ABSTRACT

How should complex, interwoven and fragmented pieces of art be dealt with, particularly when housed in areas that are permanently open to the public? The University of Bamberg, Germany, initiated two studies on this issue. Detailed research was carried out utilising the murals found in the Dominican church located in the centre of the UNESCO world heritage city of Bamberg. The issue was broken down into three objectives: development of a thorough understanding of how to decipher the meaning of artworks; establishment of appropriate conservation methods for the murals; a means of creating a full appreciation of the murals’ rich and vivid history by visitors with different levels of prior knowledge.

INTRODUCTION

It is relatively common to encounter artworks that have become fragmented over time, and are consequently very difficult to understand. How should complex, interwoven and fragmented pieces of art be dealt with, particularly when housed in areas that are permanently open to the public? The University of Bamberg, Germany, initiated two interdisciplinary studies on this. Detailed research was carried out utilizing the murals found in the Dominican church located in the centre of the UNESCO world heritage city of Bamberg. There were three objectives: development of a thorough understanding of how to decipher the meaning of artworks; establishment of appropriate conservation methods for the murals; a means of creating a full appreciation of the murals’ rich and vivid history by visitors with different levels of prior knowledge.

The study began by documenting the site. In 2005 an interdisciplinary team was formed and a pilot project established to create a comprehensive inventory and condition report of a sample area of the murals. This used the latest 3D techniques (mobile mapping system, MMS), and the results were stored within the digital building archiving system (DGA). The second study addressed the last of the above objectives. A team of conservation professionals and psychologists was formed to focus on the following questions:

- Why do the majority of visitors to the hall cut their visit short?
- What are their considerations?
- Are there different types of viewers and if so do they have varying interests?
- What motivates a visitor’s interest?
- How can the visitors’ experience be optimized?

The Dominican church has complex ecclesiastical architecture typical for an order of fourteenth-century Dominican mendicant monks, making it ideal for such research. Both the building and its contents have had a particularly arduous history, resulting in many of the murals being very fragmented. A quick historical review reveals why. During the fifteenth and sixteenth centuries the Gothic church was embellished with a vast array of intricate and high-quality religious murals. Secularization during the Baroque period brought a range of dramatic changes to the building. The church exercised extensive control over the murals, and during various phases of different doctrines, the murals were subject to further enhancements, modifications and overpainting.

Between the 1800s and the late 1920s the church became a military camp, until made available after the Second World War to the Bamberg Symphony Orchestra, when it became a major culture and performance venue. In 2002 the church came under the auspices of the University of Bamberg, and began distinguished service as the university’s official ceremonial hall. It now carries out the full range of functions that one could expect of an academic institution, e.g. congresses, concerts, examinations, etc., Fig. 1. The hall’s rich history and more recent use by various authorities have led to the murals becoming extremely fragmented over time. Deciphering their myriad of complex multi-layered fragments is an extremely difficult task for conservation professionals, and an almost impossible task for the layman.

The first aim of conservation is the preservation of the cultural object itself. The second is the retention of an object’s authenticity. It is not uncommon to find artworks whose remaining fragments have been restored to their original condition, only to find that visitors still consider them difficult to interpret.

THE DOMINICAN CHURCH AT BAMBERG: THE UNIVERSITY’S CEREMONIAL HALL

Bamberg is a centuries-old imperial and diocesan city situated in Upper Franconia, Bavaria, Germany. In 1993 UNESCO listed it as a World Heritage Site. The city boasts a comprehensive collection of monumental buildings that span more than 1000 years. The Dominican church is one of Bamberg’s most prominent buildings from the late Middle Ages, and is situated in the early settlement area known as the ‘Sand’ between Cathedral Hill and the Regnitz River. The mendicant monks’ cloister formed a significant centre of Dominican-inspired spiritual guidance and
Fig. 2  The murals of the Dominican Church.

thought from the beginning of fourteenth century to the beginning of secularization [1].

The church was filled with murals of the highest artistic quality, reflecting Dominican beliefs, which transformed a once simple church into a magnificently adorned chapel. Throughout the centuries further murals were either added to, or simply painted over, those already existing, presumably because of changes in religious beliefs or simply due to a lack of space. This procedure has lead to a comprehensive inventory of highly complex overlapping murals from different epochs. There was no overall creative plan for the murals. Each is distinguished by format, execution technique(s) and individual artists’ unique brushwork.

As a result of somewhat extreme renovation measures during the Baroque period, the murals disappeared from memory for centuries under layers of whitewash, only to be rediscovered at the beginning of the twentieth century, during further renovations. Between 1934 and 1935 there were attempts to recover the mediaeval paintings: however these attempts are now the subject of somewhat intense criticism [2]. Within the first two years large areas of the wall surfaces were re-exposed, and more recent layers destroyed, using what are now considered to be unsuitable tools. At the time the multi-layered nature of the paintings was not recognized. It was not until substantially later that multiple layers were recognized and then taken into consideration during the search for unexposed murals. Earlier activities have left a confused array of fragmented mural phases, and countless surviving areas of whitewash, Fig. 2. Although the paintings had been recently exposed, many remained unseen by the public at large after the church became a concert hall, and curtains were draped over the murals to improve the acoustics.

DEFINING THE PROBLEM
The opportunity to experience the high-quality range of images as significant design elements of the church is not currently available to visitors, or is severely restricted, due to their poor legibility. Unlike many other churches where the essence of the paintings is immediately understandable, viewers must remain in the Dominican church for reasonably long periods to gain a sense of its aesthetics. Detailed explanations of the iconographic contents, and various object histories, are necessary in order to capture the viewer’s interest in the severely-damaged artworks. The former church has an extensive array of conservation problems, yet must simultaneously act as the university’s assembly hall.

THE BAMBERG RESEARCH PROJECT
Between 2005 and 2007 a range of murals within one area was selected, with the intention of developing an overall conservation plan for the mural fragments throughout the church, through contributions from the university’s conservation scientists, information technologists and theoretical psychologists. Each group focused on a specific aspect. The conservation scientists dedicated themselves to solving technical issues, the information technologists to digital survey of the site, and the psychologists to analysing overall perception by the public at large [3]. A team of dedicated freelance conservators and students of the Erfurt University of Applied Sciences carried out conservation treatments in 2006–2007.

THE MURALS OF THE WESTERN WALL
The centre of the nave’s western wall is nearly completely covered with a rich tapestry of murals extending over 30m², including religious images for both prayer and contemplation, Fig. 3. The first layer of murals is believed to have been applied shortly after the completion of the nave itself in the 1400s. The monumental mural is prominently placed within the church between two Gothic windows and shows the Volto Santo (holy face). It has been established that the lower mural was developed either at, or very close to, the time that the Volto Santo was created. More than 16 religious figures can be seen in their individual niches. The figures are difficult to recognize because later artists subsequently overpainted many of them.

In the course of time further images were added. A portion of the original mural was overlaid with a square of ochre-coloured primer, and can no longer be seen. At the beginning of the sixteenth century the complete area was further overpainted with a depiction of Christ’s Descent into Limbo. Only a few fragments of this later image still remain, Fig. 4.

INVESTIGATION AND PRESERVATION OF THE MURALS
Initial investigations digitally recorded and scanned the murals in 3D with the help of the European Union projects VITRA and Reaching Recording Standards (RRS) [4]. The Dominican church offered conservation scientists a unique opportunity to study a wide spectrum of painting techniques used between the Middle Ages and the early nineteenth century. No in-depth knowledge of northern Bavarian mural techniques had been amassed before. This allowed the previous phases of the church to be reconstructed, and gave an incisive understanding of the ever-changing requirements of the order of Dominican mendicant monks, and related building phases. This is important, since only minimal records about the church’s construction and history have been retained in local archives.

The second aspect was long-term preservation of the mural. A new digital mapping tool known as MMS was made available to the project by the Chair of Computing in the Cultural Sciences department. This cutting-edge technology was utilized to record damages digitally onto a laptop, while observing the murals from the scaffolding. The innovation lies in the storage of metadata during manual mapping. Such detailed mapping is an important tool because it allowed the conservators to identify damage pro-cesses and track their effects over time. The environment was also monitored to aid identification of the causes of damage.

ISSUES ENCOUNTERED WHEN HANDLING FRAGMENTED ART
A number of questions were raised with regard both to the aesthetic appearance of the murals and the degree of retouching that should be applied. Purists consider that the murals should be accepted with their historical background as they currently exist, and suggest that all overlying murals and changes should remain as they currently are, i.e. with minimal, if any, aesthetic
enhancements. More progressive perspectives suggest that the murals should be enhanced to improve viewers’ perception.

The goal was to preserve the fragmented nature of the murals while making the various painting phases simultaneously identifiable. To this end a number of areas that had suffered colour loss were retouched, based on discussions with the help of virtual aesthetic visualizations, Fig. 5. However, even with these enhancements, viewers found the fragments difficult to decipher. This raised the question of how to optimize communication with visitors. What purpose would be served by passing on information to viewers? Which form(s) of communication should be applied to optimize the communication process overall? Would these form(s) be applicable in these specific situations? It also raised other questions about the visitor’s ability to comprehend the murals’ fragmentary nature. How do fragmented murals affect viewers? What are their specific thoughts and deliberations? How can conservation professionals deliver a satisfying experience to viewers?

The second study, focusing on optimizing the viewer’s ability to interpret the fragments, was developed in conjunction with the University's Institute of Theoretical Psychology. An interdisciplinary discussion was initiated to review the range of solutions available. Although a range of investigations into the specific cognitive processes and perceptions in the area of aesthetics had previously existed, very little in the way of an integrated theory encompassing the full breadth of all aesthetic experiences and their related complex perception, cognition, motivation and emotional interactions existed.

A GENERAL PSYCHOLOGICAL EXPLANATORY MODEL

The ψ-theory of Doerner et al. offers a comprehensive theoretical reference framework for the analysis of such aesthetic knowledge transfer processes [5]. It describes art as an information process that is motivationally directed. The differences between direct and indirect factors influencing aesthetic perception were based on the application of Fechner’s classic Vorschule der Ästhetik (Preparatory Aesthetics) [6]. As Halcour identified, perception of a work of art is influenced by indirect factors that awake personal memories, e.g. personal experiences and associated feelings [7]. Direct factors such as colour and shape or spatial structure determine the degree of order and disorder i.e. the ‘uncertainty’ of a fragment. If there is too much disorder then the viewer’s interest will be prematurely lost. Where too much order exists, the viewer can become easily bored. For the viewer to appreciate a fragment fully, a balance needs to be struck between uncertainty and its corresponding ability to be resolved.

PRELIMINARY STUDY OF PERCEPTION

An obvious consideration when analysing viewers’ perception processes and the associated complexities is to incorporate a representative sample of all viewer types and then to analyse the resulting focus groups.

The participants selected for the preliminary study were divided into groups according to their occupation and prior knowledge levels (no previous/ basic/expert knowledge). These groups were then subdivided according to age (children and
The participants’ prior knowledge was established through these questions:

- Do you like viewing churches and museums?
- Do you often involve yourself with art history?
- How important is art for you generally?

Demographic data from each participant was collected with regard to age, marital status, religion, place of residence and profession.

THE SEMI-STRUCTURED INTERVIEW

Each interview was made as identical as possible: participants were exposed to the same mural area, questionnaire, observation plan and video documentation process. The interviews took place without any time limit.

First observation phase: contemplation without information

Participants were initially exposed to the murals without any preparatory information. They were encouraged to think aloud and were provided with a laser pointer to assist in identifying the areas that they were contemplating.

The participants were then asked:

- What interests you about the murals?
- Exactly where did you feel that you needed more assistance during your contemplations?
- What were your impressions about the murals during your contemplations and why?

Second observation phase: contemplation with information

The second observation phase then followed. The participants were presented with the same information about the murals in one of two alternative formats: a flyer containing a brief summary of the murals’ meaning and the techniques used for their conservation, or the same information verbally. Participants were simultaneously offered the opportunity to ask questions with both formats. The participants, now equipped with background knowledge about the murals, were once again asked to repeat the exercise in full.

Then they were asked:

- How helpful was the further information to your contemplations and was any relevant information lacking?
- What were your impressions about the murals after receiving the additional information and why?

How do you think that the murals could affect other visitors?

What is your personal impression of the restoration of the murals?

What is your personal impression of where the difficulties with such restorations could lie?

EVALUATION OF THE INTERVIEWS

To structure the interviews, a system of 17 thinking phases was created (e.g. hypothesis formation, creation of associations, evaluation of participant’s various considerations). The focus groups were analysed by psychologists using videotape. The data was analysed with interaction-analysis software (Interact) which gave a breakdown of each individual participant’s thinking phases with regard to viewing duration. Of particular interest were both the inter- and intra-individual results (i.e. analysis between the various focus groups and also those of specific individuals from within any focus group).

VIEWING PATTERN EVALUATION

To identify and measure each participant’s viewing patterns two groups of participants were selected. Both groups were subject to questioning, however, one group was provided with additional background information about the murals. The interviews were then videotaped, and the data analysed in detail.

First method: independent observation of viewing path over time

With the first method the murals’ picture elements were subdivided by category. The interaction-analysis software made it possible to evaluate the viewing path that each visitor took through the picture elements, so the research team could accurately identify how many elements each participant viewed, to determine where his or her interests lay. Furthermore the duration of viewing time was established, to clarify specific areas of interest. Further observations were made of how often participants changed their view, and how often they repeated their viewing of a given mural, Table 1.

Second method: visual representation of pointer movements

Psychologists reviewed the videotapes of participant’s viewing paths and had access to photos of the murals. This allowed researchers to reconstruct precisely each participant’s viewing path, the objects of interest, and the viewing sequence, Fig. 6.

INITIAL STUDY RESULTS

The initial results show that large inter-individual differences exist when viewing fragmented murals. Nevertheless, a number of common elements can be identified.

First observation phase

In most cases the Volto Santo mural was the first to be perceived. One participant said: “To start with, I looked at the crucifixion figure because it’s located centrally and because it’s the biggest figure overall, yes, the figure of Jesus (i.e. the Volto Santo), that was the first thing, and afterwards, what was underneath (i.e. the lower murals) and whether it had any association with it (i.e. with the upper mural)”. Generally, the longest period was spent viewing the image areas of the lower mural, Christ’s Descent into Limbo, often thought to be enigmatic and mysterious. Many of the participants turn their views towards the lower half of the mural regardless of the fact that the upper half is generally considered by the psychologists to be more complete and easier to interpret. As a rule,
a longer period was spent by viewers attempting to understand the lower portion.

The viewers usually recognized that several murals lay over one another, however most of them could not differentiate them. Their viewing patterns did not stay within a single mural image layer, i.e. they typically could not identify a single mural image. Picture elements of different mural painting phases were perceived as belonging together thematically but were often merged together by the participants when forming their conclusions. Their viewing patterns indicated that they typically roamed over the complete mural area and came to rest on the prominent picture elements (e.g. the Volto Santo).

The full appreciation of the murals by the layman is very limited without providing additional information, if it exists at all. The level of uncertainty within the artwork is simply too great. There are only a few elements within the murals that provide some indications about their nature.

When participants were asked about what further information they might have required, most stated that further information about the multiple nature of the mural images, particularly with regard to the lower part of the murals, would be helpful. One surprising result of the study was that no participant was able to identify the mural’s subjects correctly.

Second observation phase: participants provided with information

All participants considered the information offered to be helpful. The short summary, offered in the form of a flyer, did not however suffice for many participants, who were unable to understand or interpret the murals correctly. This was reflected in numerous enquiries for flyer-style information, and subsequent criticisms of the flyer’s comprehensibility.

The detailed verbal information contained references to single elements within the murals, which was appreciated and considered to be far more helpful. Many important picture elements were only recognized with the provision of further specific details and explanations.

As with the first observation phase, the second observation phase results showed that after receiving further information, participants found the lower portion of the mural of particular interest. As a rule, participants’ viewing concentrated on the lower portion during the second phase. However, it should be noted that even with the provision of further information, participants still found it difficult to distinguish the individual picture fields.

The second phase also showed that participants wanted to see ‘more’. The numerous areas of colour loss appeared to have had a negative impact on participants’ perception abilities. They often requested that the areas suffering from colour loss be filled and integrated.

Initial results: participants’ individual differences

There appear to be large differences in both the style and order of the thinking processes demonstrated across all sample groups, with regard to their consideration of picture elements within the murals. Regardless of their respective knowledge levels, the participants showed significant variations in their ability to comprehend the fragmentary murals.

An optimal approach to the transfer of information must take into account individual viewers’ needs. Knowing the broad characteristics of the viewers’ group is insufficient to identify how to customize any given approach. Surprisingly, even conservators have great difficulty in identifying the issues involved with these particular murals.

INITIAL INFORMATION TRANSFER SOLUTIONS

Doerner and Halcour established that the main motivation for the appreciation of any work of art is the viewer’s ability to identify the issues involved, and then to be able to resolve them. The murals require that participants have an ability to deal with a high degree of uncertainty in what they are viewing.

A primary objective of this approach is to optimise access to artworks by providing the viewer with a comprehensive experience that is individually tailored to meet his or her needs. The effective transfer of information about the complex murals to the public at large can be a significant platform for demonstrating the substantial benefits of state-of-the-art conservation techniques, and the significant synergies gained through interdisciplinary work.

As explained earlier, secondary colour integrations and reconstructions of the missing mural areas carried out to improve viewers understanding is, unfortunately, not possible for historical reasons.

How could such a problem be resolved? Could an ‘external perception assistance tool’ really be the solution? If so, how would it work? A future target within the framework of the projects further research activities is the provision of such ‘tools’ for viewers. A beamer, i.e. a digital projector, could be applied to highlight and virtually separate the murals with the aid of tailored projections e.g. each single mural layer could be illuminated and others excluded with the aid of light and dark areas that allow viewers to focus on a specific painting phase more easily. Such an approach could be integrated into a range of delivery mechanisms such as that of a human guide, an audio guide, or simply as required.

This ‘virtual separation’ should also increase viewers’ ability to appreciate and orientate themselves during their analysis, awaken their motivation, and encourage them to investigate further. The overall result is to increase their sense of satisfaction by allowing them to resolve the artworks’ uncertainty successfully.

An added benefit of such a delivery technique is that the exceptional characteristics of the paintings could be directly experienced in situ, and appreciated in the ambience of their original location, i.e. the murals would not be explained and presented at the abstract level of a computer simulation(s) at a separate location, but would be presented within the church itself.
Such projection tools would provide reconstructions that illuminate existing mural fragments. They also have the distinct advantage of meeting the requirement that all changes must be both reversible and distinguishable from the original.

CONCLUSION
The overriding objective of the conservation programme was to optimize all visitors' appreciation of the former church's unique murals. A main goal was to provide a descriptive and productive link between the practical problems encountered and the theoretical solutions available. The lessons learnt could be applied to other artworks. The result of such efforts is that the Dominican church should become an interesting and frequently-visited attraction in the centre of Bamberg.

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MATERIALS AND SUPPLIERS

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