THE IMPACT OF DIGITIZATION AND DIGITAL RESOURCE DESIGN ON THE SCHOLARLY WORKFLOW IN ART HISTORY

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ABSTRACT | The technological progress of the past decades has had a transformative effect on both cultural institutions and academic research. It is generally accepted that mass digitization projects led by museums, libraries and archives have allowed institutions to reach new audiences and increase the impact of their collections, while the emergence of digital libraries and other types of digital resources has opened up new opportunities for scholars in terms of accessing diverse types of information. Yet, our knowledge of the impact of these resources on the scholarly workflow beyond the stage of discovery remains limited. This paper argues for the importance of understanding user behavior and needs for building digital resources that have a positive effect on the whole scholarly workflow. By employing an ethnographic approach to the study of art historians' habits we developed a sound understanding of the effect that digitization and digital resource design can have on scholars' work, from the seeking of the information to the construction of the research argument. The complex information behavior of art historians and the challenges they often face when interacting with digital resources make them a great example to demonstrate the impact that these can have on the research process.

KEYWORDS | collections, digital/digitized, information retrieval, scholarly workflow, serendipity, user interface

Introduction

The rise in digitization initiatives and the building of digital resources in recent years has facilitated both research and teaching. Never before was there such breadth of information and services available for scholars to use; most importantly, though, such developments have not only reduced the time for finding necessary information, but they have also enabled innovative research inquiry. Yet, from early on, cultural organisations and information professionals recognised the value and need to understand the informational and method-ological behavior of their users in order to design resources that make content not only accessible, but also easily discoverable and re-usable in the context of scholarship.

Regarding art history, accessing and using digital resources and collections has become a standard step in the daily working routine of scholars. However, previous research on the behavior and needs of researchers in this field has largely focused on the way they look for information; thus, we have little knowledge of the full impact of digital resources on the scholarly workflow, including the way digitization choices made by institutions benefit or hinder research enquiry. Against this background, this article aims to explore how art historians use digital resources at different stages of their research and identify the challenges they face as well as the needs they have. More specifically, the questions addressed in this paper are:

- How do art historians use digital collections and resources throughout the research lifecycle?
- What are the challenges scholars face when accessing and interacting with digital resources?
- What are the requirements for designing digital resources that meet the need of scholars in this field?

Given the complex and constantly evolving research practices of scholars in the art historical discipline, managing to answer these questions could significantly foster our understanding of their information behavior and needs; this knowledge can then be applied to the creation of better digital resources and tools to support research and teaching in this field. Yet, before discussing the methodological approach and presenting results, some background information illustrating

the importance of studying scholarly practices for improving digitization and other digital initiatives will be provided.

Studying users of digital resources

The need to study the informational and methodological behavior of scholars in the fields of the Arts and Humanities has been addressed by several studies. One of the most extensive studies over the last decades has been the Getty End-User Online Searching Project. The project was supported by The Getty Information Institute and the major part of the study was conducted over the years 1988-1990; [1] its aim was to examine the information seeking behavior of scholars by studying the searches they made and the techniques and terminology used while searching through the DIALOG databases.

In 2001, Brockman et al. examined the way researchers in the Arts and Humanities work in the new information environment.[2] More specifically, they examined the information behavior of scholars during several research stages, such as searching, reading, writing, and networking, and attempted to identify the needs that characterize scholarly work in this broad research area as well as the distinct needs of the separate disciplines it includes. Their argument was that, as digital technologies bring changes to the behavior and needs of scholars, it is important for the institutions, such as academic libraries, to adapt to the new circumstances.

In 2005, Buchanan et al. investigated the information seeking techniques academics and other scholars in the Arts and Humanities used when looking for resources in digital libraries;[3] the results of their research showed the existing gap between the researchers' skills and the digital services they used for seeking information resources. Furthermore, Rimmer et al. reported on work done for the User-Centred Interactive Search Project (UCIS).[4] Their paper focused on the information behavior and needs of scholars in both the traditional print and digital environment. The outcome of this project was intended to be used for the development of appropriate digital resources that would facilitate the needs of scholars in the digital age. In 2008, Rimmer et al. examined the behavior of humanities scholars in the physical and digital environment, emphasizing the relevant qualities of research in this area.[5]

In the same year, Warwick et al. published the results of the Log Analysis of Internet Resources in the Arts and Humanities (LAIRAH) study.[6] Their goal was to examine the scholarly resources used by researchers in the digital age, both analogue and digital, through analyzing their information seeking behavior and produce results that could be useful for the future development of information services.

Palmer, Teffeau and Pirmann in 2009,[7] based on Unsworth's[8] concept of scholarly primitives, studied the scholarly activities and primitives in various disciplines, including the Arts and Humanities. The objective was to report on the research process of scholars in different fields, make relevant comparisons and, therefore, provide useful information on the requirements needed for building effective digital infrastructure for scholarship.

Finally, Benardou et al. reported on work conducted in the context of the European project Preparing DARIAH: Preparing for the construction of the Digital Research Infrastructure for the Arts and Humanities.[9] In their paper, they argued for the importance of developing a better understanding of the scholarly research process, in order to identify the requirements for providing scholars with appropriate tools and services. They also presented a conceptual model of the scholarly research process based on the results of their interviews conducted with researchers across Europe. After also completing the research for the European Holocaust Research Infrastructure (EHRI) project, they published their results where they further discussed this model and its suggested use for exploring the practices and methods employed by scholars amongst the various Arts and Humanities communities.[10]

Methodology

This study employed an ethnographic approach to the study of scholarly practices. Therefore, for the purposes of this project, single face-to-face or Skype interviews with twenty art historians were conducted between June 2013 and October 2013. Moreover, the interviewing phase included, when possible and with their consent, observation of the interviewees' personal physical (Fig. 1) and/or digital information collections (Fig. 2). Before looking at the profile of research participants in more detail, it is worth providing more information about the factors that led to the creation of this pool of interviewees.

Thinking about the number of scholars participating in this study, several qualitative studies were consulted before the recruitment process began in order to ensure that a sample adequate for answering the research questions of this study could be collected; these included studies of different scales, exploring issues relevant to those raised here and with similar numbers of participants. For instance, in Benardou et al. we read that the number of participants interviewed (through semi-structured interviewing) in the context of the large European infrastructure projects DARIAH and EHRI was twenty-four and fifteen respectively;[11] the purpose of both works was to understand scholarly practices and information behavior of scholars in the Arts and Humanities for creating better digital tools and services for research.

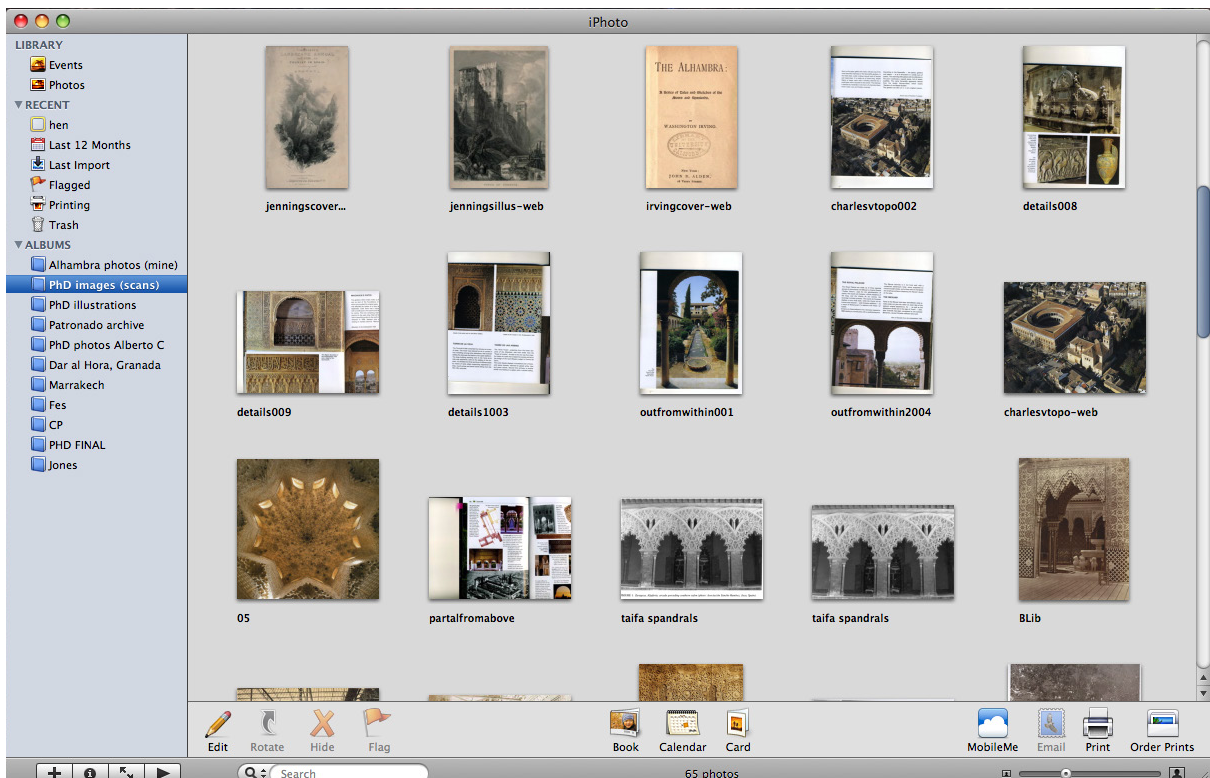Figure 1. Part of Participant 03's personal physical information collection

Figure 2. Part of Participant 07's personal digital information collection

Smaller scale projects examining issues around information seeking behavior or personal information management have also employed similar approaches. One of the earlier studies looking at the way historians organise and manage information, conducted by Case, used interviews of twenty scholars, along with observation of their personal collections, to understand their behavior.[12] A more recent project by Trace and Unmil, looking at the building of personal collections by humanities scholars, interviewed twenty-six scholars in order to draw out user requirements for a mobile application that supported related practices (e.g. document, capture, and upload information to cloud storage).[13] Recent qualitative studies around information seeking using interviews to understand the practices of scholars are those by Martin and Quan-Haase[14] and Zhang and Soergel;[15] the first, which focused on exploring the role of agency in historians' experiences of serendipity in the digital and physical environment, had twenty interviewees while the latter, which examined patterns and conceptual changes in knowledge representations during information seeking and sense-making, had fifteen participants who were interviewed and conducted think aloud tasks.

In this study, it was of particular interest to create a pool of participants consisting of two groups; one where scholars worked on commonly studied areas (e.g. various areas of European art, such as Renaissance art) or employed traditional art historical methods (e.g. stylistic analysis, historical investigation) and another where the topics examined (e.g. non-Western art, digital art) or the methods employed (e.g. quantitative, digital) were considered less traditional. Identifying any similarities and differences between these two different groups of scholars could provide a better insight into the needs that art historians in different areas of the field have in terms of resources, tools and services.

Yet, during the recruitment process, a difficulty arose with regards to reaching the target number of participants and creating a pool of scholars matching the characteristics described above; in fact, after initiating the process of the face-to-face interviews, a limited response, especially from scholars conducting non-traditional research (e.g. digital), to the call for participation was encountered. Therefore, a decision was made to open-up the study and include Skype interviews along with the face-to-face ones. This strategy considerably reduced the limitations related to the geographical barriers imposed by the face-to-face interviews and, thus, led to the desired outcome which was to gather a group of around twenty interviewees, with a relatively balanced number of scholars under each of the categories of 'traditional' and 'non-traditional' research. This categorization was based on the premise that the practices of scholars in the first group (twelve scholars in this study) had been frequently examined by previous studies in the field while the behavior and needs

of those in the latter (eight scholars in this study) had been less studied before;[16] the geopolitical or cultural profile of participants did not constitute part of the selection criteria for this study.

As a result, regarding the profile of the research participants at the time of the interviews (Table 1), sixteen were based at UK institutions, two scholars were based in mainland Europe and another two outside of Europe. Moreover, it is worth stating that their technical skills varied from advanced to basic. Also, the interviewees were at different career stages and, thus, they ranged from established academics to PhD students, early career researchers as well as independent scholars.

The eras the interviewees explored through their projects ranged from the 14th century to the present day, including Byzantine art, Medieval art, Renaissance, Contemporary and Modern art, 3D documentation of material cultural heritage, and art history education. As a result, there was large diversity in terms of the objects of study in the scholars' work; these ranged from actual objects (e.g. paintings, sculpture, manuscripts) and monuments (e.g. churches) to historical and other issues in relation to art and artists, such as arts education and the creation of guidelines and standards for 3D documentation of material cultural heritage.

Given that the majority of scholars in this study were based in UK institutions, it is worth making a comparison between the areas of interest to art historians in this research and scholars in the UK more generally. Looking at the Art Historians & Arts Professionals Member Directory of the Association of Art Historians (AAH), one can get an idea of the subject areas on which academic and professional art historians work;[17] these relate to the history of art across eras and geographical locations. It is worthwhile commenting on the small number of members conducting research on a digital art history topic or employing digital methods. A search by using the term 'digital' revealed only three results at the time of this study (from a total of 125 members) which raises questions regarding the proportion of art historians conducting digital research in the UK at the time; this might explain to some extent the difficulty we faced in recruiting participants in this area.

Overall, the range of areas researched by the participants in this study is very much in line with the diversity of expertise reflected in the AAH directory. This variety in areas of research and teaching is a characteristic of art history and a result of its interdisciplinary nature; yet, factors linked to this characteristic (e.g. variety of information objects, methods) have often been the cause of problems for scholars employing digital technologies for research and teaching. Finally, the different career levels of the interviewees in this study (Table 1) mirror the reality of the profession, where

PARTICIPANTS	RESEARCH TOPICS (ANONYMISED)	CAREER STAGE
01	Patronage of Italian Art in the Medieval period	PhD Student
02	Guidelines for 3D documentation of material cultural heritage	Lecturer
03	The history of a church in Rome with a focus on frescoes	PhD Student and Tutor (academia)
04	Anatomy images and objects from the Medieval period	PhD Student and Lecturer
05	Arts academic training in Europe and, particularly, in Spain in the 19th century	PhD Student and Art Consultant
06	Venus Iconography from the Middle ages to today	Senior Independent Scholar
07	Islamic architecture of medieval Spain and its reception during the modern times (19th century)	Research Fellow and Lecturer
08	19th century Japanese painting	PhD Student
09	Illuminated manuscripts in the 16th century	PhD Student
10	Italian Renaissance with a focus on Raphael	Senior Independent Scholar
11	Modern Art and Sport in the 20th century	Lecturer
12	Industrial Portraiture in Singapore in the 20th century	PhD Student
13	Performance Art in Britain with a focus on Asian Artists	PhD Student
14	Art and Fashion in 1920s Berlin	PhD Student and Lecturer
15	French art history and theory in 17th century	Senior Independent Scholar/ Professional
16	Victorian sculpture in 19th century Britain	PhD Student
17	Digital and Internet art	Assistant Professor/ Senior Researcher
18	Tattooing in British art from 19th century to today	Lecturer
19	Applied arts in 1950s-1960s Britain	PhD Student
20	Manuscripts in the medieval period	Tutor (academia and museums)

Table 1. Participants' research projects, areas and career stages

members range from PhD students and academic staff to independent scholars and other professionals (e.g. working in museums). Again, the fact that art history is practiced by junior and senior scholars and professionals across different institutions (sometimes with more than one professional role per person) is worth taking into account when examining aspects of their behaviour, such as information seeking.

The analysis of the interviews was conducted using the NVivo software for qualitative research and the transcripts were coded according to a grounded theory approach (a sample of representative quotes is included in this article). Finally, it may be useful to note that a theoretical framework consisting of empirically tested information behavior models was used to analyze the interview and observation data. Kuhlthau's Information Search Model (ISP) model, particularly, which is concerned with the cognitive aspects

of information seeking, was valuable for understanding the reasons behind certain decisions that scholars made when interacting with digital resources and facilitated our exploration of the scholarly practices that follow information discovery.[18] Even though this was an empirical study, the results of this research based on the ethnographic approach we employed contributed to theory through extending and varying Kuhlthau's ISP model (as will be explained later).

Starting with digital resources: inspiration or challenge?

Before discussing the role that digital resources can play at the start of a project, it is necessary to provide a brief overview of the types of information objects that the scholars in the study used. Concerning the material employed by the
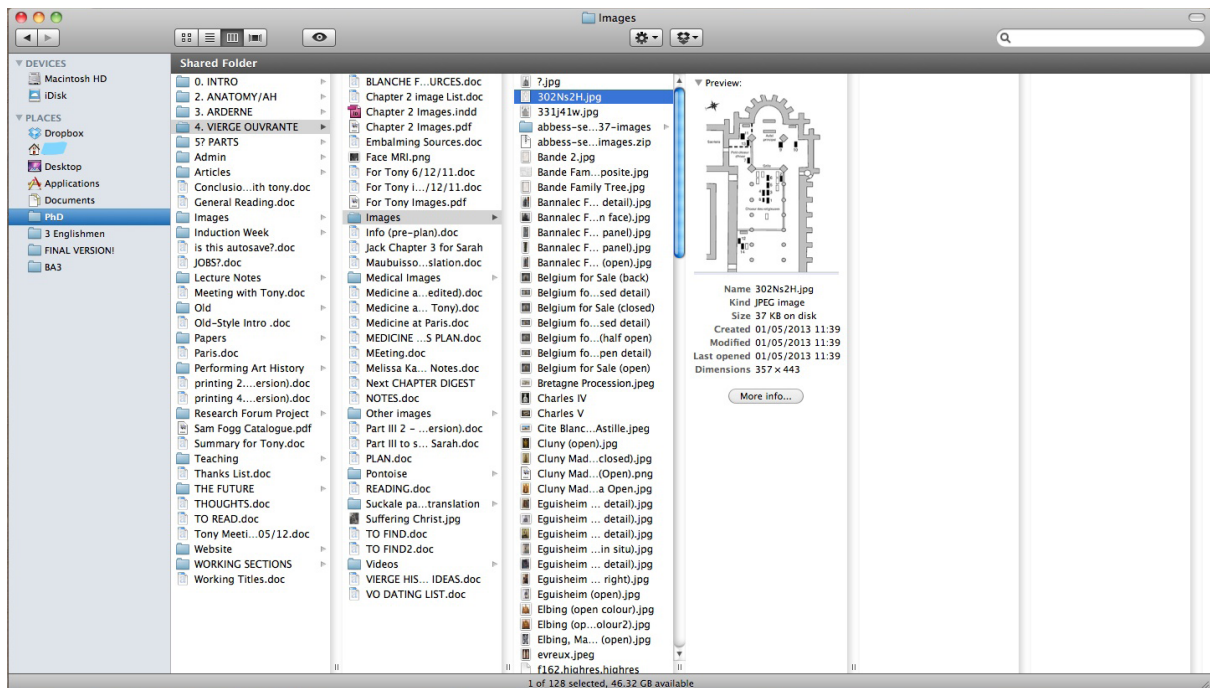
Figure 3. Part of Participant 04's digital collection, including collected digital visual surrogates

participants for the purposes of research and teaching, these comprised primary and secondary resources which could be either in conventional or digital format and included textual, visual, audio-visual or multimedia material.

Regarding the textual types of information, they generally included journal articles, books, monographs, magazines, newspapers, manuscripts, archival material, such as correspondence or genealogical records, legal documents, like wills, reports and conference proceedings, photocopies, notes and bibliographic references, and mailing lists. On the other hand, the visual, audio-visual and multimedia material usually encompassed both two and three dimensional material such as photographs in conventional formats, slides (35mm transparencies), digital visual surrogates of various kinds of artworks, other art objects, illustrated manuscripts, (parts of) monuments (e.g. frescoes in churches) and technical details (e.g. floor plans), illustrated catalogues, books and other printed resources containing images (e.g. illustrated magazines), 3D models and multispectral images, video and audio data. Other types of information objects and material in microforms, such as microfilm, were less used.

Thinking about this project's findings in relation to the types and formats of the information objects utilized by art historians, in general, they are to some extent similar to those from previous studies.[19] Yet, as some of the interviewees participating in this study were conducting non-traditional research—an issue less explored in the past—uncommon types of information objects appeared, such as computer visualizations, mailing lists, internet artworks, social media or Japanese hand-scrolls which, as it will be shown later, may raise different issues and requirements when comparing to those more traditionally employed.

The significance that original artworks and other objects of study in their original form (e.g. monuments, manuscripts), primary resources, such as archival material, and visual surrogates (physical or digital) can have at the beginning of research was also a finding that agreed with those from earlier studies.[20] For instance, in this research, it became apparent that artworks can often inspire the initiation of the art historical research process through enabling the discovery of the research subject and the generation of research questions. These questions, then, in combination with the experience of the researcher can lead to the searching of the required material. As Participant 04 (categorized as conducting traditional research) clearly explained, an art object or an image could provide the inspiration for kick-starting the actual research on a project.

Personally, I tend to start with objects or images (Fig. 3). So, an interest will often be sprung by looking at an image—often online just because it's easy to access—either in an image library or normally a museum website. [Participant 04]

This quote, apart from illustrating the importance that art objects and their surrogates can play early on in a research project, also reveals the effect that digital resources

containing relevant and openly available material can have on the initiation of research.

It is worth adding that most of the participants in this study tended to start their research in the digital environment, an approach which was also found to facilitate serendipity. Thus, there were increased chances that online discoveries made at this stage of the scholarly workflow could influence the design of a research project and the information collected. For example, Participant 03's account (categorized as conducting traditional research) of the way they looked for material on the Web suggests that serendipity can influence the material that is going to be collected in the context of research.

I mean, there are a lot of these very early texts, these are Victorian texts, all do these seem to be often on the Web somewhere, but I don't intend to go looking for them now. If they come up, I'll go for them. But I don't tend to go looking for them. [Participant 03]

Several studies have looked into the role of serendipity in scholarly practice and examined whether it can be supported by information systems. For instance, Foster and Ford studied serendipity in the context of the information seeking behavior of interdisciplinary scholars and suggested that further examination is needed in order to understand that phenomenon which, as they argued, is "a difficult concept to research since it is by definition not particularly susceptible to systematic control and prediction."[21] In this research, we discovered that serendipity was more likely to occur during the first stage of research, when scholars attempted to investigate a topic. On the other hand, and as will be explained later, encountering interesting information was more difficult during the later phase(s) of a project when scholars needed more specific and focused information. This issue arose as

part of examining scholars' information needs during the different stages of research process.

Kuhlthau's ISP model[22] constituted the basis for building our argument around the two different phases of information seeking our participants experienced, including how these may relate to serendipity, as the model refers to stages of information seeking rather than features or activities alone.[23] Thus, after comparing the behavior of the art historians participating in this study to the different feelings, thoughts, actions and tasks associated with each stage of the model, it was decided that the exploration and collection stages would constitute our main focus. This is because these stages and their properties were most relevant to explain the patterns identified in our data and, more specifically, the fact that our participants' gathering behavior tended to consist of at least two main phases (Table 2).

Although in Kuhlthau's model the gathering of information takes place only when the user has developed a certain confidence in their topic and—, thus, it is naturally more focused, art historians in this study began gathering material much earlier, at the time resembling Kuhlthau's exploration stage (when uncertainty is more common). More specifically, for the purpose of better understanding the behavior of art historians, it is suggested that an additional gathering task at the exploration stage called Exploratory Gathering should be added; this will follow the Exploratory Information Seeking which is conducted beforehand. Moreover, the second gathering task (with the same characteristics as the one described in the model) can be named Focused Gathering and will come after the Focused Information Seeking.

Therefore, the observations made through our findings expanded not only our understanding of art historians' practices related to information seeking and the use of

CHARACTERISTICS	EXPLORATORY GATHERING (1ST PHASE)	FOCUSED GATHERING (2ND PHASE)
Action	Seeking and Gathering relvant information	Seeking and Gathering focused information
Task	Investigate/ Explore the topic	Build/ Enhance the research argument (often during writing)
Stage of research	Early	Progressed
Type	Non-selective	Selective / Discriminate
Intensity	High	Low
Information amount	Large	Small
Feelings	Uncertainty / Frustration	Sense of direction
Effect on personal collections	Creating and Initial organisation of information	Further information organisation / Re-structuring

Table 2. The gathering phases and their characteristics

Figure 4. Photograph showing print-outs of a Japanese scroll used by Participant 08

digital resources, but also contributed to theory through extending and varying the ISP model. Further exploration of the reasons behind the different behavior that scholars have at the different stages of research (e.g. problematic access or the need for more 'focused' information and, accordingly, the types of material needed) can lead to more targeted digitization of material that is currently unavailable as well as to the creation of digital infrastructure that facilitates the discovery of this information, including potentially enhancing serendipity, through advanced searching facilities and useful metadata.

Moreover, the fact that some areas of research were found to benefit from a larger pool of online resources (e.g. 19th century European art compared to Non-Western art) cannot be overlooked when considering the possibilities of discovering information serendipitously. For instance, for Participant 08 (categorized as conducting non-traditional research), who was researching 19th century Japanese painting (Fig. 4), online serendipitous discovery was less likely to happen since an important part of the information they needed was only accessible physically.

And so, I've got all of that in Japan because it's very hard to get those books here. […] I'm reading as well manuscripts, handwritten books, as a sort of social context. [Participant 08]

This issue, then, generates questions regarding the extent to which information resources available online—even when including secondary material—meet the needs of scholars in the various sub-disciplinary areas of art history, such as non-Western art. Actually, the art period that a project was looking at, the geographical focus of its subject (e.g. non-Western art) or the fact that the topic under investigation

may have not been researched before were often connected to issues of availability of resources, conveniently accessible to scholars.

However, even in the cases when the material was available online, this project's results showed that issues around digitization could make the experience problematic and lead scholars to visit a resource physically. For instance, Participant 16 (categorized as conducting traditional research), when asked about the visual material they used, raised an issue around the digitization of visual resources which can constitute a possible reason for seeing the original material 'in the flesh'.

Printed photographs in secondary material; so modern photographic reproductions, engravings in nineteenth century periodicals or books which I usually see them digitized to begin with, which can be a problem because one digitization project makes it look entirely different from another, or I see them in the flesh. [Participant 16]

Thus, aspects of the design of a resource, such as the way digitization has been conducted or its interface, and the experience it offered to the user was a factor influencing scholars' information behavior.[24] Hence, such issues were not only the reasons some scholars preferred to consult an art object in person, but they could also constitute factors influencing their decisions as to which resources to use more generally. Participant 09 (categorized as conducting non-traditional research), based on their experience with online collections containing digitized material, gives an example of potential problems that can be encountered when using a

digital resource, while Participant 03 explains why they avoid using particular resources.

I mean, I have a manuscript in Rome. It's held in another library, not in the Vatican, and they have digitized their collection, but for some reason that I'm still trying to understand they have digitized only the decorated part of the page. So, basically I get a decorated initial and I cannot read the text. [...] There are choices that have been made online that to me are completely absurd. [Participant 09]

So I tend to try and avoid this sort of very dedicated websites which are special and you see all sorts of stuff because they tend not to have quite what you want and I don't seem to get quite used to finding this stuff, so I do tend to just use the search engines and see what it comes up and go from there. [Participant 03]

However, despite the challenges, digital resources can be useful to researchers when they do not have a fixed idea of the kind of information they are looking for; having good quality metadata can significantly facilitate the discovery process in such cases. Participant 17 (categorized as conducting non-traditional research) shared the reasons why they find particular resources helpful under such circumstances.

There are bodies of work that I remember even if I don't remember about exactly how I'm going to find them or where they are. Resources like Rhizome are really useful because for a long time they archived a lot of Internet artworks. So that's a good cause of call which is as similar as it gets to going to an art gallery because I can look at an artwork in that archive but I can also more often than not find discussion that surrounds that artwork. [Participant 17]

This section aimed to illustrate the impact that institutional digitization and the building of digital resources can have on the first stages of the scholarly workflow in art history. Through our participants' accounts, it can be suggested that digital collections and other online resources have the potential not only to enable research, but also to inspire the beginning of a project or influence scholars' decisions regarding its design and the data that is going to be collected. Yet, several of the challenges raised here indicate that digitization initiatives are not always conducted with the end user in mind and this can reduce their usefulness to researchers. Before making suggestions for designing resources to meet the need of scholars in the field, we will look at how digital resources are used at other stages of research as well as for teaching purposes.

The effect of digitization beyond information discovery

The art historians in this study were often conscious of the impact that digitization and the increased availability of online information could have not only on their information seeking process, but on other stages of the scholarly workflow as well, such as the gathering of this information and the construction of the research argument. Based on Participant 16, the vast amount of information available online as well as particular choices that have been made in the context of digitization projects can pose challenges that may not have been experienced prior to the digital age.

Having access to digital sources, you lose all of that feeling of what the content and scope of this resource is and how it came to be in this archive, which does tell you some things about it and so forth. I really think digitization doesn't just make things easier. It really throws up challenges in the way you have to think about your gathering of sources. It's very easy to just be on the Internet all the time, because there's no time limit. [Participant 16]

Generally speaking, participants in this study tended to gather as much material as possible during the first stages of research. Yet, this behavior was a result not only of the overabundance of information on the Web, but also of problems they usually faced when trying to re-access this information. Scholars working in non-traditional areas (e.g. digital art, non-Western art) especially, who met such challenges regularly, were often amongst those who attempted to collect as much material as possible very early in a project. For example, Participant 17, who was conducting research on internet art and using mailing list discussions as part of the research data for analysis, was often confronted with problems when re-visiting the previously discovered material online due to the temporary character of its format.

Sometimes it's just gathering as much as you can at the time and then hoping that you'll be able to Google it later on. [Participant 17]

This case may suggest that the gathering behavior of scholars may be influenced by factors such as the type and format of material they collect, especially when this does not fall into the more common types of textual (e.g. pdfs) or visual data (e.g. digital visual surrogates). These high intensity collecting phases, then, usually led to the creation of personal information collections or the expansion of existing ones for use in current and future research and teaching projects. According to information behavior models and studies, such as Kuhlthau's[25] and Palmer, Teffeau and Pirmann's,[26] the gathering of information is a task that follows information-seeking

and discovery. Information gathering is directly linked to other information practices in the scholarly work, such as the creation, use and management of personal information collections, an important activity for art historians.[27]

In this study, through examining the way our participants handled information after discovery, such as when they created and used their personal collections of information, an additional issue came to light which revealed that some scholars, especially those engaged in longer term projects (e.g. 3-5 years), could also face issues of problematic access to information at later stages of the scholarly workflow, when looking for more specific content. The quote by Participant 05 (categorized as conducting traditional research) below provides an idea of the issues faced by those scholars when looking for information to shape their research argument (usually after the writing stage had started).

So, in the beginning, I was capturing everything from administration documents to personal notes on important painters. I was capturing so much informa-tion that I didn't realise it. It wasn't until I was at trip twenty that I really knew exactly what I needed. And so the first ones were blunt work, were cannon blast, and the next ones were surgical incisions of the impression that I was getting. It is a lot more satisfying to be on that end, but it's a lot harder to find the information I need now. [Participant 05]

In these cases, difficulties in discovering and accessing the required information could significantly affect the construc-tion of the research argument and the production of results. Hence, identifying the types of materials to which scholars lack access and providing suitable digital resources may help reduce this need for intense gathering at the beginning of research. Moreover, and as mentioned in the previous section, further understanding the needs that scholars have during the later stages of research (e.g. more focused material) can lead to the building of digital resources with enhanced searching facilities and useful metadata that will enable the discovery of information as well as to prompt the digitization of relevant material in the cases where this does not already exist.

The importance of understanding the scholarly practices and needs in art history in order to design resources and tools and benefit researchers in the field was also highlighted by Participant 09 who, at the time of this project, was working on the evaluation of digital resources used in the field of art history, with a focus on illuminated manuscripts (Fig. 5).

But then in Germany [name of city removed], doing the workshop, we came up with this completely utopian

[emphasized] research environment. You shouldn't really have to learn how to use it, like a foreign language. Because it's going to be something, it's going to be an add-on and it's going to add one more layer of fragmentation to your research. [Participant 09]

Regarding other scholarly activities, it is worth adding that digital resources were found to be particularly helpful to scholars who were teaching at the time of this project. More specifically, the fact that many of the modules taught in undergraduate and postgraduate level are often of an introductory nature, and that there are fewer copyright restrictions for the use of online material in teaching, make the discovery of relevant content through digital resources much easier. Yet, as Participant 20 (categorized as conducting traditional research) explained, locating information beyond this more generic type of imagery can be challenging for researchers; their quote also suggests that the needs of art historians in terms of access to useful resources for teaching have not been fully met.

It would either be to a library or a museum or if I'm teaching an architectural subject, I'd go and see the building that I was going to be teaching and photograph it on site, because quite a lot of the things that I teach are not available visually on the Web. You can get generic images of monuments that are popularly taught, but you can't get the details that enable one to teach the material that you want to communicate. [Participant 20]

Lastly, the goal of this section was to provide an idea of the impact that digitization and digital resources can have beyond the stage of discovery of information as well as on other scholarly activities, such as teaching. Moreover, through discussing some of the challenges that scholars face at the later stages of the research process, the study aimed to highlight the importance of understanding scholarly practices and needs for designing digital resources and tools that can have a positive effect on the whole scholarly workflow. The implications for resource design for art historical research will conclude this paper.

Designing digital resources for art history

In this project, and despite the progress that digitization initiatives have made over the years as well as the increase in the availability of online material (especially secondary litera-ture), it became evident that scholars lack digital access, particularly, to primary resources and good quality, open access visual material. Finding high quality images, in partic-ular, is of paramount importance for art historical research.
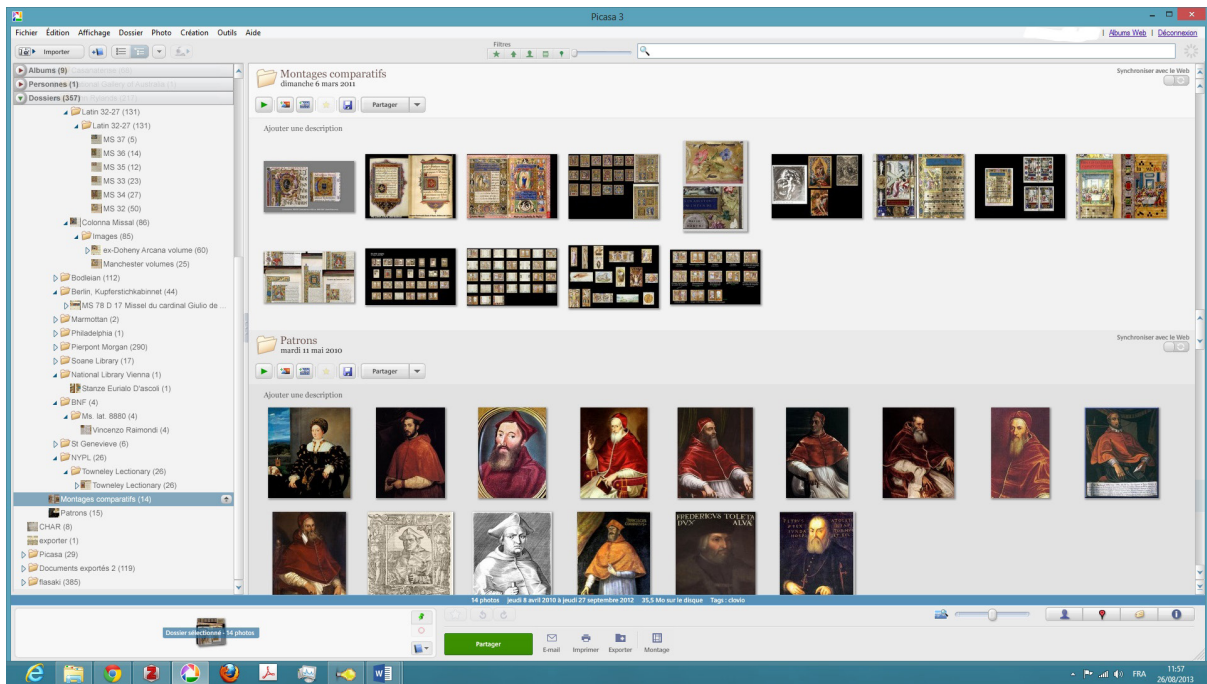
Figure 5. Part of Participant 09's digital information collection, which includes images of manuscripts

Although participants in this study did not raise the issue of color accuracy, it can be argued that, for the majority, this was one of the main concerns when looking for and using digital resources containing visual material. More specifically, high resolution and color accuracy are necessary features of the digital images used in the study of art and historical artefacts;[28] according to Rhyne "as evidence, images are valued to the extent that they approximate what one would see if looking at the object itself."[29] Digital images with these characteristics are essential tools for conducting traditional[30] and digital research[31] as well as for teaching and publishing in art history.[32]

As the findings showed, access problems perpetuated some of the habits of art historians noted in previous studies and which are often associated with pre-digital or non-digital contexts; for example, many of the participants in this study still had to travel in order to visit the archives and museums holding the material they were interested in while, even then, some found it challenging to locate or access it physically. More specifically, interviewees in some areas of study, such as Asian and Japanese art, faced greater difficulty in finding the material needed for their projects (especially primary resources) online; unsurprisingly, the availability of digital resources on the Web tended to be greater in areas dealing with Western art of particular popular eras (e.g. Renaissance art, 18th and 19th century European art). On the other hand, scholars working on digital art, were more likely to confront issues around the re-accessing of data, due to the temporary character of the format of the resources they used in their projects and the supporting infrastructure (e.g. software).

It should be highlighted that the call to conduct an examination of the needs of scholars in non-traditional areas (e.g. Non-western art, digital art) was first mentioned in Rose and has not been explored by other studies looking at the information practices of art historians since then.[33] However, since research on these areas has been found to be on the rise, issues of accessibility to resources that meet these art historians' needs become more pressing. Overall, thinking about the requirements for designing digital resources that enable art historians to discover useful information, these should be based on scholars' practices and needs (e.g. cataloguing material in a meaningful way for scholars). Through this study's examination of the criteria upon which researchers chose digital resources as well as their preferred practices for seeking and engaging with information, it can also be suggested that these should be easy to use in order to meet the needs of a diverse group of scholars (e.g. different degrees of technical ability).

Thus, the interface design should be simple and the functionalities provided should encourage different types of searching. More specifically, given art historians frequent need to browse content in collections (e.g. when they are not sure what they are looking for) and to engage visually with information, digital resources targeted to this group of researchers should enable visual exploration of collections. This could be achieved through allowing users to get an overview of the material (or groups of information) in a collection, providing suggestions for similar content and offering services that facilitate intuitive interaction with information (e.g. zooming in-out, flicking through).[34] Apart from that, including related metadata alongside the digital objects in a collection as well as information on the decision-making process with regards to digitization will enable scholars to make informed decisions when using digital content and gain necessary details for the purposes of their work. Finally, enabling access to digital collections through different means, including the ability to view and download material, is necessary in order to meet scholars' evolving need to access and manage material across devices and tools.

Finally, it is worth closing this section by arguing that art historians have increasingly become aware of the effects that the design of a user interface, including the search facilities, of a digital resource or the digitization process preceding its building can have on their work;[35] for instance, some of the participants referred to the apparent interpretative choices that had been made to the content of specific resources or referred to the searching problems encountered due to the way that the material was classified and catalogued. In fact, as the interview data indicates, such editorial choices could reduce the usefulness of the digitized content for scholars, who would then look for another resource online or, if possible, visit the resource physically.

Incorporating scholars' (as the potential users) views early on in the digitization process (e.g. through understanding their needs) and providing essential information about some of the core choices that have been made during the building of a digital resource as well as gaining user feedback about aspects of the interface design, will not only increase its usefulness for scholars and earn their trust but can also prove beneficial for the longevity of this resource.

Conclusion

To conclude, the goal of this paper was to illustrate the impact that institutional digitization and the building of digital resources can have on the first stages of the art historical scholarly workflow and beyond. The implications for digital resource design and related suggestions included in this paper can be of interest to information professionals internationally and can lead to the building of cost-effective and sustainable digital infrastructure to support scholarship in the area.

More specifically, by using Kuhlthau's ISP model as the basis for understanding the information seeking and gathering behavior of art historians in our study, it became possible to get a better insight into the information needs of scholars at different stages of their research and the challenges they faced (e.g. due to problematic (re-)access or the need for more 'focused' information).[36] This was a finding which has not been raised before and which was a result of focusing on the information practices that follow the discovery of the research material; as there is very little information on how scholars in the field handle the gathered information throughout the course of a project, our knowledge has been limited previously to the information seeking practices that take place at the initial stages of research.

Additionally, since the sampling criteria were based on the gaps existing in related literature (e.g. groups of scholars that have been understudied as opposed to those whose behavior has been examined more frequently), the interview data provided an insight into aspects of scholarly research which had not been previously discussed. Furthermore, by identifying here some of the main needs that some groups of art historians have for specific types of content that are not currently digitized or accessible, these results can have an impact on cultural institutions' (e.g. museums, libraries) digital strategies; in particular, it could enable them to save resources through conducting more targeted digitization activities to produce digital material that meets their users' needs as well as through creating digital infrastructure that facilitates the discovery of this information.

Regarding the temporality of the findings in this study, it is worth stating that they reflect the changing practices of scholars, approximately, over the past ten years. Given that there have been few studies since 2010 looking at how the rise in digitization activities and the employment of digital tools and methods have affected the information discovery, use and management of information in art history, the findings revealed issues that have not been discussed before. These include new types of information objects (e.g. mailing lists); the impact of the resource design on scholars' information seeking behavior; the problems scholars face during information gathering and use; the different information seeking and gathering behaviour that art historians had at different stages of the research process, a finding which led to the extension and variation of Kuhlthau's ISP model.

However, aspects of the evolving digital society, including the continuous digitization efforts and the greater employment of digital research methods across the Arts and Humanities disciplines, are expected to lead to new tools, applications, devices and resources which will affect the information practices of art historians. Thus, it is suggested that further research on the information and scholarly practices of art historians should be conducted at least every five years while some of the findings may need to be revised more often.

NOTES

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