

## **Designing Personal Information Management Systems for Creative Practitioners**

Tim Coughlan & Peter Johnson  
HCI Group, Department of Computer Science  
University of Bath, Bath, BA7 2AY, UK  
Email: [t.coughlan@bath.ac.uk](mailto:t.coughlan@bath.ac.uk), [p.johnson@bath.ac.uk](mailto:p.johnson@bath.ac.uk)

### **Abstract**

This paper first explores information management by creative practitioners through a review of research related to the area. Two studies are then used to explore this area from different viewpoints. Topics of interest include the types of information that are commonly managed, the reasons for creating representations, the processes of finding and interacting with materials, and the tools used. This understanding is then applied and extended through the design and evaluation of an ‘Associative Scrapbook’ application inspired by the common use of scrapbooks by practitioners. Creative practice generally involves the retention, development and communication of ideas, inspirational materials and structures of associations represented in a range of media over long periods of time. Extensive variations in information management behaviour between individuals are seen as a natural part of creative processes. Through the studies and the example of the Associative Scrapbook, we argue that support for PIM in creative practice should better integrate work on specific task instances with the long-term collection and reuse of information related to the practitioners’ interests. Whilst there are needs that are specific for particular types of creative tasks, the studies and initial evaluations of the prototype provide evidence to suggest that creative PIM needs and processes show similarities across domains.

### **Introduction**

This paper examines the role of information management in creativity. It explores how creative practitioners manage and use representations of ideas, inspirational material and other resources. Creative processes are complex and can be studied at various levels and from various perspectives. They can for example be understood in terms of a single mind, in terms of collaborative interaction, or in terms of a society. They can also be considered in the context of a single task, or over the course of a life or career. The development and management of ideas and other information in creative endeavours is poorly understood, and could provide important insights for designing effective support for both the creative practitioner and for knowledge workers in general. In this paper we link together research from several perspectives, present two studies of information management behaviour in creative practice, and describe the design of an ‘Associative Scrapbook’ application to support PIM by creative practitioners based on our findings, along with observations from initial evaluations of a prototype.

Creativity is seen as a valuable resource for economic and psychological well-being [6], as an essential characteristic of human activity [7,14], and as a product of social and collaborative interactions [1,13]. Although our understanding of creativity and how to support it is still limited, recent years have seen a flurry of research and writing that characterises and defines it. There is an increased acceptance that creativity and innovation is a driving force in the modern information-based workplace. Florida argues that the thirst for creativity is the driving force that has provoked wide changes to social and economic structures [6]. He describes the growth of the ‘creative class’ who are

“never forced to work, yet ... never truly not at work”. Their work and lifestyle have become blended in order to suit the demands on them to be creative. Where this class was once a small minority, it has grown as more and more of the skills needed for economic success require a creative impetus. Beyond the set of professions that are creative at their core, there are a wider set of roles in our modern world, where some creativity is required for solving novel problems or developing improvements [6]. As machinery and computers perform the repetitive tasks for us, it is our unreplicated capacity for creativity that is more obviously valued.

Florida also argues that the lifestyle of the highly creative worker differs from the traditional ‘9 to 5’ worker because the creative process requires it [6]. A wide range of definitions of creativity and descriptions of this process exist, but they contain several common factors:

- A focus on the production of outcomes with some level of novelty and value [4]
- The utility of periods away from consciously focusing on the work, which often leads to solutions occurring to the mind [7]
- Socialising and collaborating with other practitioners and related people [1,13]
- Interacting with media and developing ideas through representation [4,14]
- Experiencing the world, in and away from the practitioner’s domain [6,7].

Underlying these visible characteristics is a complex psychological process that leads to the production and development of ideas that could fulfil particular requirements for novelty and value. Several researchers have posed theories of how novel ideas arise based on evidence gathered from observing and questioning practitioners. At the base of these theories is the logic that novel ideas are formed through the combination of existing items in the mind of the person. Koestler defined the process of combining these elements in to a novel idea as ‘Bisociation’ [9]. More recently researchers have expanded upon Koestler’s work, in particular Gelernter argues that creativity requires periods of both low and high focus thought. Novel ideas occur when looser associations of previously unrelated items are possible, during periods away from focused work, particularly whilst performing unrelated tasks in a relaxed state of mind. An interesting difficulty is that memory is generally poorer in these low focus states, so ideas can easily be forgotten if not recorded effectively. Creativity requires more than just novel thinking however, the value of the idea must also be considered. At the other end of the spectrum, evaluating these ideas requires an analytic, focused state of mind that considers the context where these ideas can possibly be used [7].

As the basis for generating novel ideas is dependent on the items that exist in a person’s memory, the other aspect of bisociation is the need to experience and collect information that may be of use to the process. These could either be highly related to the domain or subject, or only very loosely connected, providing scope for analogical thinking that takes from one sphere of human experience and applies to another. It is this need that drives the creative practitioner both to seek new experiences and social interactions. These associative and exploratory processes have both internal and external components, as whilst the phenomenon of the ‘eureka moment’ or sudden creative insight occurring through subconscious processes is well documented [7,9], there is an equal weight of material that explores how creative ideas can occur through interaction with representations of information, sketching behaviours [14], and through the interactions between people [13].

The processes surrounding the representation of ideas have been subject to analysis. *Sketching* behaviours are common across domains, characterised by quick, low cost externalisation in any media, with scope for leaving details ambiguous or missing [4,14]. The tools that support sketching behaviours support this without structure that inhibits the free expression of ideas. Paper and pen are successful in this role because they are both fast and unrestrictive. As they define and quantify input, computer tools often enforce structure and processes upon representation and this can restrict or interrupt creative thinking [4]. Bernstein et al note that *information scraps* including ideas, brainstorm and works-in-progress often elude our PIM tools, due to unmet needs including lightweight entry, unconstrained content and visibility [2]. Similar issues with specific relevance to creative activities are raised in our empirical studies, and explored in the design study reported here.

In addition there is often the need for social interaction for creative enterprises to occur. Becker's sociological analysis of the production of art argues that although we often view an artist as the 'creator' of a piece of work, s/he depends on a network of supporting people who are often highly influential to their success or failure [1]. The same reality can be seen across all creative enterprises whether or not the relationships are seen as collaborative. In the large commercially successful creative enterprises that typify much of the work of Florida's creative class (e.g. film, computer games, advertising) collaborations are an accepted necessity, often developing around the needs of a specific project and disbanding afterwards.

Amongst all of this we have practitioners working in an increasingly technologically rich, networked world. Work is often transitory, but ideas, knowledge and relationships are developed over the long term and utilised when and where they are appropriate. Personal Information Management is therefore key to the ability of the practitioner to cope. Jones and Teevan argue that "In a vision of better and better PIM, we spend less time with the burdensome and error-prone activities of managing information and more time making creative, intelligent use of the information at hand to get things done" [8]. Finding, keeping and re-finding relevant information is key to the ability to associate relevant items together, find interesting connections and have the right ideas and material to hand in a context where they may be valuable.

The management of information has some history as a theme in HCI-based creativity research. Shneiderman argues that the designers of new computer technologies should push beyond Vannevar Bush's concept of a Memex towards *Genex*, an integrated set of tools that generate excellence by combining access to information with support for creation, refinement and dissemination. Realisation of this requires a holistic understanding of practitioner's use of tools and processes [16]. Of particular relevance to this is Shibata & Hori's work on supporting long-term creative thinking, which produced systems that aimed to identify links between problems and existing information collected by users. The importance of making previously entered information that may be relevant visible to the user is argued for, and the system provides means to support this and to connect pieces of information together in various ways [15]. Semantic approaches to organising and linking information items are being developed for PIM through the Gnowsis Semantic Desktop, which could more effectively support these needs [12]. Exploring how the web can be utilised as a resource for collecting and sharing information in creative activities, Weakley and Edmonds developed WISA, a scrapbook for materials to support designers in collecting, organising and sharing useful resources online [17].

There has been a recent recognition in the software industry of the need for general tools that support informal representation and the organisation of a range of text and media resources. Microsoft's OneNote is described as a *digital notebook*. It supports the collection of notes made through pen input and other media with the ability to search and share the collected material [11]. Recognising a need for ubiquitous access to information repositories, Evernote provides linked software for web, desktop and mobile phone to support the creation and organisation of notes, media and links [5]. Research has also considered the use of the web as a basis for finding inspirational material on relevant topics. Of particular interest is Koh et al's work on Combinformation - a system called that produces collages of related text and images based on web searches [10].

This paper analyses the specific needs of the creative practitioner for PIM as a basis for supporting creative work. Given the understanding of creative processes described above, PIM in this context should relate to the exploration and representation of ideas and inspirational materials, the development of structures through which work occurs, and communications with others. In the next section, we present results from two studies that aimed to understand these needs from different perspectives. We then convert this understanding in to a preliminary assessment of how tools should be designed to support PIM for creative practitioners. Utilising this assessment we then describe the design process of a prototype tool: The Associative Scrapbook, and initial evaluations that occurred during this design process. Finally our conclusions from this process consider opportunities and requirements when designing in this area.

### **Understanding Needs for Personal Information Management in Creative Practice**

In order to understand the needs of creative practitioners for PIM, two studies are drawn upon. Personal Information Management is a process that is both complex and pervasive, and occurs both in the context of a specific task, and over the long term in practitioners' lives. In order to have perspectives on both of these, an observational study of a collaborative film-making task over a period of three weeks was used to gain a detailed understanding of needs in a specific instance of a creative task, while a questionnaire study probed the long term aspects of information management and use in a range of practitioners' lives.

#### **Observational Study of Collaborative Filmmaking**

An observational study of a collaborative filmmaking task performed over a three-week period was used to understand the needs and processes involved in information management within a creative task. Filmmaking was chosen as it was expected to require the use of a variety of media in the process of completing the task. The study used ad-hoc groups created to perform the task, therefore presenting needs for negotiating and organising how the work would be performed. It required several meetings of the practitioners, which were recorded, along with work performed outside of these meetings as individuals and as a group, additional communications were also logged and analysed. Participants completed pre and post study questionnaires describing their existing experiences and their use of media and tools whilst performing the study task.

The task given was to *create a short informational film to encourage people to do more to help the environment*. Two groups of four participants performed the same task independently. Although several of the participants had experience of making, writing and acting in films, this experience was not a prerequisite for participation. Of particular

interest were the devices and media used to record and share relevant information in order to plan and perform the task. The participants were told to use whatever materials they felt were appropriate, and were provided with technological support in the form of individual HP iPAQ Smartphones for each participant and a room equipped with a PC with a large screen for meetings. To encourage naturalistic use of the Smartphones, participants were given credit to use for either making calls or using Internet / email on the device.

#### *Use of Media and Tools:*

The participants used a range of media and tools to support the task. Paper based notes were commonly made in and away from meetings, despite the presence of the Smartphones intended for this purpose. When asked how they had used the smartphone, participants responded that it was largely unused, because it was neither large enough to support easy note taking, nor small enough to be easily carried. Its multimedia capabilities were again considered inadequate for producing the video, however the devices were used in several cases to capture images for use as storyboards, describing ideas for the script. Figure 1 below shows a participant explaining an idea for the film, making use of images taken from the device and displaying them on the large screen PC during a meeting.



*Figure 1: Excerpts from Video from Group Meeting (top) with Simultaneous Capture of story boards from Computer Screen (bottom)*

Although a video camera was made available to the groups, the final video was produced using the participants' own video camera in the first group, and through the Smartphones for the second group (although they were unhappy with the resulting quality of the film). An interesting issue is the distinction between sketching processes for initial representation of ideas – which the Smartphone should be capable of supporting – and the production of high quality final outcomes – which require resources more specific to the domain. Ideally the Smartphone would have provided scope for sketching ideas in a variety of media forms across a range of contexts (whilst mobile, in meetings etc). As the figure above illustrates, it showed some value in this way, particular through its immediate connectivity to the large screen PC, but in other cases it failed because it did not provide quick, low cost capture, and was not carried everywhere

due to its bulk.

In addition to producing their own content, several participants made use of the Internet to find video, image and audio media for use in the films. Individual findings were related to the groups in meetings, and generally involved the collection of a set of possible alternatives or complementary pieces of media to suit an identified need, e.g. several pieces of music that could provide possible soundtrack for a particular scene, or several clips of wood being transported on a range of vehicles that would be shown sequentially as part of a story about the costs of producing paper. This behaviour highlights several aspects of the creative process that are important to designing technological support, including the reuse, association and grouping of materials for various reflective purposes.

#### *Management of Information and Work:*

The participants made use of meetings to present the work they had performed, and to negotiate and plan next steps, delegating work that could be performed on an individual basis or arranging to meet for group based tasks. The ill-structured and unbounded nature of the task presented the groups with the ability to structure their actions ad-hoc in a way that suited their personal preferences and interests. For example Group 1 decided that they could create a film that featured four short pieces, one devised by each participant. However as their work evolved the links between these pieces became more apparent and the group worked more tightly to integrate pieces through sharing their partially developed pieces. Group 2 developed a single piece collaboratively, which was devised in one session, filmed in the next and then edited in a third.

These variations in process involved different management and sharing of media. This appears typical in creative tasks, in which there is never a single 'correct' way of working, but rather a process of structuring the work through decisions made as the task progresses. It is also apparent that media resources and representations of ideas are often developed by individuals, and then shared with others with additional explanations. The storyboards presented in figure 1 provided a trigger for the participant who created them, but would have made little sense to the rest of the group without commentary.

Whilst the study provided a useful understanding of how tools to represent, retain and share information are used in a creative task, we identified some shortcomings in the scope of this method. Participants related their unwillingness to learn to use the Smartphone device, given that they would have to return it at the end of the study. It was also considered that the utility of such a device for use in a single task was limited. In completing this task, the overheads of managing material were limited, as they only had to create one output over a relatively short period of time.

#### Questionnaire Study

Our previous work in this area aimed to understand interaction in creative *tasks* through observational studies of composing musicians and the design and evaluation of prototype tools to support this interaction [4]. We then moved on to understand the *constraining structures* that are used and developed in order to complete creative tasks due to their ill-structured nature, and how creativity is supported through using the computer as a medium for building and exploring structures in which to be creative [3]. Whilst it is important to study creative processes at various levels and from various perspectives, it became increasingly clear that an important aspect was not present in

this work that considered creative practice in terms of the performance of a single task (i.e the production of a single musical composition, piece of art, film). Not only does the practitioner develop influential experience and understanding over the course of performing many creative tasks, there were clearly aspects of the practitioners' lives that were highly relevant, but not explicitly intended to form a part of any current project. These included the collection of interesting materials and the retention of ideas unrelated to current projects, and the use of previously developed ideas and structures in the observed tasks.

As it became clear that important aspects of supporting creative processes could not be entirely understood through the observation of a single task, an open questionnaire study was performed asking practitioners about their use of devices to represent ideas. Building on the existing literature, particular focus was given to the topics of bisociation, time spent away from work on specific tasks, and communication with others relating to creative practice. Table 1 lists the questions posed to the 27 respondents. 17 of these described themselves as professionals while 10 described themselves as amateurs. Most respondents listed multiple creative occupations or hobbies (an average of 2.6), with 13 describing themselves as musicians, 10 creative writers and 6 painters. Further domains represented included web designers (5), researchers (5) and filmmakers (3). Respondents were found through local arts groups, university noticeboards and web forums for creative domains. Questionnaire responses were analysed and recurrent themes coded using the Weft Qualitative Data Analysis environment [16].

1) What tools do you use to record ideas and inspirational material? (e.g. a notepad, diary, dictaphone, PDA, Post It notes, mobile phone, laptop or anything else) Please describe when you have these tools with you and how you make use of them:
2) Describe how you represent ideas and inspirational material using the tool(s). What form do they take? (e.g. written text, sketches, photos, video, voice recordings, scraps cut from magazines etc):
3) How do you integrate the tool or tools with the rest of your work? When and why do you refer to it?
4) Can you recall ever having a good idea at an unexpected or inappropriate time? Examples of this would include when you were travelling, in bed, shopping or doing any other activity away from your work or practice. Does this happen often?
5) If you can, please describe a situation like this and what you did about it:
6) Do you feel that you have forgotten good ideas in the past because they occurred at an unexpected time and you could not record them?
7) Other than as part of a completed piece of work, do you share your ideas with others in any way? Please describe how and why:
8) Do you ever show the tool(s) mentioned earlier to other people? If so, when and why?
9) Apart from using the tool(s) mentioned earlier, how do you present your ideas to other people?
10) If you collaborate with other people, how do you come to decisions about what to do next as a group? What tools, if any, do you use as part of this (e.g. paper and pen, a computer etc) and how are they used?

*Table 1: Questions Used in the Survey*

### *Use of Media and Tools:*

In their responses, 26 of the 27 respondents described some use of paper and pen. Cameras and audio recorders were the second most popular devices, mentioned by 9 participants in each case. Mobile technology use was comparatively low, with only 5 respondents mentioning use of a mobile phone as a representational device and 3 using a PDA. Computers took various roles in the creative practice of 21 of the participants.

In order that valuable ideas were not forgotten wherever they occurred, 12 respondents related that they constantly carried a device with them. 6 participants reported using more than 4 separate devices in response to question 1, reflecting their desire to capture and represent in different modalities and the varied availability of devices as ideas occurred. This highlights a complex area for designing systems that allow practitioners to manage these varied media resources.

Contrasts in the needs of the practitioners responding to the questionnaire studies can be considered both as individual variations in process, and as a product of the contextual factors such as the domain, and the interpersonal circumstances of the activity. Descriptions of collaboration from the respondents took various forms that required various supporting tools, from jazz improvisations that utilised written music and notation software to generate shared representations for rehearsals and performance, to writers meeting occasionally to negotiate major factors in the plot, taking short notes, then performing most of the writing individually. The domain of the creative work clearly influences needs, as several respondents attested by producing separate responses to questions 1 and 2 for each domain of their creative practice.

### *Management of Information and Work:*

The management of ideas and inspirational material was an issue where respondents related a variety of problems, some of which they considered new technologies resolved or could resolve. For example a professional writer using a PDA favoured the device because "it keeps me from losing notes on scraps of paper". There were however problems with adopting new devices, in particular the overheads of digitising existing collections and increased 'information fragmentation' [8] as more devices are used. The need to amalgamate information, rather than add more tools that could not be integrated, was made clear.

Respondents generally described their creative processes as a series of transitions where new representations were made based on existing ones, supporting the continuing development of the idea in a distributed cognitive system. In answering question 3, a professional composer and writer stated that he kept "writing and re-writing and re-sketching the structures and number lists until they look good. By then I don't actually need to refer to my notebooks because my idea is clear enough to be entirely memorized - and often by that time, the piece is more or less finished". This exploration and redrafting process occurred over long periods, and ideas are often kept for the right context, in which they can be utilised effectively.

Strong distinctions were made between representations stored for personal use and those for communication. In general initial idea representations are for personal use, a common reason for this was that representations were made using conventions or terminology that would not make immediate sense to others. However in other cases these representations can form *part* of the communications of ideas to others, often with

additional annotations or commentary. These are particularly useful where words cannot express the idea in detail as it uses elements such as colour or sound that cannot be accurately represented. One respondent noted that “if I am working on a film and I want to convey an idea about the particular colours and tones of a scene then I use a scrapbook. This scrapbook contains many clippings from newspapers, magazines etc. This is because it is difficult to describe an exact colour or tone. If I say blue to the cameraman he may have one idea of blue and I may have another.”

### **Designing PIM Tools for Creative Practitioners**

It is clear through the literature and in both the studies performed that creative practice relies heavily upon interactions with a range of media. Technologies for the creation and management of ideas and inspirational material provide structures through which creativity occurs. Therefore their design can provoke or hinder creativity. This section provides some concepts with which to consider the design of tools for information management in this domain.

#### **Types of Information in Creative Practice**

At a basic level, understanding PIM needs for creative practitioners requires an understanding of the forms of information that are used and the ways in which they are used. In addition to the generic forms of information that are commonly managed, much of the information to be managed can be classified as either *idea representations* or *inspirational material*. A further essential form of information is the *associations* between these items.

##### ***Idea Representations:***

Ideas are not acquired in the sense that information can be, but emerge from a person or group. They are expressed in external representations that support initial retention, development towards a final outcome, and communication. However in many cases alternative representations of an idea, or combinations of these, are used for each of these purposes.

##### ***Inspirational Materials:***

Materials captured from the environment, from the Internet or other resources are an essential source of inspiration for creative practitioners. Common examples of these from the studies included existing work by others – either from the same domain or from another. This provided scope for the cross fertilisation of ideas within or across disciplines. Captured materials such as images taken of a location or object of meaning were used as triggers for memory. Clippings from magazines or newspapers, or links to material from the Internet were also collected for inspiration or instruction. Again these can be used in communication, but often require additional explanation.

##### ***Associations:***

In developing a creative output, defining the connections between, or composition of items, is a major aspect. In the long term, these connections are developed to organise materials and reflect upon them. The meaning of an association can be ambiguous or well-defined, they may reflect alternatives for a particular need or mutually inclusive items for use in a project. The context in which an idea is used is essential to its value, so the development of ideas for use often requires reflection on how items fit can together to form a coherent outcome.

#### **Common Interactions with Information in Creative Practice**

### *Retention:*

Ideas and inspirations are often retained simply because they are ‘interesting’ rather than having an obvious role to play in a current project. As the value of an idea is related to the context of its use, practitioners often retain representations of these items in the hope that they will be found again at an opportune moment. The use of various devices for idea representation in a range of contexts is an interesting design challenge. Not only is there scope for this initial capture to be better supported, it is evident from the questionnaire study that it is the rediscovery of these representations at the right time, and the ability of them to jog the memory of the person, which are essential to this process of idea retention actually being worthwhile. Systems should integrate support for collecting ideas from various sources, but one of the main requirements of such repositories is that they make these previously collected ideas visible at the right time.

### *Development:*

The development of a creative outcome occurs as practitioners work from initial sketches in any form through to a completed outcome. Representations are often redrafted and reflected on. A particular issue raised by questionnaire respondents was that multiple pieces of media often needed to be viewed simultaneously for comparison, yet computer tools rarely supported this effectively. Physically arranging media is also often cited as an important part of this reflective process. Development can also involve revisiting retained items for inspiration. One respondent to the questionnaire described the start of a new project as a “shuffle and cull” of collected ideas and inspirations.

### *Communication:*

Although many of the respondents to the questionnaire did not consider that they actively collaborated with others in their work, the majority shared ideas and partially completed work with other people as part of their development process. As described above this generally relied upon representations specifically developed for communication or combinations of representations and explanations.

### Supporting Task Specific and Long Term PIM

A useful distinction can be made between the management of a project aiming at a particular creative outcome, and the long-term management processes that occur in the course of a practitioner’s life. Project-specific PIM requires development and communication, as well as the refinding and reuse of suitable ideas and inspirational materials. Long-term processes include the retention of interesting ideas and the management and exploration of these collections. Support for creative PIM requires the consideration and integration of both these management needs, so that work can be developed based on existing materials, and associations that may be relevant can be easily explored.

### Variations in Process and Needs:

Despite the common elements described above, the needs for information management vary according to their context (e.g. the domain and any interpersonal dependencies), and diversity between practitioner’s adopted processes due to the ill-structured nature of creative activities. Identifying these commonalities and providing scope for variations is key to providing effective support. Interesting differences in process include the way in which film creation relies more heavily on an initial planning component, where musical composition often begins with periods spent exploring possible musical ideas using instruments. The process of developing a script that would then be filmed and edited made for a much more linear structure than was commonly seen in musical composition.

There are obviously tools and media that are necessary for specific creative tasks. Video cameras and files are of paramount importance in a video creation task, yet are less common in a musical composition task. A distinction can be made between the *forms of the outcome* that is highly relevant to these needs.

However there are overall similarities in media use and processes involved in both the tasks. Tools can in many cases provide the same facilities to be performed with a range of media, although there are of course individual differences and issues in implementation. With this in mind, we aimed to identify a set of requirements and actions that could be drawn from these studies and the literature, and in contrast to our previous work, produce a tool that worked across a wide range of contexts.

Although there is clearly a link between task performance and PIM, information management can be to some degree distinguished from the interaction with the outcome media (for which more specialised tools and functions are necessary as they form the structures of creative interaction), we would argue that support of PIM for creative practitioners is an area where general tools are more appropriate than is otherwise the case.

In addition to the domain specific differences mentioned above, there are clearly individual variations in process and needs. Novel outcomes emerge from novel processes and tools, so creative practitioners are drawn towards developing new and individual methods, and exploring the use of new tools. Both studies showed variation even within a domain of practice, so support tools need to provide for a range of approaches to information management.

### **Design of The Associative Scrapbook**

In this section, we apply the findings above to the development of a prototype tool for creative PIM. This is an ongoing iterative project, the initial design and evaluation of which are described below.

#### **Aims and Basic Design**

The use of scrapbooks and other means to collect, organise and display representations of ideas and inspirational material led to the adoption of a scrapbook metaphor as a basis for this design project. Exploring the opportunities for a computer-based scrapbook tool to improve upon or add to the usefulness of a physical scrapbook was an initial design aim in this project. It is hoped that through the project, not only will a useful tool for practitioners be produced, but also our understanding of creative interaction with representations both in specific tasks and over the long term can be improved.

Another aim was providing a means for users of the tool to be exposed to material that is associated in some way to their current work, to explore how this could aid the process of creativity. The exploration of media resources that are either loosely or closely related to the current focus needs to be understood as both appear to have uses in creative work. The way in which scrapbooks or similar sets of collected representations can be used as a tool for individual retention and reflection, but also as a tool for communication is also of interest.

At a basic level, a scrapbook allows the collection and arrangement of a range of media. It is unrestrictive in that objects can be placed anywhere and in any order. Like a

physical scrapbook, the application has *pages*, used to hold *scrap objects* such as a note, image or file. Every object created in, or added to the Associative Scrapbook is a scrap – even the pages themselves, allowing them to be referenced on other pages. The application can be used to create text notes and sketches, and will display images and thumbnails of video, however any kind of file can be added to the scrapbook and opened with an external application. This allows the scrapbook to provide an effective tool with which to collect and organise media of any form. The Associative Scrapbook provides scope for user-developed structures that support the *management of representations* rather than performing as a specialised tool with which to produce creative outcomes in any specific domain. It does not restrict the tools creative practitioners can use, and does not require the people that the practitioner communicates with to adopt the application.

Files can be added through drag and drop on to the library or directly on to a page. Alternatively single files or entire directories can be added to the library. Providing easy capture of materials from any resource is a priority. Once added to the library items can be replicated in multiple pages, allowing users to organise material according to various methods simultaneously. Essentially the scrapbook forms an overlay to the file system, as all added or created files are placed within a directory structure.

Scrap objects can have annotations added to them, using a small yellow box below them. These annotations can be used to tag objects or provide a description or title. All scraps held in the library can be searched by this annotation text, titles and also by the type of media.

Tagging items with the same term provides one method of association, and the spatial positioning of scraps on free form pages is a simple yet effective means for users to represent relationships. The design and evaluation of Associative Scrapbook is an opportunity to explore how functionality for building structures of associations can be effectively provided across the varied needs of creative practitioners. Supporting a range of forms of association, and functionality that effectively makes use of these structures to make relevant content visible at the right time, are key to creating an effective PIM tool for creative practitioners, and one topic of the ongoing development of the tool.

In response to the findings of the questionnaire study, rather than providing the ability to share the scrapbook itself or allow several users to collaborate through it, it was thought more appropriate that the application be considered a personal resource, with the ability to support communication. The basis for communication supported in the tool is to send pages, objects or groups of objects by email along with added text comments. Users can either develop a page specifically to communicate their idea, send existing representations with comments or send a single object quickly and easily. *People objects* are created as contacts with email data etc, to use for communications.

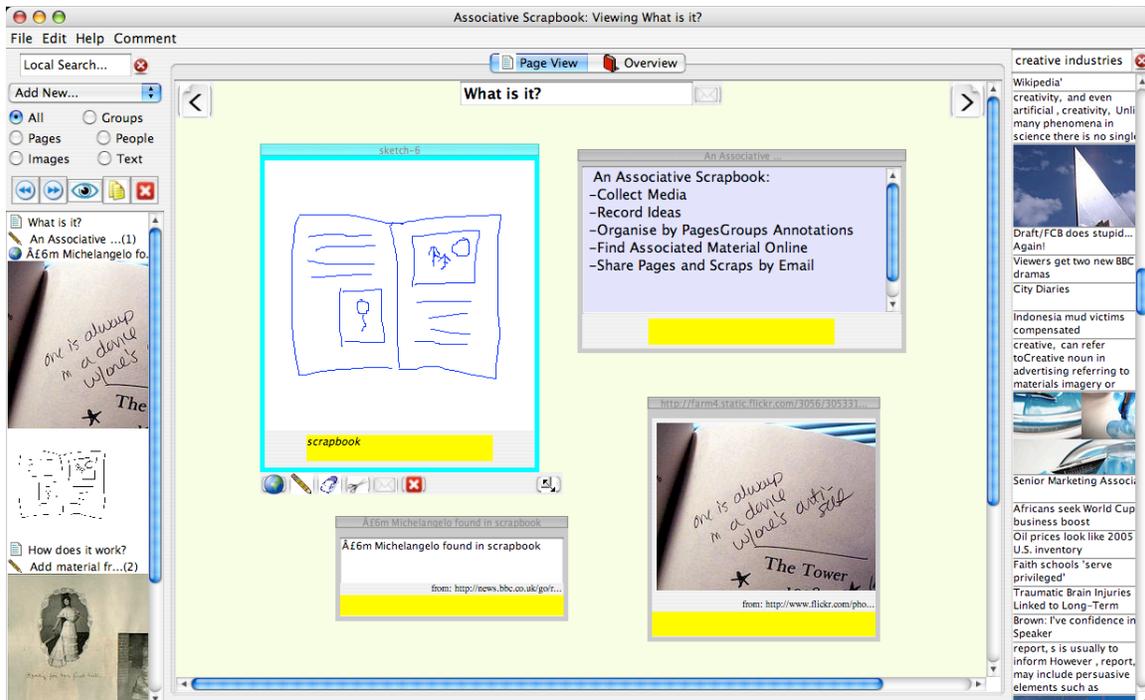


Figure 2: Page of the Scrapbook (centre), library (left) and web association panel (right)

A novel feature of the associative scrapbook is the display of material associated with the current focus of the user, collected from the web as the tool is used. This is shown in a scrolling display on the right side of the scrapbook, as shown in figure 2. This panel works in several ways, aiming to expose the user to inspirational material and also supporting explicit, focused searches.

As the user goes about using the scrapbook, the web association panel shows links to images, video and text from a variety of searchable content libraries (e.g. flickr, youtube or technorati) based on search terms taken from the scrap that is currently being viewed or manipulated. This provides a passive, loose search that may inspire the user, but is not costing the user any effort on her / his part. Alternatively, the user can select a particular scrap or piece of text within a scrap and perform a search based on this for a focused, explicit search for associated material. Through analysing the use of this system we hope to understand how creative users want to find and explore associated material, and how support for these processes can best be provided.

### Evaluations and Additional Features

Two evaluations of an initial version of the software were used to consider how users would want to use the tool to organise and reflect on stored scraps. Participants were a filmmaker (A) and a composing musician (B). The evaluations began with an initial questionnaire asking the participant to describe their creative interests, particular tasks they were interested in working on at this point in time and the media and tools they normally used in these cases. After this the participants were asked to use the Associative Scrapbook for at least half an hour.

To effectively evaluate the tool it was necessary that it be used in as naturalistic a context as possible, despite the tool being only a prototype and that longitudinal evaluations would be an inappropriate cost at this stage. Participants were asked to use

the tool as part of a creative task they were already working on. So that the effort made by the participants would not be considered wasted, the participants were also told that any work produced in the scrapbook would be available to them afterwards in the form of generic files containing the produced scraps that they could take away to use as they wished. They were also encouraged to bring existing materials along to work with. Participants were encouraged to speak-aloud during the evaluations to provide details of their current intentions and any problems they faced using the software.

Participant A used the tool to relate pieces of his developed script to actor's roles, locations for shooting and required resources (e.g. cameras and lighting). He proceeded to create pages in the Scrapbook to represent different scenes, and added scrap objects representing people, portions of script and the needs in each case. He also used the web association panel to find related media such as pictures that reflected the scene and added these to pages. Participant B used the tool to collect materials needed to develop drum parts for compositions he was working on with a band. He brought recordings of the band playing and a set of mp3 files containing songs that he and other band members felt represented inspirational material for the kind of sounds they were trying to produce. After importing these in to the scrapbook he proceeded to develop prospective drum parts using tab notation in note windows. New pages were added for each song, with inspirational material and songs listened to in sessions. These included videos of drum lessons, found using the web association panel.

Both participants described much of their activity as involving the grouping or pulling apart of the added material. Several features were added in response to this: As well as being able to organise content by adding it to specific pages, scraps can also be grouped together, with the group of objects acting as a scrap itself (i.e. it can be annotated and replicated in multiple pages). Objects can also be linked on a one to one basis, providing scope to infer a range of relationships, for example chronological links or sub-categories in a 'mind map' style. For several types of scraps (e.g. text, images and sketches), functionality was also implemented to allow *sub-scraps* to be created. This allows the user to cut a selected area of an existing scrap, and form a new scrap from this. A perceived need for extending these features is the ability to point to parts of files or scraps, independent of their type. For example, linking a note to a part of a sound or video file.

Another feature added in response to the evaluations was the ability to cycle through all instances of a particular scrap in the pages of the book. This was added in response to occurrences in the evaluations where, for example, the user wanted to cycle through all the scenes in which a particular character occurs, or all the occasions a drumbeat had been used. A final feature added was an overview of all the pages of the scrapbook, identified by evaluator A as a helpful tool to visualising the progress of a project or to aid the collection and organisation of scraps which can be distributed amongst pages by dropping them on the required page in the overview.

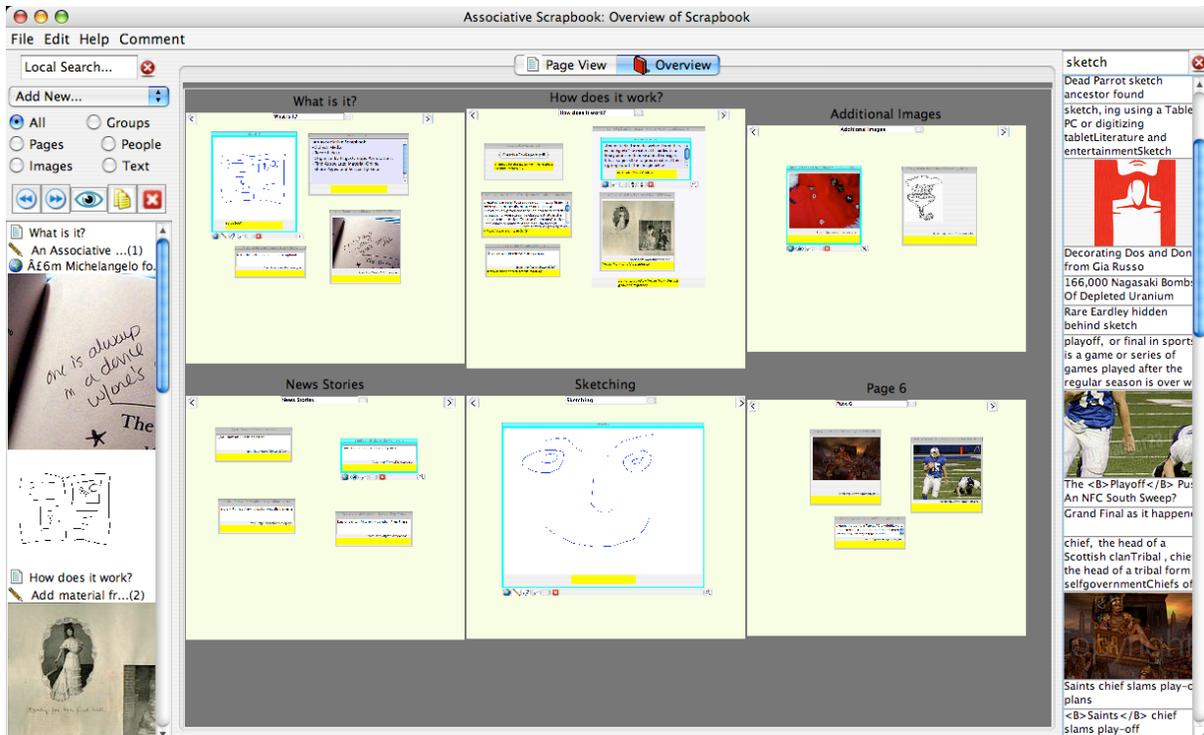


Figure 3: Overview of Scrapbook Pages

In its current form, The Associative Scrapbook amalgamates the needs of the creative practitioner to retain, develop and communicate information. It also provides a means for information discovery through the web association panel. This links the facilities for low-cost retention provided by OneNote [11] and Evernote [5] closer to the functionalities for information discovery in creative tasks provided by Combinformation [10]. The Associative Scrapbook provides the ability to freely juxtaposition and compare any kind of information items on a page. We have found the ability to grab and move items on a page, to sketch, and to associate items together, to be important features for the creative use of PIM tools that is often lacking in existing systems, which focus on allowing users to view one item in detail at a time. The findings of the empirical studies would suggest that facilities for easily capturing and amalgamating materials from mobile devices and web browsers, as seen in Evernote, would be an important extension to supporting the common need to retain ideas and inspirational materials away from the place of work. Semantic approaches to building structures of associations are an example of an approach that could be applied to improve both the organisation of retained materials, and the mechanisms for information discovery.

### **Conclusions**

This paper has identified key aspects of information management by creative practitioners. These include idea representations, inspirational material and associations as the major types of information specific to creative practice, and retention, development and communication as specific activities that occur in relation to these materials.

The Associative Scrapbook tool described here aims to support behaviours that form aspects of PIM in creative activities. Initial evaluations have shown that the tool is usable in two distinct creative activities, and has provided evidence upon which improvements

to the software have been developed. We now aim to collect data on the long-term use of the system. By integrating information discovery facilities with information management, users can be effectively guided towards inspirational materials. By effectively supporting scrapbook-like affordances in a virtual environment that can be used to retain and organise all kinds of idea representations and inspirational materials, the system will improve users ability to utilise collected ideas and resources in individual tasks and in the long term.

The Associative Scrapbook is available for download from [www.cs.bath.ac.uk/~tc225/AS/](http://www.cs.bath.ac.uk/~tc225/AS/) . We encourage you to try the tool for yourselves and to see how the project and findings develop.

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