

**Embedding Creativity into Digital Resources: Improving
Information Discovery for Art History**

Journal:	<i>Digital Scholarship in the Humanities</i>
Manuscript ID	DSH-2019-0197.R1
Manuscript Type:	Full Paper
Date Submitted by the Author:	n/a
Complete List of Authors:	Kamosiori, Christina; Research Libraries UK, ; University College London, Information Studies Warwick, Claire; Durham University, English Studies Mahony, Simon; Beijing Normal University
Keywords:	art history, digital resources, scholarly practices, serendipity, creativity, information seeking, research, teaching

SCHOLARONE™
Manuscripts

Embedding Creativity into Digital Resources: Improving Information Discovery for Art History

Christina Kamposiori, University College London, United Kingdom

Claire Warwick, University of Durham, United Kingdom

Simon Mahony, Beijing Normal University at Zhuhai, 519087, China

Introduction

The emergence of digital libraries and archives has greatly facilitated the need of Arts & Humanities scholars for finding diverse types of information. Never before was there such breadth of information and services available for scholars to use; most importantly, though, such developments have offered the advantage of not only speeding up the research process, but also for enabling innovative research inquiry. Thus, accessing and using a variety of digital resources has become a standard step in the daily work routine of scholars.

Previous research has showed that, until recently, art historians were still considered to be hesitant about the adoption of digital technologies, while many researchers were not convinced about the positive effect such technologies could have on their research (e.g. see Rodríguez-Ortega, 2013; Zorich, 2012, pp. 19-22; Cuno, 2012). However, this issue can be better understood if we consider several factors that characterize the field and are often associated with complex information behaviour and needs, making the employment of digital technologies for research purposes especially challenging.

Firstly, the extensive list of subjects studied – often interdisciplinary in nature – and methodological approaches employed by art historians today frequently require the use of a wide array of information objects (e.g. textual, visual and multimedia) in order to successfully answer a project's research questions. On the other hand, the different career stages of scholars, the various degrees of digital literacy as well as the difficulties often faced by researchers when using digital material - such as access problems, low image quality, copyright issues, cost (e.g. see Beeman, 1995; Rose, 2002; Grindley, 2006; Haynes, 2008; Zorich, 2012) - can significantly impact the use of digital services and tools in research and teaching. Despite the challenges, though, art historians have started developing a greater reliance on digital resources (Beaudoin and Brady, 2011, p. 30).

1
2
3 Thus, the complex information behaviour of art historians as well as the challenges they often
4 face when interacting with digital resources make them a great example of the impact that
5 digital libraries and archives can have on the research process and enable us to reflect on how
6 these can be improved to ensure that are tailored to the needs of scholars. For the purposes of
7 this paper, we aim to explore the following question:
8
9

- 10 • What can we learn from the study of scholarly practices during different stages of research
11 and the creative interactions of art historians with information that we can apply to the
12 building of better digital resources for scholarship in the field?
13
14
15
16
17
18

19 Given the constantly evolving research practices of scholars in the art historical discipline,
20 answering this question will significantly deepen our understanding of their information
21 behaviour and needs; this knowledge can then be applied to the creation of better digital
22 resources and tools to support key areas of scholarship in the field. Before we discuss our
23 results and attempt to answer the above question, the methodological approach employed for
24 the purposes of this study will be presented.
25
26
27
28
29

30 **Using ethnography to study scholarly practices**

31
32 This study employed an ethnographic approach to develop a sound understanding of
33 scholarly practices in art history. Ethnography has been increasingly used in the context of
34 library and information studies since the 1990s (Lanclos and Asher, 2016). Khoo, Rozaklis,
35 and Hall (2012) conducted a useful survey of ethnographic research in libraries, including the
36 most frequently used methods, which noted an increase in the use of this type of approach to
37 explore issues related to libraries and library users.
38
39
40
41
42

43 However, even though the use of ethnography is becoming more widespread, Lanclos and
44 Asher (2016) argued that the circumstances under which it is often conducted do not enable
45 librarians and information professionals to gain the full benefits of this approach. More
46 specifically, the approach usually employed within libraries, called ‘ethnographish’ by
47 Lanclos and Asher, utilises ethnographic methods in the context of short-term, and with
48 narrow scope, projects. Yet, in order to be able to conduct long-term and open-ended projects
49 through which the potential of this approach can be realised (e.g. gain perspectives that
50 quantitative approaches can not provide), Lanclos and Asher (2016) suggested that problems,
51 such as lack of resources and limited training in ethnography, need to be first overcome
52 within libraries. Khoo, Rozaklis, and Hall (2012) and Priestner and Borg (2016) also agreed
53
54
55
56
57
58
59
60

1
2
3 that ethnography involves time consuming processes when it comes to data collection and
4 analysis which require additional effort and, thus, additional support for those who conduct it.
5
6

7 Ethnographic methods, such as interviews and observation, have been widely employed by
8 studies seeking to understand scholarly and user practices in the Arts & Humanities, many of
9 which have been taken into consideration while designing this project and analysing its
10 results (e.g. see Benardou, Constantopoulos, and Dallas, 2013; Antonijević and Cahoy, 2014;
11 Antonijević, 2015; Martin and Quan-Haase, 2016; Zhang and Soergel, 2016). Even though
12 the majority of these studies did not employ the kind of longitudinal approach that tends to
13 characterise traditional ethnography, their authors still managed to conduct an in-depth
14 exploration of scholarly and user practices and reveal aspects of behaviour that are not
15 possible to uncover through employing different approaches (e.g. quantitative).
16
17
18
19
20
21
22

23
24 In this study, by conducting semi-structured, in-depth interviews with twenty art historians as
25 well as observation of their physical and digital personal information collections, we aimed to
26 identify the particular needs they have when they build them. Personal collections are at the
27 core of art historians' workspace (e.g. see Long and Schonfeld, 2014, pp. 23-25), and so are
28 an important starting point for understanding behaviour and practices that are difficult to
29 study otherwise, due to the private nature and the various personal criteria applied. The
30 interviews, either in person or on Skype, were based on a semi-structured interview guide;
31 each lasted approximately one hour. Moreover, the interviewing phase included, when
32 possible and with the interviewees' consent, observation of the interviewees' personal
33 physical and/ or digital collections, taking photographs as part of the process.
34
35
36
37
38
39
40
41

42 Sixteen of the research participants were based at UK institutions, two scholars were based in
43 Europe and another two outside Europe. Eleven of the participants were female and nine
44 male. Their technical skills varied from advanced to basic and career stages ranged from
45 established academics to PhD students, early career researchers, and independent scholars.
46 We were particularly interested in interviewing two groups of scholars; one where scholars
47 worked on commonly studied areas (e.g. various areas of European art, like Renaissance art)
48 or employed traditional art historical methods (e.g. stylistic analysis, historical investigation)
49 and another where the topics examined (e.g. non-Western art, digital art) or the methods
50 employed (e.g. quantitative, digital) were considered less traditional. This categorisation was
51 based on the premise that the practices of scholars in the first group (twelve scholars in this
52 study) had been frequently examined by previous studies in the field while the behaviour and
53
54
55
56
57
58
59
60

1
2
3 needs of those in the latter (eight scholars in this study) had been less studied (Rose, 2002, p.
4 37). Identifying any similarities and differences between these two groups of scholars could
5 provide a better insight into the needs that art historians in different areas of the field have in
6 terms of resources, tools and services.
7
8
9

10
11 The eras the interviewees explored through their projects ranged from the 14th century to
12 today, including Byzantine art, medieval art, Renaissance, contemporary and modern art, 3D
13 documentation of material cultural heritage, and art history education. The objects of study in
14 scholars' work ranged from actual objects (e.g. paintings, sculpture, manuscripts) and
15 monuments (e.g. churches) to historical and other issues in relation to art and its artists, such
16 as arts education and the creation of guidelines and standards.
17
18
19
20
21

22 A theoretical framework of empirically tested information behaviour models was used to
23 analyse the interview and observation data; more information on how these models were used
24 in the context of this study is provided in the section looking at the impact of digital resources
25 beyond discovery. These included Ellis's (1993) behavioural model which was based on
26 empirical, qualitative research of the information seeking behaviour of scholars in the social
27 and physical sciences. Ellis (1993, p. 482) presented the various behaviours involved in
28 information seeking as features; these are starting, chaining, browsing, differentiating,
29 monitoring, extracting, verifying, and ending. Additionally, we used Meho and Tibbo's
30 model (2003, pp. 581-582), who after studying a group of social scientists, discovered similar
31 characteristics in the information seeking behaviour of their participants with those that Ellis
32 had found, but they added three more features: accessing, networking and information
33 managing. These models were useful for identifying the distinctive behaviour of art historians
34 in this study in terms of the way they look for information during the initial stages of their
35 research.
36
37
38
39
40
41
42
43
44
45
46

47 Kuhlthau's Information Search Model (ISP) model (1991), which is concerned with the
48 cognitive aspects of information seeking, was valuable for understanding the reasons behind
49 certain decisions that scholars made when interacting with digital resources and facilitated
50 our exploration of the scholarly practices that follow information discovery. Kuhlthau's
51 model (1991, pp. 366-368) consists of the following stages: initiation, selection, exploration,
52 formulation, collection, and presentation. Shneiderman's (2000) framework, on the other
53 hand, enabled the interpretation of our data concerned with the creative interactions of
54 scholars with information (more information is provided later). Finally, given the fact that we
55
56
57
58
59
60

1
2
3 used scholars' personal collections of information to examine how art historians collect, use
4 and manage information for research and teaching, Palmer, Tefteau and Pirmann's (2009, pp.
5 16-19) scholarly activities and primitives, based on Unsworth's (2000) concept of scholarly
6 primitives, were fundamental for examining the practices (gathering and organizing) related
7 to the building of personal collections.
8
9

11 12 **Looking for inspiration**

13
14
15 Our study confirmed previous studies' findings (e.g. Bakewell, Beeman and Reese, 1988;
16 Beeman, 1995; Durran, 1997; Beaudoin, 2005) in terms of the significance that information
17 objects such as original artworks and primary resources, such monuments, manuscripts and
18 archival material, and visual surrogates (physical or digital) have for art historians' work.
19 Yet, apart from being the evidence upon which to base a research argument, in this study it
20 became apparent that these resources could also provide inspiration to begin a project. For
21 example, the examination of artworks can enable the discovery of the research subject and
22 support the generation of research questions. These questions, then, in combination with the
23 experience of the researcher, provoke searches for the required material. As Participant 04
24 (categorized as conducting traditional research) clearly explained:
25
26
27
28
29
30
31

32
33
34 Personally, I tend to start with objects or images. So, an interest will
35 often be sprung by looking at an image- often online just because it's
36 easy to access- either in an image library or normally a museum
37 website. [Participant 04]
38

39
40 This quote, apart from illustrating the importance that art objects and their surrogates can
41 play early on in a research project, also reveals the inspirational effect that digital resources
42 containing relevant and openly available material can have on research. Graham
43 and Bailey (2006, p. 22) also found that digital images can facilitate creativity and the
44 thinking process of art historians, while Makri and Warwick (2010, p. 1758) had a similar
45 finding showing the inspirational effect that information found online could have on
46 triggering new ideas for current and future projects in the work of postgraduate architecture
47 students in their study. At this point, it is worth noting that, according to Shneiderman (2000)
48 getting inspiration from information is a characteristic of creative disciplines; based on the
49 findings presented in this paper, we argue that art history is a creative discipline (more
50 information is provided later) and this characteristic should be taken into account when
51 designing digital resources to meet scholars' needs.
52
53
54
55
56
57
58
59
60

1
2
3 Most of the participants in this study started their research in the digital environment, an
4 approach which was also found to facilitate serendipity. Online discoveries made at this stage
5 of the scholarly workflow were likely to influence the design of a research project and the
6 information collected. For example, Participant 03's account (categorized as conducting
7 traditional research) of the way they looked for material on the Web suggests that serendipity
8 can influence the research process.
9

10
11
12
13
14 I mean, there are a lot of these very early texts, these are Victorian
15 texts, all these do seem to be often on the Web somewhere, but I don't
16 intend to go looking for them now. If they come up, I'll go for them.
17 But I don't tend to go looking for them. [Participant 03]
18
19

20
21 Additionally, Participant 01's statement on 'trial and error' as a method of finding the needed
22 information digitally suggests the existence of an element of serendipity in information
23 discovery that can have an impact on the information seeking process.
24
25

26
27 I think it's generally true that people tend to find what they need
28 digitally by trial and error. People say Google and you occasionally
29 get a sort of a passing reference to 'Oh there is a good website, have
30 you tried Gallica?', but there are very little structured places to go for
31 digital resources. [Participant 01]
32
33

34 The above quote also implies that, often, there is a user perception that 'trial and error' during
35 information seeking leads to a serendipitous discovery. This discovery, then, has an impact on
36 other decisions related to their information seeking behaviour. This can happen especially
37 when there is a lack of or limited awareness of structured places where one can find digital
38 resources relevant to their area of work.
39
40
41
42

43 There are two points that need to be discussed further to yield useful insights for designing
44 information systems to support serendipity. The first is users' mental models around
45 information searching and the way that digital libraries and other information environments
46 work. The second is the different factors that affect the chances of a serendipitous discovery.
47 Thinking about the former, Makri et al. (2007) found that a 'trial and error' approach to
48 information seeking was often encountered when there was a low understanding amongst
49 users of how aspects of a digital library operate, including the decisions behind the design of
50 the search facilities. They argued that users develop mental models of how information
51 systems and environments work based on their interactions with them; these can often be
52 'incomplete' and, thus, hinder them from achieving their information goals. They conclude
53
54
55
56
57
58
59
60

1
2
3 that it is important to be aware of users' different levels of understanding of how digital
4 libraries work to be able to support them effectively. It needs to be highlighted, that this
5 should also be taken into account when developing relevant services and designing user-
6 centred systems that support different information seeking practices, including the concept of
7 serendipity.
8
9

10
11
12 In the case of Participant 01, the connection between 'trial and error' and serendipity may
13 partly be the result of having an incomplete picture of how digital libraries and the Web
14 operate. However, we should also consider the existence of other factors that may have
15 influenced their chances of making an unexpected, but useful, discovery during their
16 searching sessions and which may often be difficult to incorporate into design. According to
17 Race and Makri (2016), there are personal, internal factors that affect one's chances of a
18 serendipitous discovery. For example, aspects of the user's personality, such as curiosity, and
19 issues such as topical knowledge, time, and communication can all play a role in making a
20 serendipitous discovery. Similarly, external factors, such as systemic characteristics, can also
21 have an effect on this process.
22
23
24
25
26
27
28
29

30
31 Factors, such as the user's curiosity or communication with colleagues, may have also
32 contributed in alleviating the negative impact that problematic access had on Participant 01's
33 information seeking behaviour by leading to serendipitous discoveries. Thus, even though it
34 may be difficult to control serendipity, from the perspective of information professionals,
35 careful planning which takes into account aspects of the users' mental models or the factors
36 that can affect serendipity increases the possibility of influencing this process (also in Race
37 and Makri, 2016, p. 21).
38
39
40
41
42

43
44 Several studies have looked into the role of serendipity in scholarly practice and examined
45 whether it can be supported by information systems (one of the most recent is that by Martin
46 and Quan-Haase, 2017). For instance, Foster and Ford (2003, p. 337) studied serendipity in
47 the context of the information seeking behaviour of interdisciplinary scholars and suggested
48 that further examination is needed in order to understand that phenomenon which, as they
49 argued, is '[...] a difficult concept to research since it is by definition not particularly
50 susceptible to systematic control and prediction.' In this research, we discovered that
51 serendipity was more likely to occur during the first stage of research, when scholars
52 attempted to investigate a topic. At this stage, researchers tended to be more 'open' to
53 accidental information discoveries - a personal characteristic identified by Race and Makri
54
55
56
57
58
59
60

1
2
3 (2016, p. 17) as necessary to experience serendipity - and the possibilities to find unexpected
4 information that would significantly affect the research process were greater.
5
6

7 Yet, the fact that some areas of research benefit from a larger pool of online resources (e.g.
8 19th century European art compared to Non-Western art) cannot be overlooked when
9 considering the possibilities of discovering information serendipitously. For instance,
10 Participant 08 (categorized as conducting non-traditional research), who was researching 19th
11 century Japanese painting, found online serendipitous discovery less likely since an important
12 part of the information they needed was only accessible physically.
13
14
15
16
17

18
19 And so, I've got all of that in Japan because it's very hard to get those
20 books here. [...] I'm reading as well manuscripts, handwritten books,
21 as a sort of social context. [Participant 08]
22

23 This issue, then, generates questions regarding the extent to which information resources
24 available online - even when including secondary material - meet the needs of scholars in the
25 various sub-disciplinary areas of art history, such as non-Western art. The art period that a
26 project was looking at, the geographical focus of its subject (e.g. non-Western art) or the fact
27 that the topic under investigation may have not been researched before were often connected
28 to issues of availability of resources, conveniently accessible to scholars.
29
30
31
32
33

34 However, even in the cases when the material was available online, issues around digitization
35 sometimes meant that it was necessary for scholars to visit a resource physically. As,
36 Participant 16 (categorized as conducting traditional research) commented:
37
38
39

40 Printed photographs in secondary material; so modern photographic
41 reproductions, engravings in nineteenth century periodicals or books
42 which I usually see them digitized to begin with, which can be a
43 problem because one digitization project makes it look entirely
44 different from another, or I see them in the flesh. [Participant 16]
45
46
47

48 Thus, aspects of the design of a resource, such as the way digitization has been conducted or
49 its interface, and the experience it offered to the user were factors influencing scholars'
50 information behaviour. Such issues could also influence their decisions as to which resources
51 to use more generally. Participant 09 (categorized as conducting non-traditional research),
52 gives an example of potential problems that can be encountered when using a digital
53 resource, while Participant 03 explains why they avoid using particular resources.
54
55
56
57
58
59
60

1
2
3 I mean, I have a manuscript in Rome. It's held in another library, not
4 in the Vatican, and they have digitized their collection, but for some
5 reason that I'm still trying to understand they have digitized only the
6 decorated part of the page. So, basically I get a decorated initial and I
7 cannot read the text. [...] There are choices that have been made online
8 that to me are completely absurd. [Participant 09]

11
12 So I tend to try and avoid this sort of very dedicated websites which
13 are special and you see all sorts of stuff because they tend not to have
14 quite what you want and I don't seem to get quite used to finding this
15 stuff, so I do tend to just use the search engines and see what it comes
16 up and go from there. [Participant 03]

19
20 However, despite the challenges, digital resources can be useful to researchers when they do
21 not have a fixed idea of the kind of information they are looking for; having good quality
22 metadata can significantly facilitate the discovery process in such cases. Participant 17
23 (categorized as conducting non-traditional research) shared the reasons why they find
24 particular resources helpful under such circumstances.

28
29 There are bodies of work that I remember even if I don't remember
30 about exactly how I'm going to find them or where they are.
31 Resources like Rhizome are really useful because for a long time they
32 archived a lot of Internet artworks. So that's a good cause of call
33 which is as similar as it gets to going to an art gallery because I can
34 look at an artwork in that archive but I can also more often than not
35 find discussion that surrounds that artwork. [Participant 17]

38
39 Moreover, digital resources were found to be particularly helpful to scholars who
40 consulted them for teaching purposes in art history. For instance, Participant 11
41 mentioned finding electronic material useful when it came to preparing class material.

44
45 I teach a lot, so I tend to use electronic versions as much as possible.
46 [Participant 11]

48
49 Yet, teaching, although there is often flexibility in terms of copyright, has its own challenges
50 in terms of the information objects to be used and the places they can be found. For
51 example, Participant 20 explains how the material needed is subjected to requirements posed
52 by the topic taught as well as the level of the tutees.

55
56 It would either be to a library or a museum or if I'm teaching an
57 architectural subject, I'd go and see the building that I was going to
58 be teaching and photograph it on site, because quite a
59
60

1
2
3 lot of the things that I teach are not available visually on the Web. You
4 can get generic images of monuments that are popularly taught,
5 but you can't get the details that enable one to teach the
6 material that you want to communicate. [...] Well, the
7 level that you're teaching a student will dictate the specialisation
8 of the images you're searching for. [Participant 20]
9
10
11

12 This section aimed to illustrate the impact that institutional digitization and the building of
13 digital resources can have on the first stages of the scholarly workflow in art history. Our
14 participants' accounts suggest that digital collections and other online resources have the
15 potential not only to enable research, but also to inspire the beginning of a project or
16 influence scholars' decisions regarding its design and the data that is going to be collected.
17 Yet, several of the challenges raised here indicate that digitization initiatives are not always
18 conducted with the end user in mind, and this can reduce their usefulness to researchers.
19 Before making suggestions for designing resources to meet the need of scholars in the field,
20 we will look at the impact of such resources beyond the first stages of research.
21
22
23
24
25
26
27

28 **The impact of digital resources beyond information discovery**

29
30
31 Thinking about art historians' behaviour after the discovery of information, Palmer, Tefteau
32 and Pirmann (2009, p. 16) highlighted our limited knowledge around practices such as the
33 gathering and organizing of information, along with any patterns in scholarly behaviour.
34 Gathering, in particular, can be challenging to study; the reasons why scholars decide to
35 gather specific information when they discover it, and the way in which they collect it are
36 details that are difficult to capture. However, our data allowed us to make new discoveries
37 about the actions of scholars after information discovery.
38
39
40
41
42
43

44 Generally speaking, art historians in this study collected any material they considered of
45 importance for the purposes of their projects at that time or in the future; this finding is in
46 accordance with earlier studies about Arts & Humanities scholars' gathering habits (e.g.
47 Palmer, Tefteau and Pirmann, 2009, pp. 16-17). Yet, the design of our study and the
48 employment of relevant information behaviour models enabled us to identify a pattern in
49 their gathering behaviour not previously recorded. We started with Kuhlthau's Information
50 Search Model (ISM) (1991, pp. 366-368) and its six stages of information seeking.
51
52
53
54
55
56

57 We then compared the behaviour of the art historians' participating in this study to the
58 different feelings, thoughts, actions and tasks associated with each stage of the Kuhlthau's
59
60

1
2
3 model, and decided that the ‘exploration’ and ‘collection’ stages would constitute our main
4 focus. These stages and their properties were most relevant to explain the patterns identified
5 in our data and, more specifically, the fact that our participants’ gathering behaviour tended
6 to consist of at least two main phases (see Table 1 below, also see Kamposiori, Warwick and
7 Mahony 2018, p. 95). Although in Kuhlthau’s model the gathering of information takes place
8 only when the user has developed a certain confidence in their topic and, thus, it is naturally
9 more focused, art historians in this study began gathering material much earlier, at the time
10 resembling Kuhlthau’s exploration stage (when uncertainty is more common).
11
12
13
14
15
16

17
18 Indeed, apart from being conducted in the context of exploring a new topic at the beginning
19 of research, our participants’ first phase of gathering was often a result of the feelings
20 associated with obstacles encountered during the information seeking process (corresponding
21 to Kuhlthau’s exploration stage), such as frustration due to limited access, which made the
22 need to gather as much as possible (digitally and physically) more urgent. Then, a more
23 focused gathering phase was identified which often took place at a more advanced stage of
24 the research, after reading and during writing (especially in the cases where projects lasted
25 for a long time) and bore similarities to Kuhlthau’s collection stage. Yet, as Kuhlthau argued,
26 it is possible for users to gather information during various stages of the research process
27 based on their particular behaviour and needs, while entering the writing stage as well as
28 conducting an initial organization of the collected material may enable them to develop this
29 more focused approach which leads to a second phase of gathering (1991, pp. 368-369).
30
31
32
33
34
35
36
37
38

39
40 Therefore, after using Kuhlthau’s ISP model to closely examine the behaviour of art
41 historians that followed the discovery of information, and identifying the impact that the
42 challenges associated with digital resources can have on this process, we suggest a variation
43 of the model. This should include an additional gathering task at the exploration stage called
44 *Exploratory Gathering* which will follow the *Exploratory Information Seeking* conducted
45 beforehand. Moreover, the second gathering task (with the same characteristics as the one
46 described in the model) could be named *Focused Gathering* and will come after the *Focused*
47 *Information Seeking*.
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. The gathering phases and their characteristics

Characteristics	Exploratory Gathering (1st phase)	Focused Gathering (2nd phase)
Action	Seeking and Gathering relevant 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	Creation and Initial organisation of information	Further information organisation/ Re-structuring

This finding was also examined from the perspective of other information seeking studies which include aspects of information collection in their models (e.g. information gathering, information managing), such as Shneiderman's framework (2000) or Meho and Tibbo's (2003) extended version of Ellis's information seeking model. More specifically, based on the assumption that there are two - at least - distinct stages of information seeking (of different nature and with different purpose) preceding the different gathering phases, we can then talk about repetitive tasks or a need to go back to a previous stage and, hence, refer to Shneiderman's framework (2000, pp. 119-124). Shneiderman suggested that non-linearity or repetitive tasks can be part of information seeking behaviour in creative areas while users can have different needs during these tasks. Having argued that art historical practice could be characterized as creative, especially in terms of its interaction with information, these observations suggest that art historians have different information needs during the different phases of their information seeking and gathering activities. This finding constitutes an addition to our current knowledge about the information seeking and gathering behaviour of art historians and should be taken into consideration when designing digital resources and tools to support scholarship in the field.

Finally, if we consider art historians' behaviour during the exploratory stage in more detail, gathering information indiscriminately early in the research process can pose information management challenges for scholars later in their research and have an impact on other

1
2
3 scholarly activities, such as reading and writing. As discovered in this research, scholars often
4 had to take action with regards to the management of the collected material and sometimes,
5 as Participant 19 also argued, even discard information, in order to be able to use it
6 effectively (e.g. to retrieve useful information).
7
8
9

10
11 But I would say the first year was the main phase of gathering and being
12 quite indiscriminate. Then, the second year you gather but you're much
13 more discriminate about what you choose to include and what you
14 choose to ignore because then you have to contain it. Contain, you know,
15 is a keyword [laughs]. [...] It's always a struggle to keep up on top of
16 all the information that you gather. And you have to make some
17 decisions; even regarding things that you thought would be useful, you
18 have to make some decisions to just discard. [Participant 19]
19
20
21

22 This observation also brings to mind Meho and Tibbo's (2003, p. 584) argument about
23 information management; even though it is not considered an actual information seeking task,
24 information management (or managing information) is essential when personal collections
25 play an important role in the research process (as in the case of the art historians in our
26 study), since it can affect other scholarly practices and tasks conducted in the context of
27 research, such as information retrieval (from personal collections). Thus, understanding that
28 the problems that art historians face with regards to the use of digital resources can have an
29 impact on different stages of the scholarly workflow is a necessary step towards meeting their
30 needs and improving the research process.
31
32
33
34
35
36
37
38

39 **Designing for creativity**

40
41 Creativity is a concept that has been examined by a variety of disciplines, including the
42 humanities, psychology, social sciences, organisational theory and information studies, and
43 science; according to Seidel, Müller-Wienbergen and Becker (2010), originality and
44 innovation are at the core of the majority of definitions. In this research, we looked at
45 creativity as part of understanding art historians' practices when they work with information
46 and how they can best be supported by information systems. More specifically, while
47 studying scholars' information behaviour at different stages of their research, it became
48 apparent that aspects of the way they interacted with information could be characterised as
49 creative; this means that the way information was discovered or used gave rise to a
50 breakthrough moment in their work.
51
52
53
54
55
56
57
58
59
60

1
2
3 For the purposes of analysing this part of their behaviour, we consulted relevant studies from
4 the field of information science; Shneiderman's (2000) framework for creativity was
5 particularly useful. This four-phase genex framework was developed based on three different
6 theories of creativity - inspirationalist, structuralist, and situationalist - to enable system
7 design that supports creative work. Briefly, the inspirational view on creativity advocates
8 brainstorming, free association, lateral and divergent thinking and, accordingly, about
9 strategies that support creative work by looking at a problem 'with fresh eyes' (Shneiderman,
10 2000, p. 116). On the other hand, the structuralist perspective supports a more
11 methodological approach to problem solving (e.g. by looking at strengths and weaknesses) to
12 achieve innovation, while the situationalist stress the key role that the cultural and social
13 environment play in an innovator's work (Shneiderman, 2000, pp. 116-117).

22
23 Shneiderman's framework includes four creative activities - collect, relate, create and donate
24 - and potential tasks associated with them (2000, p. 123). The discussion around the
25 framework also referred to some of the characteristics of creative work; examples are the
26 ability to get inspiration from information (as mentioned earlier), especially visual
27 information, and the non-linearity of the tasks involved in this type of work (e.g.
28 Shneiderman, 2000, p. 120). Regarding the latter, and as discussed previously, by using
29 Kuhlthau's model alongside Shneiderman's framework, we discovered that the information
30 seeking behaviour of art historians entailed repetitive tasks. This, alongside other creative
31 aspects of participants' information behaviour - such as the inspiration they gained when they
32 discovered certain types of information and, at a later stage, organised their personal
33 information collections, and the positive impact this had on the progress of their work -
34 enabled us to argue that art history is a creative discipline.

43
44 Regarding the first stages of research, when serendipity was found to be more likely to
45 happen in this study, it was noted that unexpected discoveries while searching and browsing
46 online could have an impact on scholars' work, by triggering creative thoughts and
47 influencing the research process. The contribution of serendipitous encounters to the
48 development of creative insights has been recognised by several studies (e.g. Boden, 1996;
49 Foster and Ford, 2003; McCay-Peet and Toms, 2011; Race, 2012; Taramigkou et al., 2013;
50 Race and Makri, 2016). For example, Race argued that a serendipitous discovery promotes
51 creative thinking 'by fostering novel connections and frameworks' (2012, p. 140). On the
52 other hand, Race and Makri highlighted the link that exists between creativity, serendipity
53 and innovation, noting that 'most of the same factors that encourage or discourage creativity
54
55
56
57
58
59
60

1
2
3 and innovation encourage or discourage serendipity as well' (Race and Makri, 2016, p. 16).
4 Problematic access to digital resources, such as due to limited availability, low quality of
5 digital material or non-user friendly system design, is one of the factors that can affect the
6 chances of a serendipitous discovery and, accordingly, hinder creativity (also see
7 Shneiderman, 2000; Race and Makri, 2016); as noted earlier, this was an issue faced by
8 several participants in this study.
9
10
11
12

13
14 More specifically, despite the progress that digitization initiatives have made and the
15 increased availability of online material (especially secondary literature), we found that
16 scholars still lack digital access, particularly to primary resources and good quality, open
17 access, visual material. Finding high quality images, in particular, is of paramount importance
18 for art historical research; as we argue above, the discovery of interesting digital images can
19 have an inspirational effect in research. It is essential that digital images used in the study of
20 art and historical artefacts are of high resolution and colour accuracy (e.g. see Rhyne, 1997).
21 Such images are essential tools for conducting traditional and digital research as well as for
22 teaching and publishing in art history.
23
24
25
26
27
28
29

30
31 Access problems continue to perpetuate some of the habits of art historians noted in previous
32 studies (e.g. see Bakewell, Beeman and Reese, 1988, p. 86; Beeman, 1995, p. 95). These are
33 often associated with pre-digital or non-digital contexts and could cause significant
34 challenges at the later stages of research; for example, many of the participants in this study
35 still had to travel in order to visit the archives and museums holding the material they were
36 interested in, and even then, some found it challenging to locate or access content physically.
37
38
39
40

41
42 Interviewees in some areas of study, such as Asian and Japanese art, faced greater difficulty
43 in finding the material needed for their projects (especially primary resources) online;
44 unsurprisingly, the availability of digital resources on the Web tended to be greater in areas
45 dealing with Western art of popular eras (e.g. Renaissance art, 18th and 19th century
46 European art). Whereas scholars working on digital art were more likely to confront issues
47 around the re-accessing of data, due to the temporary character of the format of the resources
48 they used in their projects and the supporting infrastructure (e.g. software). The importance of
49 understanding the needs of scholars in non-traditional areas (e.g. Non-western art, digital art)
50 was first mentioned in Rose (2002) but has not yet been explored by other studies of the
51 information practices of art historians, despite the fact that research on these types of art is
52
53
54
55
56
57
58
59
60

1
2
3 growing. Thus issues of accessibility to resources that meet these art historians' needs
4 becomes ever more pressing.
5
6

7 To address these problems, digital resources that enable art historians to discover useful
8 information, enhance the chances of a serendipitous discovery and facilitate the creative
9 nature of research in the area, these should be based on scholars' practices and needs (e.g.
10 cataloguing material in a meaningful way for scholars). Our study also shows that they must
11 meet the needs of a diverse group of scholars with various degrees of technical ability and
12 potentially different mental models, meaning different understanding of how digital
13 information systems work.
14
15
16
17
18

19 Thus, the interface design should be simple and easy to use, and the functionality should
20 encourage different types of searching. Given art historians' frequent need to browse content
21 in collections, (especially when they are not sure what they are looking for) and to engage
22 visually with information, digital resources targeted to this group of researchers should
23 enable the visual exploration of collections. This could be achieved by allowing users to get
24 an overview of the material (or groups of information) in a collection, providing suggestions
25 for similar content and offering services that facilitate intuitive interaction with information
26 (e.g. zooming in-out, flicking through) (also see Shneiderman, 1996, Whitelaw, 2015).
27 Including related metadata alongside the digital objects in a collection, as well as information
28 on the decision-making process with regards to digitization, will enable scholars to make
29 informed decisions when using digital content and gain necessary details for the purposes of
30 their work. Finally, enabling access to digital collections through different means, including
31 the ability to view and download material, is necessary in order to meet scholars' evolving
32 need to access and manage material across devices and tools.
33
34
35
36
37
38
39
40
41
42
43
44

45 Art historians have increasingly become aware of the effects that the design of a user
46 interface, including the search facilities, of a digital resource or the digitization process
47 preceding its building can have on their work; for instance, some of the participants (e.g.
48 Participant 09 below) referred to the apparent interpretative choices that had been made to the
49 content of specific resources or referred to the searching problems encountered due to the
50 way that the material was classified and catalogued.
51
52
53
54
55

56 I mean, I have a manuscript in Rome. It's held in another library, not in the
57 Vatican, and they have digitised their collection, but for some reason that
58 I'm still trying to understand they have digitised only the decorated part of
59
60

1
2
3 the page. So, basically I get a decorated initial and I cannot read the text.
4 [...] There are choices that have been made online that to me are
5 completely absurd. [Participant 09]
6
7

8 Our interview data indicates that poor editorial choices reduce the usefulness of the digitized
9 content for scholars, who must then look for another resource online or visit the resource
10 physically. Therefore, incorporating scholars' (as the potential users) views early in the
11 digitization process, providing essential information about the choices that have been made
12 during the building of a digital resource, and gaining user feedback about aspects of the
13 interface design, will not only increase its usefulness for scholars and earn their trust but can
14 also prove beneficial for the longevity of this resource. This is far from being a new
15 recommendation; indeed, it is one that members of our research group have been making for
16 over a decade in different contexts.
17
18
19
20
21
22
23

24 The design requirements we suggest may also seem simple: the importance of features such
25 as clear interface design and ability to gain an overview of collections has long been known,
26 but is not as easily achieved as might initially have been imagined (e.g. see Greene et al.,
27 2000; Dillon, 2000; Rapp et al., 2003; Makri et al., 2007; Warwick, 2017). The experience of
28 the users that we interviewed, and the continued hesitant stance of many art historians to
29 adopt digital research techniques suggests that they do not yet feel that digital resources are
30 sufficiently easy to use, or sufficiently well suited to their needs. Thus, we feel it is important
31 to reiterate the need for such apparently basic design features and for user centred design
32 from the beginning of projects.
33
34
35
36
37
38
39
40

41 **Conclusion**

42
43 The aim of this paper was to explore how digital resources can be best improved to enhance
44 information discovery and use in art history through examining the creative interaction of
45 scholars in the field with information at different stages of the research process. By looking at
46 the scholarly practices and needs of art historians at the beginning of research as well as after
47 information discovery, we make recommendations for digital resource design that will
48 facilitate the creative encounters of scholars with information. Achieving this will have a
49 positive effect not only on the processes of information seeking and discovery, but also on the
50 whole scholarly workflow.
51
52
53
54
55
56
57

58 At the first stages of art historians' research, we discovered that information encountered
59 serendipitously online could influence the research process, for example by inspiring the
60

1
2
3 beginning of a research project, directing further information seeking activity, and triggering
4 creative thoughts. However, it became evident that art historians still have limited access to
5 digital resources containing primary material which is digitised and presented according to
6 their preferences and needs. Through documenting and analysing the behaviour and needs of
7 scholars when they seek and gather information for their research and teaching projects, we
8 were not only able to identify the problems they faced, but also understand how these
9 affected aspects of research beyond the early stages.

10
11 Challenges associated with digital resources (e.g. lack of digital resources in an area of study,
12 poor digitization or resource design) were often found to impact scholars' behaviour at later
13 stages of their research by leading to the need for additional information seeking and
14 gathering; this could complicate other scholarly practices such as writing. More specifically,
15 in this study, at least two different stages of information seeking were found to occur in the
16 course of a project where scholars had different information needs during each of them, a
17 new discovery which has direct implications for digital resource design.

18
19 In this paper, we also highlight the need for digital resources that contain better quality
20 primary information such as images. However, user-friendly design that facilitates the
21 discovery and use of this information is also important. Thinking about enhancing the
22 chances of a serendipitous discovery, we argue that careful planning should take into account
23 users' mental models and other factors that can affect serendipity, such as aspects of the
24 user's personality. Moreover, the interface design will need to be simple and enable intuitive
25 and creative interaction with information (e.g. through visual exploration of collections) to
26 meet the needs of different groups of users (e.g. with various degrees of technical ability).

27
28 Incorporating scholars' views early on in the digitization or resource design process, and
29 making the surrounding decision making process more explicit, will increase user trust and
30 significantly enhance usability. Despite the simplicity of some of these recommendations, our
31 findings showed that many digital resources targeted to art historians still do not adequately
32 meet these criteria. Therefore, it is necessary to reiterate the importance of developing digital
33 resources with the end-user in mind if it is to ensure their longevity and usefulness for
34 scholars.

References

- Antonijević, S. (2015). *Amongst Digital Humanists. An Ethnographic Study of Digital Knowledge Production*. Palgrave Macmillan US, US.
- Antonijević, S. & Cahoy, E.S. (2014). Personal Library Curation: An Ethnographic Study of Scholars' Information Practices. *portal: Libraries and the Academy* 14(2), 287–306.
- Bakewell, E., Beeman, W.O. & Reese, C.M. (1988). *Object, Image, Inquiry. The art historian at work*. United States of America: J. Paul Getty Trust.
- Beaudoin, J. (2005). Image and Text: A Review of the Literature Concerning the Information Needs and Research Behaviors of Art Historians. *Art Documentation: Journal of the Art Libraries Society of North America*, 24(2), 34-37.
- Beaudoin, J.E. & Brady, J.E. (2011). Finding Visual Information: A Study of Image Resources Used by Archaeologists, Architects, Art Historians, and Artists. *Art Documentation: Journal of the Art Libraries Society of North America*, 30(2), 24-36.
- Beeman, A. (1995). Stalking the Art Historian. In Shields, M.A. (Ed.) *Work and technology in higher education: the Social Construction of Academic Computing*. Montclair, N.J.: Lawrence E. Earlbaum, 89-102.
- Benardou, A., Constantopoulos, P. & Dallas, C. (2013). An Approach to Analyzing Working Practices of Research Communities in the Humanities. *International Journal of Humanities and Arts Computing* 7(1/2), 105–127.
- Boden, M.A. (Ed.) (1996). *Dimensions of Creativity*. Cambridge, Massachusetts & London, England: MIT Press.
- Cuno, J. (2012), How Art History is failing at the Internet. *The Daily Dot*. Available at <https://www.dailydot.com/via/art-history-failing-internet/> (accessed 28 Oct. 2019).
- Dillon, A., 2000. Designing a Better Learning Environment with the Web: Problems and Prospects. *CyberPsychology & Behavior* 3. htt
- Durran, J. (1997). *Art History, Scholarship and Image Libraries: Realizing the Potential of the Digital Age*. Available at <http://www.scribd.com/doc/3799275/Art-History-Scholarship-and-Image-Libraries-Realising-the-Potential-of-the-Digital-Age> (accessed 27 Oct. 2019).
- Ellis, D. (1993). Modeling the information-seeking patterns of academic researchers: A grounded theory approach. *The Library Quarterly*, 63(4), 469-486.
- Foster, A. & Ford, N. (2003). Serendipity and Information Seeking: an empirical study. *Journal of Documentation*, 59(3): 321-340.

- 1
2
3 Graham, M.E. & Bailey, C. (2006). Digital images and art historians – Compare and contrast
4 revisited. *Art Libraries Journal*, 31(3), 21–24.
5
6
7 Greene, S., Marchionini, G., Plaisant, C., & Shneiderman, B. (2000). Previews and overviews
8 in digital libraries: Designing surrogates to support visual information seeking. *Journal of*
9 *the American Society for Information Science*, 51(4): 380-393.
10
11 Grindley, N. (2006). *What's in the Art-Historian's Toolkit? A Methods Network Working*
12 *Paper*. UK: AHRC ICT Methods Network.
13
14
15 Haynes, C. (2008). Art History. *Making History. The changing face of the profession in*
16 *Britain*. Available at
17 http://www.history.ac.uk/makinghistory/resources/articles/art_history.html (accessed 19
18 Feb. 2018).
19
20
21 Kamposiori, C., Warwick, C. & Mahony, S. (2018). Accessing and Using Digital Libraries in
22 Art History. In: Münster, S., Friedrichs, K., Niebling, F., & Seidel-Grzesińska, A. (Eds.),
23 *Digital Research and Education in Architectural Heritage*. 5th Conference, DECH 2017,
24 and First Workshop, UHDL 2017, Dresden, Germany, March 30-31, 2017, Revised
25 Selected Papers. Communications in Computer and Information Science. Switzerland:
26 Springer International Publishing, 83–101.
27
28
29
30 Khoo, M., Rozaklis, L. & Hall, C. (2012). A survey of the use of ethnographic methods in the
31 study of libraries and library users. *Library & Information Science Research* 34(2), 82–91.
32
33
34 Kuhlthau, C.C. (1991). Inside the search process: information seeking from the user's
35 perspective. *Journal of the American Society for Information Science*, 42(5), 361-371.
36
37
38 Lanclos, D. & Asher, A.D. (2016). “Ethnographish”: The State of the Ethnography in
39 Libraries. *Weave: Journal of Library User Experience* 1(5). Available at:
40 <http://hdl.handle.net/2027/spo.12535642.0001.503> (accessed 01 Aug. 2021).
41
42
43 Long, M. & Schonfeld, R.C. (2014). *Supporting the Changing Research Practices of Art*
44 *Historians*. ITHAKA S+R, 30 April 2014. Available at [http://www.sr.ithaka.org/research-](http://www.sr.ithaka.org/research-publications/supporting-changing-research-practices-art-historians)
45 [publications/supporting-changing-research-practices-art-historians](http://www.sr.ithaka.org/research-publications/supporting-changing-research-practices-art-historians) (accessed 31 Oct.
46 2019).
47
48
49 McCay-Peet, L. & Toms, E. (2011). Measuring the dimensions of serendipity in digital
50 environments. *Information Research* 16(3) Available at [http://www.informationr.net/ir/16-](http://www.informationr.net/ir/16-3/paper483.html)
51 [3/paper483.html](http://www.informationr.net/ir/16-3/paper483.html) (accessed 01 Aug. 2021).
52
53
54 Makri, S., Blandford, A., Gow, J., Rimmer, J., Warwick, C. and Buchanan, G. (2007). A
55 library or just another information resource? A case study of users' mental models of
56 traditional and digital libraries. *Journal of the American Society for Information Science*
57 *and Technology*, 58(3): 433-445
58
59
60

- 1
2
3 Makri, S. & Warwick, C. (2010). Information for inspiration: Understanding architects'
4 information seeking and use behaviors to inform design. *Journal of the American Society*
5 *for Information Science and Technology*, 61(9), 1745-1770.
6
7
8 Martin, K. & Quan-Haase, A. (2017). “A process of controlled serendipity”: An exploratory
9 study of historians' and digital historians' experiences of serendipity in digital
10 environments. *Proceedings of the Association of Information Science and Technology*, 54,
11 289–297.
12
13
14 Martin, K. & Quan-Haase, A. (2016). The role of agency in historians’ experiences of
15 serendipity in physical and digital information environments. *Journal of Documentation*
16 72(6) 1008–1026.
17
18
19 Meho, L.I. & Tibbo, H.R. (2003). Modeling the Information-Seeking Behavior of Social
20 Scientists: Ellis’s Study Revisited. *Journal of the American Society for Information*
21 *Science and Technology*, 54(6), 580-587.
22
23
24 Palmer, C.L., Teffeau, L.C. & Pirmann, C.M. (2009). *Scholarly Information Practices in the*
25 *Online Environment. Themes from the Literature and Implications for Library Service*
26 *Development*. Graduate School of Library & Information Science (GSLIS), Center for
27 Informatics Research in Science & Scholarship (CIRSS), University of Illinois at Urbana-
28 Champaign. Dublin, Ohio: OCLC Research.
29
30
31 Priestner, A. & Borg, M. (2016). *User Experience in Libraries: Applying Ethnography and*
32 *Human-Centred Design*. UK & US: Routledge.
33
34
35 Race, T. (2012). Resource Discovery Tools: Supporting Serendipity. *DLTS Faculty*
36 *Publications*. Available at: https://digitalcommons.wku.edu/dlts_fac_pub/22 (accessed 01
37 Aug. 2021).
38
39
40 Race, T.M. & Makri, S. (2016). *Accidental Information Discovery. Cultivating Serendipity in*
41 *the Digital Age*. UK: Chandos Publishing, Elsevier Ltd.
42
43
44 Rapp, A. Taylor, H., & Crane, G. (2003). The impact of digital libraries on cognitive
45 processes: Psychological issues of hypermedia. *Computers in Human Behavior*, 19(5):
46 609-628.
47
48
49 Rhyne, C.S. (1997). Images as Evidence in Art History and Related Disciplines. In: Bearman,
50 D. & Trant, J. (Eds.), *Proceedings of the Museums and the Web*, 15-19 March 1997. USA:
51 Archives & Museum Informatics.
52
53
54 Rodríguez-Ortega, N. (2013). It’s Time to Rethink and Expand Art History for the Digital
55 Age. *The Iris. Behind the Scenes at the Getty*. Available at [http://blogs.getty.edu/iris/its-](http://blogs.getty.edu/iris/its-time-to-rethink-and-expand-art-history-for-the-digital-age/)
56 [time-to-rethink-and-expand-art-history-for-the-digital-age/](http://blogs.getty.edu/iris/its-time-to-rethink-and-expand-art-history-for-the-digital-age/) (accessed 31 Oct. 2019).
57
58
59 Seidel, S., Müller-Wienbergen, F. & Becker, J. (2010). The Concept of Creativity in the
60 Information Systems Discipline: Past, Present, and Prospects. *Communications of the*

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Association for Information Systems 27(1), Article 14. Available at:
<https://aisel.aisnet.org/cais/vol27/iss1/14> (accessed 01 Aug. 2021).

Shneiderman, B. (2000). Creating Creativity: User Interfaces for Supporting Innovation. *ACM Transactions on Computer-Human Interaction - Special issue on human-computer interaction in the new millennium*, Part 1, 7(1): 114-138.

Shneiderman, B. (1996). The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations. In: *Proceedings of the 1996 IEEE Symposium on Visual Languages* (1994), 336-343.

M. Taramigkou, E. Bothos, D. Apostolou, & G. Mentzas (2013). Fostering serendipity in online information systems. *2013 International Conference on Engineering, Technology and Innovation (ICE) & IEEE International Technology Management Conference*, pp. 1-10.

Unsworth, J. (2000). Scholarly Primitives: what methods do humanities researchers have in common, and how might our tools reflect this? Presented at the 'Humanities Computing: formal methods, experimental practice' Symposium, King's College London, 13 May 2000. Available at <http://www.people.virginia.edu/~jmu2m/Kings.5-00/primitives.html> (accessed 28 Oct. 2019).

Warwick, C. (2017). Beauty is truth: Multi-sensory input and the challenge of designing aesthetically pleasing digital resources. *Digital Scholarship in the Humanities* 32 (2), 135–150

Whitelaw, M. (2015). Generous Interfaces for Digital Cultural Collections. *Digital Humanities Quarterly*, 9(1). Available at <http://www.digitalhumanities.org/dhq/vol/9/1/000205/000205.html> (accessed 30 Oct. 2019).

Zhang, P. & Soergel, D. (2016). Process patterns and conceptual changes in knowledge representations during information seeking and sensemaking: A qualitative user study. *Journal of Information Science* 42(1), 59–78.

Zorich, D.M. (2012). *Transitioning to a Digital World: Art History, Its Research Centers, and Digital Scholarship*. Report to the Samuel H. Kress Foundation and the Roy Rosenzweig Center for History and New Media, George Mason University.

Characteristics	Exploratory Gathering (1st phase)	Focused Gathering (2nd phase)
Action	Seeking and Gathering relevant 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	Creation and Initial organisation of information	Further information organisation/ Re-structuring