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Anneli Palmsköld is Professor in Conservation specialised in Craft Science, at the Department of Conservation, University of Gothenburg. She is a Swedish Ethnologist, who used to work as an antiquarian in museums, responsible for public outreach activities. In 2007 she received her PhD in Ethnology on the dissertation Textila tolkningar: Om hängkläden, drättar och hängkläden. The study is an investigation on the production, use, and interpretation of a group of decorative interior textiles made during the period 1750–1850. As a researcher she has been focusing on material culture and making; contemporary and historical perspectives on textiles and handicraft; sloyd and home craft as idea and phenomenon as well as cultural heritage, and reuse and circulation connected to craft.

Johan Knutsson is Professor at Malmstens Linköping University. He received his PhD in Arts History in 2001 on the dissertation Tradition och egenart. Folkliga möbler, where he investigates the design, sources and making of vernacular Swedish furniture. As teacher and researcher in furniture culture his attention is directed towards techniques and materials, elements of special relevance to his students in furniture design, furniture making and upholsery. From 1981 to 2009 he was active at several museums, curating exhibitions, making research, holding lectures and publishing books in the field of craft, design and applied art. The cooperation and interaction with conservators and students as well as craft people transmitting traditional skills as intangible cultural heritage has encouraged and influenced his actions in both museums and the university´s spheres.

KEYWORDS: Art technology, Heritage science, spectroscopy, connoisseurship, folk arts and crafts, cultural heritage and sustainability

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Exploring Folk Art in Historical Interiors

By Ingalill Nyström, Anneli Palmsköld and Johan Knutsson

INTRODUCTION

In 2012 the World Heritage Committee (UNESCO) appointed seven decorated farmhouses in the region of Hälsingland as Sweden's fifteenth World Heritage Site. At the same time and with financial support from the Swedish Research Council, a multidisciplinary research group was established with the intention of exploring the decorative folk arts and crafts in the farmhouses of Hälsingland. The project, which was located at and directed from the Department of Conservation at the University of Gothenburg, was concluded in 2019. Its purpose was to investigate these interiors, analysing and interpreting them by using methods among which many are closely related to the field of craft science.

This article is about how we performed a holistic research study of decorated folk art interiors dating from 1750–1850, combining art-technological, conservation, and craft scientific perspectives. The aim of our research was to map and unfold the craft techniques and manufacturing processes, as well as the artist's and craft materials in wall paintings, painted furniture, and patterned textiles. The purpose of doing so was to gain information about prevailing conventions and social networks within a geographically defined territory in the central part of Sweden within a defined period. We use Art Technological Source Research (ATSR) combined with scientific methods as an approach, developed within the field of conservation science, in order to understand an object, its context, and the period when the object was created.

In ATSR, sources of different kinds are combined (cf. Nyström 2012). The sources can be the object itself; realia (i.e., tools used in the craft and manufacturing process); secondary and primary information from the craftsperson (i.e., prescriptions, illustrations, and other descriptions); and

contemporary information that contributes to the understanding of the context, such as manuals, taxae, and other recent research findings on the subject. ATSR also encourages the implementation of reconstructions to better understand the craft and manufacturing processes, the material used, and the object itself. Using ATSR resonates with the multidisciplinary point of departure for the research project. The approach made it possible to combine methods used in conservation science, humanities, and craft science, and to critically engage in the different analyses that were carried out. ATSR is a method that was developed as a criticism against research only focusing on one thing, for example cross section analysis, historical sources, or art historical based research. By using the folk art objects in Hälsingland as a point of departure for the research project, it has been possible to make a holistic analysis that truly combines natural science and humanities.

Making reconstructions is closely linked to the method of "Authentic Processual Reconstruction" in which the researcher tries to reconstruct the craft processes and the craft situation in order to achieve an authentic picture of how an object was manufactured (Almevik 2012, 54). A similar method is used within archaeology and is called "experimental archaeology" (cf. Nyström 2012, 21f). However, in the case of experimental archaeology, it is rare that written sources and original texts are available. In addition, the archaeologist who explores the techniques is in some cases not a craftsperson or trained in craft skills. Thus, without written sources and original texts, there is more of an experimental situation. But even in cases where historical written sources such as recipes and descriptions are available, it can be difficult to understand precisely how the process was performed (Nyström and Roxvall 2018; Palmsköld and Fabler 2018). This is due to the fact that general knowledge and, at the time, widely spread knowledge—for example, tacit knowledge, smell, and appearance—had often been omitted from the written texts. Such common knowledge can also be about specific moves and operations that need to be performed in different situations and at different stages of the craft process. This knowledge can be crucial for understanding and interpreting a craft and manufacturing process. When it fails, the reconstruction may be very difficult and can therefore require repeated attempts. Therefore, in craft science it is crucial to test different processes and techniques by performing reconstructions to understand a craft and manufacturing situation. Although this has not been a main topic in our project, our collective practical experience (formerly accumulated) in the fields of painting and textile has been crucial in our understanding and interpretation of the results.

Investigating historical objects as a starting point for the analysis and interpretation is common in some humanistic fields. Textile researcher Pernilla Rasmussen shows that objects as historical sources can offer opportunities to answer different questions, but also, in turn, generate new questions due to new facts (Rasmussen 2010, 20). She emphasises the importance of using many different sources together, to gain increased knowledge. Referring to the folklorist Henry Glassie, she writes that "the objects contain meaning not formulated in written material but left in the tracks" (2010, 19). Starting from texts alone as source material inevitably means that many dimensions are missing. Ethnologist Marianne Larsson emphasises the importance of being in touch with the objects, actively recording the perceptions of mind that the object gives—that is, to taste and feel them (Larsson

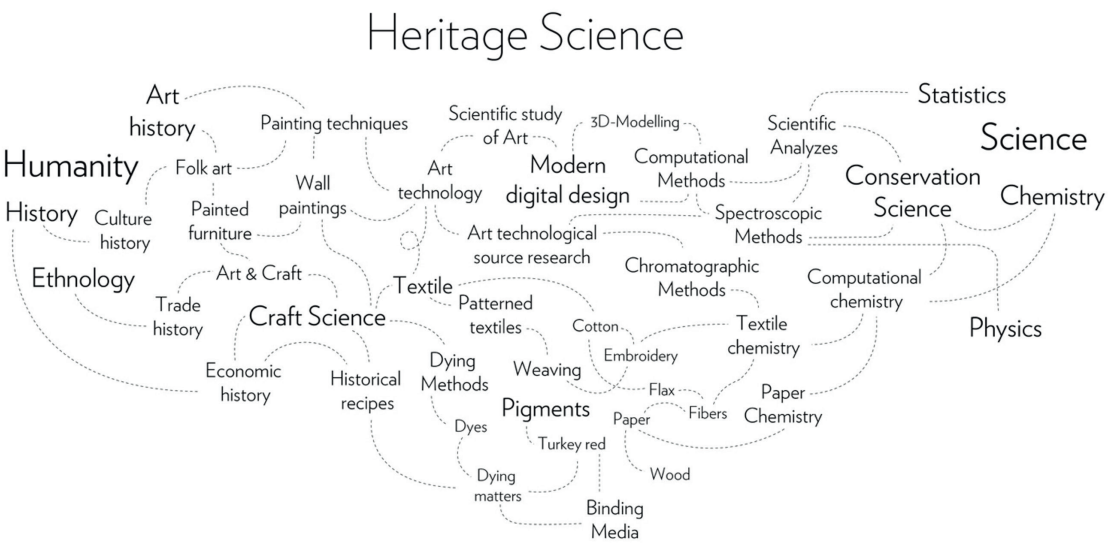

Figure 1: Starting from a comprehensive, holistic perspective in a research project within the field of heritage science involves using a combination of different perspectives, study materials, and methods. The example shows how a research project on folk art in historical interiors has been investigated. Illustration: Jonathan Westin.

2008, 31). One way of describing the method is to speak of "tactile vision,"[1] a term used by ethnologist Charlotte Hyltén-Cavallius (2007, 26). Attending to objects in this way opens up the opportunity of a deeper understanding of materials, techniques, and manufacturing processes. This is also something that happens in conjunction with a preservation situation. The conservator handles and touches the object, disassembles it, and documents it with the help of different lights, cameras, and filters. This helps the conservator to understand the construction, the raw materials, and any damage to the object in order to be able to perform the correct conservation treatments. The conservation processes thus occur over a long period of time and require close proximity to the object.

Scientific methods used in conservation science can help to deepen both the art technological research and the craft scientific research. In order to understand the craft and manufacturing process, the construction, and the material content, different types of analysis can be performed. This will help the researcher to see various layers in depth, at both the micro and macro levels. Such information forms the bases of material cultures, a field formulated by Anglo-American scholars in the 1970s and primarily directed towards anthropology, archaeology, and art history. The analysis and interpretation begin with an overview—that is, with observation and examination of the object at a macro level. This involves the use of technical equipment, special lighting, filters, and cameras, as well as a microscope. The actual material characterisation of the objects is then performed through various chemical and spectroscopic analysis. Even the historical recipes can be critically analysed using natural

science in order to understand the various chemical phases in the making processes (cf. Palmsköld and Fabler 2018). In other words, when studying the object at both a macro and a micro level, the understanding of the object increases.

In our research, we are moving within the field of heritage science, where we adopt a comprehensive, holistic approach to the cultural heritage field. In Figure 1 we present an image of the perspectives, materials, and methods that can be activated within this complex field. Thus, we use different perspectives to answer the research questions, derived from both humanistic and natural sciences. In the following, we will describe and discuss the variety of methods that we use in our research. We will be focusing on object analysis and style-historical analysis, connoisseurship analysis, reconstructions, and scientific analysis, and we give examples of results we have come up with by using the different methods.

OBJECT ANALYSIS

Using objects as a historical source and starting point for the analysis requires a wide use of different sources to gain increased knowledge. From a heritage science perspective, the first step is to analyse the object itself, to note the physical characteristics as they appear to the researcher. Materials, craft techniques, the use and reuse of the object, and aesthetics are all points that are considered. The interpretation is made during a process when the researcher is using his or her senses to determine which kind of object is in focus for research (cf. Palmsköld 2007; Pink 2009). This can be done by, for example, carefully looking at the object from different angles (vision), by smelling it, by touching it (sensation), and by listening to how it sounds (hearing).[2] The physical characteristics are documented in words and using visualisation techniques.

The next step when analysing an object is to look into the contemporary and historical context. The folk art objects[3] in focus for our research project are in the possession of museums, homestead museums, and individuals. In the case of historical collections at institutions and non-profit associations, the objects are labelled, registered, and catalogued, and the data constitute an important part of the information and knowledge about them (Palmsköld 2007, 37ff). Previous and current ownership conditions are important pieces of information that are noted, as well as any conditions associated with the circumstances under which the object has been collected. The object's previous ownership testifies the networks it has been a part of. But the records are also a way of adding information that is not apparent from the object itself. In the case of private owners, the same kind of records seldom exist. On the other hand, there may be relevant oral or verbal information about the history of provenance and about the context that the object has been part of which may also be supplemented with genealogical data. In both cases, complementary information can sometimes be found in images and art works, where the objects have been visually interpreted and represented.

When the object has been documented, the written and oral information available has been noted, and images are added, the analysis will continue. Frequently asked questions may refer to:

- Materials, manufacturing and craft techniques and processes
- Function/use (use and reuse)
- Shape, design, and decoration (aesthetics)
- The context, origin, and history of the object (including its different values in the context they have been part of).

The analysis can be completed using natural scientific methodology, for example using mi-

croscopy to determine which fibres are part of a textile, or chemical analysis can be performed to understand which binders and pigments have been used in a painting. The aggregated documentation forms the basis for ongoing analysis and interpretation—in this case, an interdisciplinary approach that allows multiple perspectives. In this context, knowledge and experience in practical skills are of importance to help to find reasonable conclusions.

One example of how object analysis has been used as a method in the research project is connected to the textile craft technique of crocheting. This is a technique that has not been studied as thoroughly as other lace-making techniques, and how it was practiced in a Swedish context is less known. However, it is known that a crochet pattern was published in a Dutch magazine in 1824 (Palmsköld 2017). When analysing and documenting interior textiles in Hälsingland, two examples of white cotton lace made by crocheting were discovered. One was marked the year "1827" and the other was marked by the letters "MED". By using the letters, it was possible to identify the owner of the textile and it could be dated to before 1815 (Palmsköld 2017). In both cases the objects were analysed to establish whether the two pieces of lace were primary or secondarily attached to the main textile.

STYLE-HISTORICAL ANALYSIS

Within art history, style-historical analysis has been used for dating art objects. The method has primarily been applied to those objects that follow a normative style development—that is, the style chronology that was designed for Western art history in the late 1800s and early 1900s. However, using it as a source to determine the dating of folk art objects may be misleading. In previous research, the term *retardation* was used to describe how folk art objects were formed with a certain time lag. This way of describing aesthetics within folk art contexts reflects a view of the folk artist as ignorant and unaware of modern styles. As a consequence, earlier research has disregarded the aesthetic considerations that folk artists used in their creation. Thus, it may be more relevant to talk about style combinations and style anachronisms (Knutsson 2001).

Another influential idea has been the conception that new styles, fashions, and aesthetic solutions sank down from the elite to the lower layer of society. This layer was not considered to fully grasp how the styles should be applied in a "correct" manner. Researchers in the early-twentieth century labelled it "sunken cultural goods" (from the German concept of "*gesunkenes Kulturgut*"), leaking from a superior and exclusive level of society to an inferior and broader one, and saw it as a tendency for folk artists to imitate something without actually succeeding. Both concepts—style retardation and sunken cultural goods—have long since been abandoned by researchers, but are visible in older interpretations of folk art in literature.

However, there are occasions when the style-historical analysis as a method generates further insights and information in addition to the possibility of credible dating. Through this, attention is sometimes given to details such as the costume and hair fashion of the pictured figures, which otherwise might be overlooked if the object had been provided with a carved, stamped, or embroidered dating. Style-historical analysis can show how the craftsperson or artist relates to his or her inspiration sources—freely, independently, and yet consciously. Thus, it can tell us something about the artistic work and the individuality of the artist. The adoption of Rococo ornaments in an otherwise Renaissance Baroque work of art, such as one

of the interiors by Gustaf Reuter (1699–1783), confirms that the rural painters—far from what is frequently supposed—often acted in accordance with current taste.

CONNOISSEURSHIP ANALYSIS

In both object analysis and style-historical analysis, deep and broad knowledge, familiarity with the material, and "a large experience of large amounts of objects that together build a specialist knowledge" are required (Rasmussen 2010, 20). This is usually referred to as connoisseurship and can provide better opportunities for identification and attribution of works of art to a specific artist or artist's group(s) (Knutsson 2001). The connoisseurship can be described as a specific knowhow or professional skill that is based on many years of experience within the field. This means that the connoisseur has seen a large number of works and observed specific details that help him or her to distinguish works by one artist from the works by another. A connoisseurship analysis can also involve recognition and comparison between different designs, technical solutions, and material choices. The analysis may sometimes give indications of an artist's education, the economic conditions of the client, and other economic and geographical factors which in turn affect technology, materials, performance, and quality.

Criticism has been raised against connoisseurship analysis, stating that it can appear subjective and is based on some kind of intuition that the connoisseur holds. Therefore, it is said to be difficult to scientifically argue for the conclusions drawn. However, this statement may be questioned. On the one hand, we must not neglect nor exclude or reject the connoisseurs' judgement due to the fact that it is not explicit enough or expressed in words. On the other hand, we have to consider that information of this kind has to be articulated in a way that is accessible, apprehended, and possible to review by others if we want it to be continuously communicated and accumulated. As a matter of fact, this "tension between the explicit justification required by research and the tacit appreciation and judgement that expertise and connoisseurship entail" have recently attracted attention in the field of design research and craft science (Nimkulrat, Niedderer and Evans 2015).

In our project we use connoisseurship analysis to define and describe the work of an individual artist or works from a geographical area or connected to a certain interior, then to identify details crucial for the attribution of an anonymous, unsigned painting, furniture, or textile to a particular named person or artist. In painting, for example, connoisseurship can be about the manner or the individual personal design of numbers and letters. Today, through digital image banks, we have more opportunities than ever before that allow comparisons of a large number of objects. Similarly, we have access to databases and the results of genealogical research which help us to establish relationships between craftspeople or artisans and the places where they worked.

In addition, there is another factor that has been of particular importance in our research. Our aim has been to primarily focus on signed works of arts and handicrafts (cf. Nyström 2012). By chemical material characterisation of signed painted works, the results in combination with connoisseurship analysis can be used for a more secure attribution. By doing this, artist's raw materials and specific painting techniques can provide new knowledge that altogether gives a more comprehensive picture of the artistry and its context. The analysis of artist's materials and techniques helps us to strengthen or reject the previous attributions with more credibi-

lity than if we were referring only to style-historical analysis and connoisseurship. The painters Olof Henriksson, Hindriks-Olle (1793–1861), and Anders Erik Ädel (1809–1888) were both active in the northern part of Hälsingland, creating decorative interiors in similar manners, the one being closely related to the other. The material analysis confirms that the latter, whose activities exceeded the former for several years, carried on his craft with access to a greater number of pigments.

When connoisseurship analysis is applied as a means of evaluating the quality of skills and artistry and to describe the craft process behind a work of art, it is important that the curator or scholar who is performing this analysis shares the experiences of the materials and practices used by the artist or craftsperson that is to be studied. Likewise, connoisseurship as a means of identifying the artist or craftsperson behind the work of art whose identity is not known is dependent on the curator's or scholar's own insights into the practice of craft. Whatever the objectives, connoisseurship is a method that requires deep understanding of materials, techniques, and processes. The relationship between expertise, connoisseurship, and experimental knowledge in professional skills was highlighted by the special interest group in experimental knowledge as a theme at the international conference "Knowing Inside Out—Experimental Knowledge, Expertise, and Connoisseurship" held in 2013 (see Nimkulrat, Niedderer and Evans 2015).

A painter's personal style, manner, and expression depend on raw material choices, the use of technique, and the choice of motif, as well as the artist's influences, conventions, and education. They also depend on the painter's experience, skill, driving force, temperament,–and choice of composition and repertoire. This is evident in, for example, folk art from Hälsingland, which combines different motifs, repertoires, techniques, tools, and the use of figurative freehand painting with nonfigurative stencil technique and premade wall papers, giving great opportunities for varying visual expression (Nyström et al. 2018). It may also be possible to detect a personal manner in painting, woodcarving, and free embroidery. However, it is significantly harder in bound techniques like weaving. But even where bound techniques are concerned, there is a possibility of observing individual features. Since folk art painters, wood craftspeople, and needle workers did not usually sign their work, the identification of the craftsperson could be established by means of the personal style that the connoisseur is able to identify and put on display how works of art and handicrafts that at first sight seem similar, may be traced back to different persons. In all these cases, the interpretations and the analysis are based on knowledge of the craft techniques that are present in the work of art. To be able to identify how the craftspeople have worked, the choices they have made in every procedure are of importance if one is to be able to recognise the individual artistry. Familiarity with the techniques used to create the object in question may promote and support the identification of an artist's or craftsperson's specific manner and separate it from those of others. It is easier to detect the individual's sign when you are deeply experienced in the handling of the tool. The way in which the brushstrokes of the painter Anders Ädel differ from those of Hindriks-Olle in the interior of Jon-Pers, Ljusdal, is hardly discernible unless you are familiar with the practice of painting (Assis 2017).

By highlighting the various individual styles, the knowledge of who has done what is accumulated. The driving force behind the method

of the connoisseurship analysis is the will to find and identify a specific named and traceable artist behind the work. In this way, the contemporary cultural and economic value of the work increases, thus establishing a basis on which the objects are to be more appreciated and better preserved. However, the current economic value is primarily related to furniture and fine art paintings, rarely to textiles (cf. Palmsköld 2005). The detection of the personal style reminds us that painting and textile production and other works of folk art have been practiced and developed by individuals—not by a collective, anonymous mass of people with a common "temperament," as has previously been claimed by a number of scholars—although several individuals already in the 1920s were highlighted by more advanced researchers in the field, like Sigurd Erixon. Furniture paintings by Jöns Månsson (1809–1888) contain details exclusively developed by this skilled craftsperson imitated by other painters, although none of them reached the same level of skill.

Connoisseurship analysis as well as material characterisation or art technological analysis rarely suffices as evidence of who did what. Recently, the network of painters in a specific area in Hälsingland during the 1800s has been identified (Assis 2016). It seems as if painters have collaborated with one another, rather than competed. For example, a painter may have been assisted by another painter to complete an assignment. This complicates matters related to attribution. Several painters may have dipped the brush in the same colour, using the same stamps and stencils. If they have painted in the same room, they have also adapted closely corresponding motifs and styles to create a uniform expression.

A connoisseurship which is based on a combination of written sources about the provenance, scientific research on artists' materials and art technology, and the knowledge of the craftsperson's and artist's personal manners and the choice of motifs, patterns, and working techniques, has the greatest chance of success. However, the connoisseurship and the style-historic analyses, which are part of the object analysis, are only part of the overall assessment of an object.

RECONSTRUCTIONS AS METHOD

Connoisseurship analysis is not only closely related to the experience of practical activities; it is also connected to reconstruction as method. Reconstructions of historical craft processes, painting materials, and authentic objects are made using historical sources, realia (such as painting tools), and original documents (recipes, manuals, drawings, and sketches). The reconstruction processes help to better understand craft processes and the various results of them. "What are the crucial points in the processes?" and "How can hand grips, choices of tools, and materials affect the outcome?" are examples of important questions to ask.

In our respective pieces of research, we initially sought to find original texts describing the historical use of various dyes and pigments, as well as authentic recipes (Olars 2015; Palmsköld and Fabler 2018; Nyström and Roxvall 2018). These texts have provided the basis for producing references,[4] dyed textiles, and paint which have then been used for the various chemical analyses (see Figure 2). Reconstructing pigments, dyes, or paint based on historical prescriptions and painting manuals is a commonly used method in conservation research (cf. Nyström 2012). In this way, painting techniques and material content in an art work or object can be understood in a more profound way. Even the chemical analysis will be easier to interpret and understand if a reconstruction of a craft process has been made. Thus, it requires both a craft science ap-

Figure 2: Examples of reference samples produced in the project. Woad-dye samples, woad pigments, and a sample of dyed textile. Photograph by Ingalill Nyström.

proach and a heritage science approach to carry out technical art studies. In the process of a reconstruction, the scientist gains a personal, practical craft experience of how materials behave when applied, and how tools act when handled—experiences providing him/her with the skills necessary to interpret and evaluate the analysis of materials and traces of tools, and to identify the individual style of any painter or textile worker on a connoisseur's level. In other words, an awareness of the way in which varying materials behave offers a better insight enabling an interpretation of the labour process behind the object examined. Having the relevant practical experience of applying glue paint to the surface, and in what way this application technique differs from the one which is required to apply linseed oil paint, may assist the observer in describing and considering the prerequisites and situation at the time and place where interior decorations such as the ones by Gustaf Reuter in Hälsingland were executed. Even though reconstructions have not been part of this project, we all are very familiar with the method and have used the perspective "think like a craftsperson" as a point of departure. Ingalill Nyström and Johan Knutsson have deep knowledge in practicing painting using historical techniques and materials. Anneli Palmsköld likewise has much experience of studying and practicing different textile techniques.

SCIENTIFIC METHODS AND APPROACHES FOR THE OBJECT ANALYSIS

Interpreting the results from chemical analysis requires more than experience and expertise within the field of analysis itself. It is also important that the researcher who interprets the results has artistic or crafts knowledge, as well as knowledge in conservation or heritage science. For example, in order to be able to interpret the results of a binder analysis, knowledge of historic binders and knowledge about the chemical constituents of the binders is required, otherwise misleading conclusions may be drawn and important facts that the artist or craftsperson had to take into consideration may be disregarded (Nyström 2021a; 2021b; cf. Fors and Isaksson 2018).

When choosing a scientific method from a conservation perspective, non-invasive methods are preferred because you do not have to take samples from the objects that are in focus for research and analysis. This is especially important when working with objects that have been appointed as rare and unique pieces of cultural heritage. In our respective research, with some exceptions, we have mainly been using non-invasive methods, especially during fieldwork in interiors and collections.

The scientific methods we have used in analysing the materials and techniques for further interpretations concerning the social context and aesthetic preferences of maker and user are based primarily on different spectroscopic methods. Spectral methods are based on different types of light, also referred to as electromagnetic radiation (see Figure 3). In conservation and heritage science, the methods are common and used for gaining increased knowledge of the material content of the objects, the stratigraphic layers, the construction, and the manufacturing technique. Light can also be used to see changes and later additions. The results form the basis for decisions regarding possible and relevant conservation treatments, but can also be used to describe an object technologically and qualitatively.

The analytical techniques used are mainly Multi Spectral Imagine Technique, X-Ray Fluorescence (XRF), Dispersive Raman, Fourir Transform (FT) Raman, Direct Sampling Analysis-Time of Flight-Mass Spectrometry (DSA-ToF-MS), Fourir Transform Infrared Spectroscopy (FTIR), and Gas Chromatography with Mass Spectroscopy (GC-MS). Multi Spectral Imagine Technique, XRF, and Dispersive Raman are non-invasive methods that can be used directly in the field without taking samples from the object.

Multi Spectral Imagine Technique is initially used to identify original surfaces and to get a first structural indication. XRF is used to identify the elements in pigment and thus get an initial indication of the pigment used. Dispersive Raman can be used in field and in labs for pigment and dye analyses. Additional dye analyses have been performed with FT-Raman and DSA-ToF-MS in the laboratory. Analyses of binders in the paint are mainly made by destructive analyses, where the sample is destroyed. However, FTIR may be used for a first indication of binder. To get a more comprehensive and secure indication, the analyses have been performed in the laboratory. We have combined FTIR with GC-MS in a step-by-step analysis. First, we use FTIR to establish whether the binder consists of protein, lipids, or polysaccharides. After that, we analysed the lipids, which are fats in the binders (Fors and Isaksson 2018). The analytical methods used in our project are described below in a brief and simplified manner. For example, the analyses confirm that the paint used for wood in our cases normally contains vegetables lipids, an observation which also matches written sources. In some instances, the paint is based on tempera, which is normally the case on cupboard interiors. Wall paintings on textiles often contain tempera. In terms of the pigments, our analyses confirm that mostly okra and vegetable pigments were used during the eighteenth century. During the nineteenth century, many new pigments have been adopted, such as massicot, yellow, and Schweinfurt green.

The first step in an examination of a painted object is ocular inspection. It is carried out by means of simple spectral techniques. This first analysis of the object is usually called an *overview analysis* and provides information on the original layers and later additions on the front and back sides (Nyström 2012, 35 ff). Even indications of techniques, construction, material content, and stratigraphy of the object can be obtained. Normally, visible light

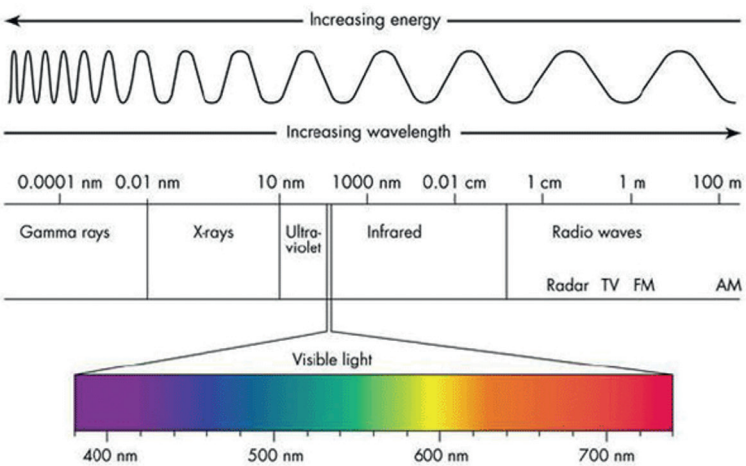

Figure 3: DThe electromagnetic field. https://www.hemma-odlat.se/odla/fotosyntesendel-1/ [2019-10-10]

is used, with a wavelength between about 400 and 700 nm (see Figure 3), and a camera for documentation. The light may be dispersed or more collected. The light source is placed at an angle of approximately 45° on each side of the object to avoid reflections in a glossy flat surface. Light from behind an object, such as a painting on canvas, can reproduce the transmitted light, where holes, tears, and sparse structure can become more visible. With raking light, the structures of the surface (for example, impasto paint layers) can become more visible.

In addition, further light sources in other spectral areas can be used, combined with filters and camera, to document what might otherwise be invisible. Ultraviolet (UV) light, with wavelength bands between 320 and 400 nm, which is close to the visible violet light along with a special filter that only permits reflected UV light, can be used to see surface structures like the trace of a brush in varnish. UV light can also be used to view UV fluorescence. This means that materials that are fluorescent in UV radiation give specific bright colours. To be able to photographically document the UV fluorescence, a yellow filter that filters off the UV and violet radiation is needed to make the specific colour of fluorescence more distinct. Certain pigments have specific fluorescent colours, thus indicating which pigments may be included in the paint layers. Likewise, later additions such as retouches and over-painting may become visible due to the fact that aged material generally fluoresces more. Later additions appear as dark, purplish areas or stains. It was easy to state that most of the interiors attributed to the famous painter Gustaf Reuter have been seriously tampered with, for example—an observation pointing towards the fact that works by this painter have been cherished by prosperity.

Another light source such as near-infrared (IR) light can be used to get further information about the underlying layer of the painted surface. IR is the same as heat radiation, whose wavelength is between about 700 and 1250 nm. This light, together with an IR filter that shuts out all visible light, can detect underlying sketches, provided the superimposed paint layers contain pigments that transmit IR radiation. Additionally, good contrast in the sketch is

needed. For example, a lead-white-containing paint layer on top of a carbon drawing on a chalk-white ground gives good images of the sketch when using IR. In the actual project, the free sketching technique of Gustaf Reuter could easily be explored. In addition, composition lines that had been drawn with a graphite pencil could be identified.

Following the overview analysis, further analysis can be performed using more advanced spectroscopic methods. Some analyses can be performed directly on the object using portable instruments. If additional samples are required for further analysis in the laboratory, samples of approximately 1 mm in size are taken from all original colours or colours of interest. The samples are preferably taken near lacunas and losses, or in places where the loss causes the least harm. The overall impression of the paint and finish of the object must be preserved and must not be put to any risk of failure. Each sample area is documented by photos and recorded in a sample form with a short object description, as well as information about the analytical methods.

All analyses that have been performed and samples taken are registered in a database. The database that proved most suitable for the project was the KD-Tools database system, designed for Architectural Paint Research investigations of buildings (Edvardsson and Verweij 2016). Each investigated object received its own registration number. All analyses performed on site and the samples taken in a sample series from each object are marked on a photo of the object (see Figure 4).

The advanced spectroscopic analysis methods are also based on light beam technologies that interact with materials in different ways. Usually, special detectors and other devices are combined with the light source to interpret and record the emitted or absorbed photons/electrons. For example, infrared light can be used to investigate the functional groups in organic substances such as binders and dyes. Functional groups with dipole bonds absorb energy from the light source, and they begin to vibrate. The reflective or transmitted light that occurs has lower energy and can be split up and separated using special gratings in an infrared spectrometer. With a detector, the different light waves can be recorded as a spectrum specific to the different functional groups in the paint layer.

By means of X-ray, the elements of, for example, inorganic pigments can be analysed. However, X-ray has high energy and is thus hazardous, which is why special equipment with an electron detector is required. When using an X-ray fluorescence instrument, the X-ray's electron beam sweeps over the surface to be analysed. Fluorescence—lower energy electrons—is emitted from each point on the examined surface. The emitted electrons can be detected by means of an electron detector. The different energy lines specific to each element are recorded. The technique gives an indication of possible pigments in the paint layer.

Laser light can also be used for pigment analyses. Laser is a monochromatic, coherent light of a single wavelength. There are lasers in the ultraviolet (UV), green, red, and near-infrared (NIR) regions. When a material of polarisable bonds, for example pigment or dye, is irradiated with laser light, Raman scatterings occur (Edwards and Chalmers 2005, 18ff). The Raman signal can be separated from the incident laser light by means of holographic filters. This technique is called Raman spectroscopy. Raman instruments with lasers in the UV and NIR fields up to approximately 900 nm utilise a spectrometer called a monochromator, which contains a grid and a CCD camera as the detector. When using an infrared laser light with a

Figure 4: XRF analyses performed on site at Bortom åa Fågelsjö. Photograph by Jacob Thomas.

wavelength of 1064 nm, a Fourier Transform Interferometer is required, which amplifies the Raman signal in the spectrometer. In order to detect the Raman signal in this instrument, a special cooled detector is needed. The detected signal is recorded as a wave number spectrum. This spectrum is like a fingerprint and is specific for each substance—whether pigment or dye. The recorded spectrum can be compared with spectra from various known substances. From such a match, the pigment or dye can be identified.

Mass spectrometry is used to investigate the mass of fragments of a large molecule (Harris 2003, 518). This is done to determine which substances the molecule contains. The sample is first vaporised with high heat, using, for example, a gas chromatograph. The molecules in the sample disintegrate into charged particles called ions. The ions are accelerated in an electronic and magnetic field so that light and heavy ions are spread in different ways and then meet the electron detector at different points. Particles with the same mass and charge move to the same point on the detector and thus the substance can be characterised. This is a destructive method, which is why the analysis takes place in the final stages of the entire analysis process. Using mass spectrometry made it possible to identify egg yolk as a binder on decorations in some cases.

All the scientific methods described offer evidence of the materials and tools that have been used. For example, in our research we have found that egg mixed with oil on wooden objects is more common in the decorative folk art than was previously known (Nyström 2020b). We have also found that possibly woad was used when dying textiles, as, for example, in carpet weaving (Nyström et al. 2016). To appreciate the quality of skills in the artists' or craftspeople's ways of handling the tools and applying the materials in the composition of the motifs and patterns, one must consider the actual making process, which in its turn requires deep insights into the practical matters.

CONCLUSION

In conclusion, we can say that our theoretical perspectives are closely related to our methodological approach. The theoretical perspectives are largely based on experience and on the collective knowledge of the cross-disciplinary research group members. As several of the group members are practitioners in various crafts, such as decorative painting, conservation, and textile techniques, we are able to interpret the results from a craft scientific perspective. We understand the objects not only as artefacts created by someone but as craft materials and handicraft processes. We use our senses—vision, smell, sensation, and hearing—as a complement to the scientific analyses. We also use as many sources as possible to build as comprehensive a picture as possible of the objects and their social context, combining each group member's skills and experience in various fields in the interpretation of the results.

REFERENCES

Almevik, Gunnar. 2012. "Byggnaden som kunskapskälla." Dissertation. Gothenburg: University of Gothenburg.

Assis, Anders. 2016. Ljusdals många allmogemålare och bygdeforskaren Carl Perssons källvärde. *Hälsingerunor*. Hälsingekretsen Gästrike-Hälsinge Hembygdsförbund.

Assis, Anders. 2017. "Jon-Pers i Nore, dess målerier och målare". *Museivännen*. Ljusdalsbygdens museum.

Edvardsson, David, and Edwin Verweij. 2016. *Att fånga dekorationshistoriken av interiörens ytskikt – ett digitalt dokumentationsverktyg inom färgundersökningsfältet. Sammanfattningar av föredrag Färgforum 2016*, Karlstad. Visby: Riksantikvarieämbetet.

Edwards, Howell G. M., and John M. Chalmers. 2005. *Raman Spectroscopy in Archaeology and Art History*. RSC Analytical Spectroscopy Monographs. Cambridge: Royal Society of Chemistry.

Fors, Yvonne, and Sven Isaksson. 2018. "GCMS Analyses by Direct Methylation (Permetylation) of Lipids in Binders used in 18th–19th Century Folk Painted Interiors in Hälsingland, Sweden." *Journal of Archaeological Science: Reports*, 23: 127–36.

Glassie, Henry H. 1999. *Material Culture*. Bloomington, IN: Indiana University Press.

Harris, Daniel. 2003. *Quantitative Chemical Analyses*. 6th ed. New York: Freeman.

Hyltén-Cavallius, Charlotte. 2007. "Traditionens estetik: spelet mellan inhemsk och internationell hemslöjd." Dissertation. Stockholm: Stockholms universitet.

Knutsson, Johan. 2001. "Folkliga möbler: tradition och egenart: en stilanalytisk studie av renässans- och barockdrag i den svenska folkliga möbelkonsten." Dissertation. Stockholm: Stockholm University.

Larsson, Marianne. 2008. "Uniformella förhandlingar: hierarkier och genusrelationer i Postens kläder 1636–2008." Dissertation. Stockholm: Stockholm University.

Nimkulrat, N., K. Niedderer, and M. A. Evans. 2015. "On Understanding Expertise, Connoisseurship and Experimental Knowledge in Professional Practice." *Journal of Research Practice* 11 (2): Article E1.

Nyström, Ingalill. 2012. "Bonadsmåleri under lupp: spektroskopiska analyser av färg och teknik i sydsvenska bonadsmålningar 1700–1870." Dissertation. Gothenburg: University of Gothenburg. Accessed 7 January 2022. http://hdl.handle.net/2077/30154.

Nyström, Ingalill. 2021a. "Konstteknologisk källforskning med ett hantverks- och konserveringsvetenskapligt perspektiv." In *Hälsinglands inredningskultur*, edited by Ingalill Nyström, Johan Knutsson, and Anneli Palmsköld, 220–31. Makadam. DOI:10.22188/kriterium.23.

Nyström, Ingalill. 2021b. "Konstteknologiska undersökningar av hälsingemåleri och hur de kan hjälpa till vid attribueringar." In *Hälsinglands inredningskultur*, edited by Ingalill Nyström, Johan Knutsson, and Anneli Palmsköld, 295–322. Makadam. DOI:10.22188/kriterium.23.

Nyström, Ingalill, and Andreas Roxvall. 2018. "Översikt: Färgväxten vejdes användning i Sverige under 1700- och 1800-talen." *RIG. Kulturhistorisk tidskrift, temanummer Hälsingland*, (101) 2–3: 69–84.

Nyström, Ingalill, Anneli Palmsköld, Johan Knutsson, and Kristina Linscott. 2018. "Hälsingegården och den färggranna folkkonsten." In *Bondeherrgårdar - den nyrika bondeklassens gårdar 1750–1850*, edited by Johannes Daun and Christer Ahlberger. Lund: Nordic Academic Press. Kriteriumgranskning.

Nyström, Ingalill, Susanne Wilkens and Jacob Thomas. 2016. "FT-Raman Analyses of Blue Dyes Stuff Common in Swedish Folk Art from Hälsingland during 18th and 19th Century." *Chemical Sciences Journal* 7 (2). DOI: 10.4172/2150-3494.1000123.

Olars, Katarina. 2015. *Hälsingegårdarnas textila färglandskap – En kartläggning av tänkbara kulörer färgämnen och färgningsmetoder i hälsingegårdarnas interiöra textilier under 1700 och 1800-talen*. Kandidatuppsats. Institutionen för kulturvård, Göteborgs universitet.

Palmsköld, Anneli. 2005. "Hängkläden, drättar, lister och takdukar: inredningstextilier i ny belysning." In *Den feminina textilen: makt och mönster*, edited by Birgitta Svensson and Louise Waldén, 141–62. Stockholm: Nordiska museets förlag.

Palmsköld, Anneli. 2007. *Textila tolkningar: om hängkläden, drättar, lister och takdukar.* Dissertation. Stockholm: Nordiska museets förlag.

Palmsköld, Anneli. 2013. *Textilt återbruk: om materiellt och kulturellt slitage*. Möklinta: Gidlund.

Palmsköld, Anneli. 2017. "Den omoraliska virkningen." In *Politiska projekt, osäkra kulturarv*, edited by Lars-Eric Jönsson, 23–55. Lund: Lund Studies in Arts and Cultural Sciences.

Palmsköld, Anneli, and Anna Fabler. 2018. "Turkisk rödfärgning – tolknings av historiska färgrecept." *RIG. Kulturhistorisk tidskrift, temanummer Hälsingland*, (101)2–3: 123–42.

Pink, Sarah. 2009. "Re-Sensing Participant Observation: Sensory Emplaced Learning." *Doing Sensory Ethnography*, edited by Sarah Pink, 63–80. London: Sage. DOI: http://dx.doi.org/10.4135/9781446249383.

Rasmussen, Pernilla. 2010. "Skräddaren, sömmerskan och modet: arbetsmetoder och arbetsdelning i tillverkningen av kvinnlig dräkt 1770–1830." Dissertation. Uppsala: Uppsala University.

ENDNOTES

1. In Swedish: *känselseende*.
2. When touching a surface or a material, different sounds can be detected.
3. The objects in focus for the research are interior paintings that have been studied in situ and individual objects such as tools, raw materials, furniture, and textiles.
4. The making of dye references was performed in 2014 by textile artist Mia Olsson and textile conservator Katarina Olars. Binder references were made by painting conservator Andreas Roxvall.