensor is well defined at different companies. Indeed, several types of sensors have been described by international standards, and as a sensor they give reproducible results when re-calibrated frequently. However selling only a sensor makes no money, and therefore they are packed in a probe or a sound case. This design however may make unsound readings as was proved by Camuffo´s work. Thus not only the sensor needs standardization, also on how it will be used. Furthermore members of D42 and CEN TC346 are having serious discussions on storage conditions and guidelines. Here also the results of the work coming from EU co-financed projects are involved as the PaperTreat project, dealing with the preservation of acidic paper by means of deacidification [5].

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