A Study of the Role of Visual Information in Supporting Ideation in Graphic Design

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ABSTRACT. Existing computer technologies poorly support the ideation phase common to graphic design practice. Finding and indexing visual material to assist the process of ideation often falls on the designer, leading to user experiences that are less than ideal. To inform development of computer systems to assist graphic designers in the ideation phase of the design process, we conducted interviews with 15 professional graphic designers about their design process and visual information needs. Based on the study, we propose a set of requirements for an ideation support system for graphic design.

1. INTRODUCTION

Graphic design shares many similarities with other design disciplines such as architecture, fashion and industrial design. Schools of design such as the Bauhaus (c.1920) have taught different design disciplines alongside one-another. According to Carvalho, Dong and Maton (2009), although there is a common understanding of what is meant by the word 'design' that is shared among various disciplines, they each give emphasis to different aspects of the process. There is also however a general consensus that design activity is creative in nature.

Graphic designers are defined by Marcus (2002) as those who "work in small or large offices to give form to the books, magazines, web sites, advertisements, and other graphic messages that their clients want to communicate through print and digital media" (p.17). Design follows a process for which a number of descriptive models have been proposed, such as Fletcher's (2001) 5 step model; Meggs' (1992) 5 step model; Hembree's (2006) 5 step model; Arntson's (2007) 6 step model; Lawson's (2005) various 3 step models; and

Curtis's (2002) 7 step model. In addition to the models in literature, Hembree (2006) notes that designers also develop their own models of the creative process. However the intended outcomes of the models are essentially the same. Furthermore, Lawson (2005) suggests that model development can often be motivated more by billing needs rather than deeper differences in the underlying thought processes.

According to Kerne et al. (2007) an important feature of the design process is that it involves ideation, defined as "the process of generating new and sometimes creative ideas" (p.118). In graphic design, more specifically, ideation often involves the creation of thumbnails which are "idea sketches [...] visual evidence of the thinking, searching, and sorting process that brings out solutions" (Arntson, 2007, p.9).

Graphic design work relies on existing information to construct messages and convey meaning to the intended audience. Arntson (2007) explains that "designers are expected to build on the work of others" (p.8). Heller and Ilić (2007) demonstrate this through identification of probable influences of various graphic design projects. Other influences on the design process are the intended audience for the work, as well as the client for whom the design is created. Curtis (2002) advises "eat[ing] the audience" (p.75) to discover the tastes, desires and motivations of that audience, and advocates treating the client as an important base of knowledge.

The expectation is that graphic designers will reason with information in the production of their work. Despite the implications of a large amount of visual information to manage, there are however few tools to support effective management and retrieval of visual information during ideation. It has been suggested by Dorta et al. (2008) that computer support of the design process is not ideal; one factor being excessively precise software interfaces (attributed to Stacey and Eckert, 2003; Lebahar, 1983; in Dorta et al. 2008, p123-124).

In order to understand how computer technologies might better assist professional graphic designers as they access information during the process of ideation, we conducted a series of interview and observational type study of professional graphic designers at their workplace.

This article presents this study and its findings. The article starts with a review of related literature. We then describe our study in terms of its methodology and findings. Based on the results of this study, we propose a set of requirements for development of future ideation support systems for graphic designers.

2. Related work

As stated, design is an activity requiring creativity. Pinker (1997) considers creativity to be a process of revision and of immersion in the problem at hand. The idea of immersion is supported in design literature, for instance Meggs (1992) describes an act called "ocular reconnaissance" in which designers experience, look at and inspect things not necessarily related to a problem, which Meggs considers to be "one of the most fertile sources of inspiration for designers" (p.158). Although it must be noted that designers ultimately may not be conscious of the direct influence on their work (Heller and Ilić, 2007). In engineering design literature, a summary by Hernandez et al. (2010) of ideation components shows similar ideas such as "provocative stimuli", "frame of reference shifting" and "incubation and example exposure" (p.387). Makri and Warwick (2010) also report that architecture students using libraries are interested in being "led to and to come across things and for things to inspire them, which a comprehensive search wouldn't necessarily do" (p.1766), suggesting that a form of ocular reconnaissance is carried out to assist the process of immersion.

Collado-Ruiz and Ostad-Ahmad-Ghorabi (2010) identify a "consensus among researchers [...] that creativity involves the generation of ideas that are novel and appropriate" (p.483), and note that design is aligned with a psychological or "p-creativity" level, in which the goal is novel and valuable solutions that are not necessarily historically unique. Dubberly (1995) attributes the definition of 3 levels of design problem to Peter Rowe, as "well-defined, or simple; ill-defined, or complex; wicked-hard, or unsolvable". Furthermore, Dubberly considers problems given to students at design schools to be mostly in the "well-defined" category, while professionals generally deal with "ill-defined" or "wicked-hard" level problems.

In addition to literature, such as the above, which aim to define creativity in general and describe what may contribute to better creativity, other attempts have been made to analyse the process of design and creativity more systematically by either studying the cognitive and perception processes involved in creativity, or investigating how designers carry out their tasks when undertaking creative design activities.

Although the focus of our work, as presented in this article, is not on cognitive aspects of design, it is useful to point out that there have been many attempts to understand the visual system from within art and design, as well as other disciplines. From a cognitive science perspective, Pinker (1997) suggests that the raw act of seeing involves making assumptions about what we perceive based on our understanding of the world, which can be modelled using Bayes' Theorem. The uncertainty present in the act of seeing is of particular interest in design and art. In design, many attempts have been made to try and determine a formal visual language to allow for controlled communication. For instance, Lupton (2004) names works such as Klee's (1925) "Pedagogical Sketchbook", Kandinsky's (1926) "Point and Line to Plane", Kepes' (1944) "Language of Vision", and Moholy-Nagy's (1947) "Vision in Motion", all of whom were associated with the Bauhaus school. Gestalt psychology is generally considered to be a strong influence on contemporary thinking about perception (Dondis, 1973; Lupton, 2004), with authors such as Arnheim (1969) often referencing Gestalt ideas in explaining perception.

Current thinking on graphic design has settled on basic visual elements, such as the dots, lines, shapes, tone, colour, and texture as the root of visual communication. Some of the more radical theories expressed around colour have included attempts by the Bauhaus to link it to shape, but these are not generally accepted. Gestalt laws are still considered to inform graphic design thinking, and describe such acts as perception of shapes, the ability to distinguish between foreground and background objects, and to perceive groups of elements.

Despite the fact that the importance of imagery to graphic design seems obvious, since graphic design involves visual communication, the role that visual information plays in ideation is not well defined. For example, graphic designers are meant to "develop a feeling" for the work "by studying design annuals, periodicals, and Web sites" (Arntson, 2007, p.8). However it is not clear what "feeling" is to be gained or how this "studying" is to be carried out.

Furthermore, although designers are said to "save personally significant visuals and collectibles" (Arntson, 2007, p.8), how designers are supposed to manage and subsequently utilise those collections to support ideation is not described either. Similarly, in design practice, information gathered about the target audience is identified as being important because "effectively communicating with the target audience depends upon the development of a visual vocabulary that appeals to the sensibilities of the viewer" (Hembree, 2006, p45). However, once again, how such information might be managed or efficiently retrieved is not adequately addressed. Various studies have, therefore, been undertaken to provide answers to questions such as those proposed here, by better understanding how designers carry out their design tasks. As our focus in this article is on the role of visual information in the process of design we limit our review of related literature to those dealing more specifically with visual information.

Mougenot et al. (2009) studied four automotive designers to find which images were of interest to them, and how the participants decided what was interesting about the images. Their study identified three levels of abstraction used by the participants in selecting images of interest: "high (atmospheres, sensations)", "medium (products or sector names)", "low (materials, colours, textures)" (p 4478).

Herring et al. (2009b) carried out a general study of the creative processes of 15 individuals including engineers, industrial designers, product designers, occupational health practitioners, architectural designers and a graphic designer, leading to their definition of an "Idea Generation Process Model" with three phases of "idea generation", "implementation"

and “evaluation” (p.4). This operates in a cyclic process, moving between “represent, refine, research” (p.4). Herring et al. also comment on the poor support of technology for design tasks.

Makri and Warwick (2010) reported on a naturalistic observation of nine postgraduate architecture students as they sought image resources. They observed and documented a range of behaviour, including “finding information” which they classified as “accessing, searching, browsing, encountering, surveying, monitoring, exploring, chaining”; “assessing information”, classified as “selecting, distinguishing, extracting”; “interpreting information”, classified as “analysing/synthesising, visualising/appropriating”, “using information”, classified as “editing, recording” and “communicating”, classified as “consulting, sharing/distributing” (p.1754). The authors reported participants’ information seeking behaviour, including “looking at material that was not directly related” to the given design task, but which had the potential to later inspire the student. They remarked that participants were not seeking exact results in their searching, instead reporting inspiration as “a driver for and outcome of information seeking and use” (p.1766).

Herring et al. (2009a) conducted semi-structured interviews in the workplace with 11 professional designers, of whom 4 were graphic designers. This study identified benefits associated with the use of “examples” in a number of design activities, including the idea generation phase of design. The study also showed that examples can help facilitate client-designer communication. According to Herring et al., during the “preparation phase” designers view relevant information “in order to develop an understanding of what is required and to provide a basis for generating valid solutions”. Relevant examples are encountered by the designers through “active” and “passive” search mechanisms “when the designer is looking for inspiration” (p.89). The findings of this study suggest that designers search and browse relevant material to see what exists. Although examples from the same domain are “most useful”(p.90), other examples from outside the domain may also be used to determine current fashion and style trends.

However, graphic design literature appears only to encourage designers to collect new visual information, without providing guidance as to how the collected information should be managed, how it is actually accessed and used in the design process, or what type of information is useful to the designer.

Researchers such as Jörgensen and Jörgensen (2005); Westman and Oittinen (2006) and Cunningham et al. (2004) have analysed usage logs of professional image databases to discover the kinds of images sought by designers and other image professionals. However, the use of log analysis techniques is not without risk. For instance they may reveal only search strategies employed rather than the terms used (Westman and Oittinen, 2006), and it is difficult to distinguish different users in public logs (Jörgensen and Jörgensen, 2005). Ultimately, log analyses of online collections present only information about how individual images are sought, without providing insight as to the context in which they are needed or used.

Other studies into the use of digital image collections such as Keller et al. (2006b, 2004, 2009) have been carried out. Keller et al. (2004) reported on a study of the management of digital collections by home users. Keller et al. (2006b) studied professionals from six design agencies (involving only one graphic designer) and identified potential principles for a computer system to support design. Keller et al. (2009) looked at the use of a prototype design tool with three designers over a period of four weeks. These studies however are not specific to graphic design, and have involved small numbers of participants.

In summary, studies such as Herring et al. (2009a,b) present findings that may inform graphic design, though they include only a small number of graphic designers in their study. Other studies such as Makri and Warwick (2010) provide insight into related design disciplines practice (e.g. architecture), however their findings are based on students rather than professional designers.

3. Study Methodology

Due to the lack of empirical studies of professional graphic designers focusing on the ideation phase of the design process, we have conducted a study to better understand the role of visual imagery in the ideation phase of graphic design process. The method and findings of our study are discussed in the following sections.

Our study is a qualitative inquiry based on semi-structured interviews with professional graphic designers in their working environment. The interviews involved visiting the working environment, and reviewing samples and artefacts used during the design process by the participants. Some artefacts, photographs and sketches of the environment were collected for further analysis where permitted by the participants.

The study looks at the practices of designers operating within New Zealand, using companies identified from publicly listed sources such as phone books and web sites. Companies were selected on the basis of the professional services they advertised, with emphasis given to graphic design services. Requests for interviews were with staff directly responsible for providing graphic design services, rather than management or support personnel.

3.1. **Study Participants.**

Fourteen interviews were conducted, involving 15 professionals from 10 different companies, all located within the North Island of New Zealand. Table 1 provides a summary of the companies and participants involved in this study.

The participants included eight males and seven females, whose work experience ranged from 3 to 25 years. The median for experience was 12 years. The companies ranged in size from sole owner–operator to businesses with teams of five or more designers and other staff. The two sole operators interviewed had both experienced working in larger companies previously. Participants described their own roles within their respective companies as: Graphic Designers(3), Senior Designers(8), Senior Web Developer(1), Marketing Director(1), Creative Director(1) and Art Director(1).

TABLE 1. Summary of the study participants and their companies.

Participant	Company	Work type	Role	Gender	Years of experience
1	a	advertising, web, print	senior designer	F	8
2	a	advertising, web, print	senior web developer	M	15
3	b	marketing, print	marketing director	M	8
4	c	advertising, web, print	creative, designer	F	3
5	d	3D, compositing, print	senior designer, creative director	M	11
6	d	2D motion graphics, print	senior designer, creative director	F	13
7	e	print design	senior graphic designer	F	8
8	e	print, web layout	graphic designer	M	12
9	f	web, print design	senior designer	M	25
10	g	advertising, web, print	art director	M	14
11	h	corporate graphics	creative director	M	22
12	h	corporate graphics	designer	F	4
13	i	graphic design, print	director, graphic designer	F	20
14	i	graphic design, print	graphic designer, senior	M	6
15	j	graphic design, print, web, video	senior designer	F	12

Table 1 provides a summary of the demographic of our study participants. In subsequent discussion, the study participants are referred to using the codes 1 to 15.

3.2. **Data Collection.** The interviews typically lasted between fifteen and forty-five minutes, though some continued longer. Each interview was conducted in or near to the workspace of the participant as permitted by them and their managers. Raw data was

captured using digital voice recordings, supplemented with written notes and other physical materials from the participants. While some of the participants agreed to having their work area photographed, most did not permit photographs, citing confidentiality and other concerns.

Figures 1 and 2 provide schematic diagrams of two work environments, for participants 3 and 4 respectively. These two work spaces were typical of those used by other study participants, and generally consisted of various seating arrangements to meet with clients or work, and working surfaces which may or may not include a computer system.

3.3. **Interview Questions.** Open-ended questions were used to guide the semi-structured interview process. The questions were divided into four sets. The initial set of questions asked for demographic and general information from the participants, including their age group, nationality, formal title, commercial graphic design work experience and the kind of work they performed regularly.

The second set of questions sought information about the design processes employed by the participants, and asked them to discuss these with reference to recent examples where possible. This set included questions such as: “How would you describe your design process?” and “Do you work within defined stages in your process?”

The third set of questions identified sources of inspiration utilised by the study participants, including questions such as: “What do you use to inspire you?”, “Do you have a collection of imagery or objects for inspiring the development of ideas?”, “When looking for inspiration, what criteria do you look for?” and “What are the common problems that confront you when coming up with new ideas?”

A fourth set of supplementary questions was used when time permitted. Questions asked as part of this set included: “How do you evaluate the success of a design concept?”, “Are there features of the space that are intended to optimise the generation of new ideas and concepts?” and “How do you decide that something is inspirational?”. Additional questions

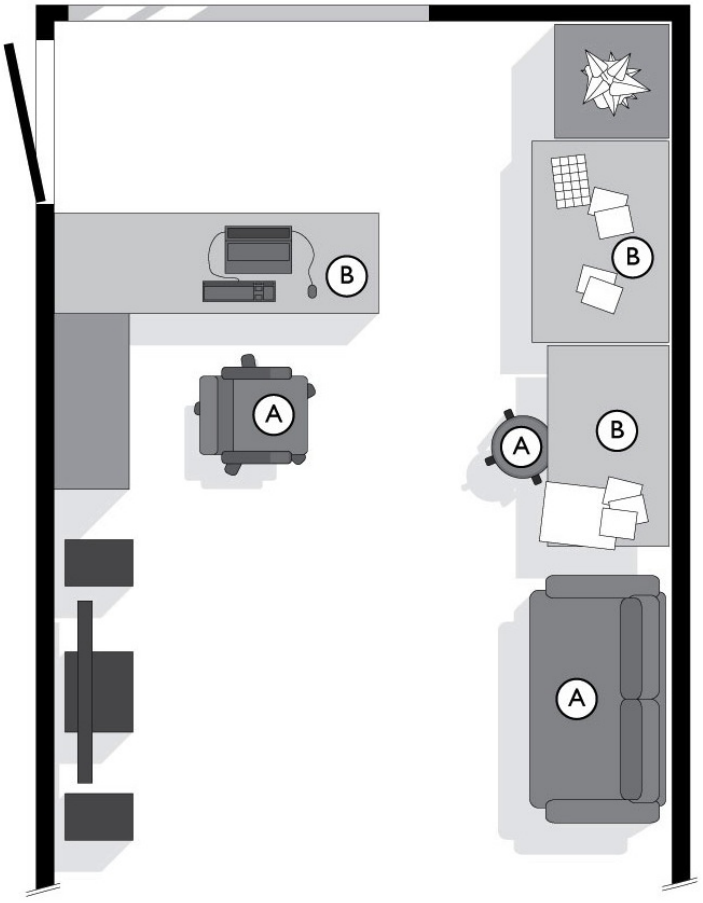

FIGURE 1. A floor plan drawing of the workspace of participant 3. The designer has seating at positions marked as A, and working surfaces in positions marked B

and discussion developed during the course of the interviews and were included in the analysis.

3.4. **Data Analysis.** The interviews resulted in a collection of data in the form of audio recordings, written notes, some photographs, and artefacts provided the participants. Audio data was transcribed by the researcher with some summarisation to account for non-verbal communication and to remove off-topic or sensitive discussion that took place. The collected

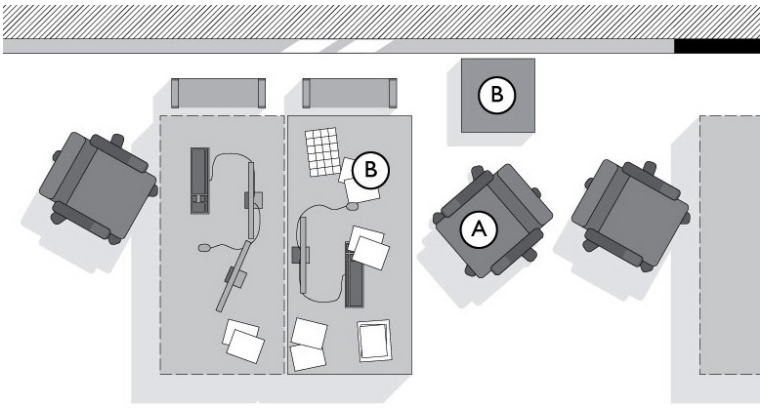

FIGURE 2. A floor plan drawing of the workspace of participant 4. The designer has seating at the position marked A, and working surfaces in positions marked B

data was subjected to a "Thematic Analysis" (Braun and Clarke, 2006), focussed on identifying how the participants sought inspiration during their projects, but also open to the broader context of the whole process. The information was coded only by the first author, and therefor inter-coder reliability was not applied. Consistent with a Thematic Analysis approach, the coding was created by the researcher and subjected to testing against the data to ensure it accurately related to it.

4. RESULTS

The findings of the study have been divided into three sections: section one describes the general design processes used by the participants, section two presents the sources of inspiration utilised for ideation, and section three focuses on the observed role of visual imagery in graphic design ideation.

4.1. **Design Processes Employed.** A number of descriptions and models of the design process were given by the participants. The descriptions varied in levels of formality and detail: some participants follow defined and explicit models of a process, while others rely on an internalised model which they were able to articulate during the interviews. One of the models

that was described progressed through the following stages: client briefing, research, conceptualisation, mockups, sign-off, and production. Other models were discussed that had been formalised in diagram form. In some cases, models of the process were shown to, or discussed with, the clients to help guide their expectations of the process and encourage their participation in it.

Not all the participants were involved in all stages of the design process. Larger companies seemed to establish protocols as to who the client speaks to initially to convey their needs, often introducing intermediaries such as account managers as the point of contact for the client. In smaller companies, designers tend to have more direct contact with clients and are necessarily involved in a wider range of the process. What is common, however, is that there is an ideation stage in the design process, during which the designers are expected to generate appropriate solutions to the problems they are presented with. Variations in the ideation mechanisms tend to focus on the level of abstraction that the individual works with. Senior designers and creative directors typically consider a broader philosophical approach, while lower-level designers often address more direct concerns.

Overall, the design processes discussed by our study participants were judged to be consistent with the models referred to earlier in our literature review.

4.2. **Sources of Design Inspiration.** The types of material collected as part the participants' regular working practice were discussed during the interviews. Collected material took the form of electronic photographs, illustrations, computer screen shots, fonts, website links; printed material such as books, magazines, photographs; and other physical material like packaging, toys, paper samples, hand drawings and sketches. The variation in different material collected by our study participants is consistent with the graphic design practice described in literature such as Arntson (2007) and Meggs (1992).

TABLE 2. Themes identified in Visual Information Seeking Activities

Code	Theme	Description
PD	Personal Development	An Image or artefact sought, viewed, or gathered for personal development rather than a specific task
CA	Cognitive Aid	Image or artefact created or used to give expression to an idea specific to the current design problem
CI	Communication of an idea	Image or artefact used to support communication between parties during ideation
AC	Aesthetic of the client	Images or artefacts used to discover or define the aesthetic tastes of the client
AA	Aesthetic of the audience	Images or artefacts used to discover or define the aesthetic tastes of the end user
AM	Aesthetic of the market	Images or artefacts used to discover or define the aesthetic and visual language used by competitors

In addition to collecting material, some participants described going to places such as bookshops, or locations directly related to their clients' business, consistent with Meggs' (1992) description of ocular reconnaissance.

4.3. **The Role of Visual Information in Ideation.** One of the main aims of this study was to identify the nature and purpose of visual information sought by graphic designers and to understand how this contributes to the ideation phase of the design process. We propose that there are distinct information seeking behaviours that take place at different stages in the ideation phase, each of which has a bearing on the formation of new ideas. We have classified these activities into a set of themes: Personal Development, Cognitive Aid, Communication of an Idea, Aesthetic of the Client, Aesthetic of the Audience, and Aesthetic of the Market. Table 2 provides a summary of these categories, which are referred to in the following sections.

4.3.1. *Personal Development.* Designers in our study reported gathering visual material to inform their professional practice in general. We define material collected as part of this type of activity as Personal Development. A designer engaged in such an activity is not identified as having a particular design task in mind when they engage with different forms of visual media; instead they seek material that is either personally interesting or that might inform some future design task. Such behaviour is consistent with advice given in design textbooks such as Arntson (2007). Many different forms of media are accessed in this type of activity, including both physical and digital, moving and still imagery, interactive and passive media. Participants also mention engaging in ocular reconnaissance. Information retained or recorded in PD activities forms collections, either private or shared with colleagues. Collection forming habits sometimes manifest in multiple collections being formed, reflecting different interests and levels of access. Information from PD collections sometimes plays a role in influencing the design thinking of later projects. Time frames between collection and later use could be separated temporally on a scale of days to years. The act of collecting visual material is a long term activity, ongoing throughout the career of the designer.

Examples of PD activities by the participants included: visiting specialist book retailers to browse their collections of new books without necessarily purchasing (participant 7), copying digital images from online resources (participants 2, 8, 10), maintaining physical collections of photographs (participant 11), and maintaining collections of visual materials (almost all participants).

4.3.2. *Cognitive Aids.* Participants seek visual resources intended to express an idea, concept, or attribute, when such imagery is not necessarily intended for use in the final design output. We refer to this type of material as Cognitive Aids (CA) in the design process.

What distinguishes cognitive aids from personal development, is that for CA the visual is sought specifically for a certain job, whereas PD material are not job specific. CA resources are typically viewed by the designer in the context of a particular job, often within the

immediate workspace. Imagery used tends to relate to the communication objectives and visual language of a particular project. This imagery does not necessarily belong to a particular target group, competitor, audience or client, instead it serves as an aid in expressing, understanding or recording a particular visual quality that the designer determines to be significant to the project. Imagery sought can be inter- or intra-domain, and may be sourced from materials collected as part of earlier PD actions.

Examples of CA material used by participants included artefacts such as photographs, colour samples, websites, material samples, previous works by the designer, previous works by colleagues, mood boards (see subsection 5.7), sketchbooks or drawings and notes. Participant 15 described working with samples inside functional documents, alongside where the idea is being created. This participant also remarked that his colleagues had been observed operating in a similar mode. The subject depicted or represented in CA materials was described as being very difficult to predict (participant 15), since it expressed an idea that the designer wished to convey in the work through some property of the sample image that may be significant only to them.

4.3.3. *Communication of an Idea.* Visual materials play a role in communication with colleagues, any subcontractors, and clients during the design process. We refer to this type of material as Communication of an Idea (CI). Note that the use of CI is distinct from communicating with the target audience via the final design output.

Example CI material identified in our study included visual imagery used by designers to communicate with photographers, particularly where an effect is sought for the design, without the imagery necessarily being the final output (participants 10, 11, 13). In these cases the imagery was used to articulate the visual outcomes in a way that words alone could not express.

4.3.4. *Aesthetic of the client.* Importance is placed on the aesthetic tastes of the client, and often plays a role in influencing the thinking of the designer in creating ideas for that client.

The participants look for clues about the tastes of their clients, in order to consider solutions appropriate to those tastes. Visual material used to represent those tastes are referred to here as the Aesthetic of the Client (AC).

AC material include referencing the clients' appearance, or the appearance of artefacts, people, places or objects that the client is understood to respond well to. The designer uses the information to try and define some of the potential parameters or bounds for acceptable solutions; participant 10 described seeking "a feel for the client" to inform their design.

Participants used a number of different approaches, varying from active and overt to more subtle and passive. Subtle approaches where the designer had access to the client included simply making note of the visual appearance of the client and any artefacts that they have with them (participants 8, 10, 13). In active approaches, participants ask the client to provide material examples of things that they find interesting or inspiring (participants 3, 13, 15). Other approaches included showing or describing samples to the client to gauge their reaction (participants 9, 15); asking the client to choose images from a given resource (participants 3, 7). Participant 7 mentioned that interaction with the client can trigger memories of previously encountered designs that may provide a basis for developing solutions to the design task.

4.3.5. *Aesthetic of the Audience.* An important aspect of the task of the designer is to communicate to an audience, and as part of this designers often explicitly consider the visual sensitivity of the target audience. We define material used in this type of activity as the Aesthetic of the Audience (AA).

Participants engaged in these types of activities to find the appropriate visual language for a specific target audience. Some of the designers try to understand styles or visual language likely to be effective with the target audience through personal critique of existing design work aimed at the same subject area or market. Some of the participants deliberately collect visual AA resources specifically to inform their knowledge of a particular audience: "if the

target audience is 60+ in a retirement home, what are the graphic elements that are going to appeal to them?" (participant 1). Participant 8 spoke of the need to to observe the end user engaging with the product or service first hand to "...see people ...how they move ...how they react [...] would want to see what emotions you convey, and how people react to [you]. Concepts would then come from that".

4.3.6. *Aesthetic of the Market.* Designers seek out design work in use by the competitors of the client as identified by the client, the designer, or someone else involved in the design process such as an account manager or colleague. Visual material related to information about the aesthetics of the competitors of the client are defined here as the Aesthetic of the Market (AM).

The information gained from AM material informs an understanding of the visual styles and language that the competitors employ when engaging with their target audience. Discovery of the visual AM material associated with competitors is considered important in helping define parameters of acceptable design solutions.

Approaches to gathering this kind of information vary. Participant 3 asked the client to identify their competition, while other participants sought the information indirectly from other sources. In all cases the result leads to retrieval and review of visual AM material relating to the competitors in the market, dictated by the available media e.g. printed matter, web pages, physical products. Some designers described accessing collections that they had formed as part of their PD, retrieving from their PD collections images or samples that were perceived to relate to the particular market that they were to design for.

It was not universally accepted by the designers interviewed that explicitly looking at the competition was an appropriate activity during the development of ideas. Some of those interviewed felt that knowing the aesthetic of the competitors in the market helped provide what participant 3 described as the "look and feel", others were wary of being drawn to

imitate existing work. It did appear to be common to evaluate proposed solutions in the context of existing works.

5. Issues related to the use of visual material

The interview participants discussed a range of issues related to the use of visual material during the ideation phase of the design process. They identified problems relating to collecting material, the costs and time associated with gathering these visual resources, the ageing of resources, the diversity of media and devices that are used in the design environment, problems of fixation on existing works during the design process, and problems with knowing where resources came from. These themes are discussed in more detail in the following sections.

5.1. **Collection problems.** One of the identified problems in interacting with visual material for inspiration is the lack of an appropriate overview for a given collection. Participants developed strategies to cope with the lack of an overview: participant 15 described frequently checking shared collections so as to maintain awareness of what they contained. The strategy exemplified by this participant is not without risk however, as the participant described a chance of becoming lost in the exploration process and devoting too much time to it.

For digital image collections, there is a significant reliance on keyword searching, coupled with browsing as the means of retrieving the information required. The preference for browsing is motivated in part by a lack of alternative methods. For example it was described by participant 1 that they often seek images with a particular 'feel', however there is no mechanism that allows for describing and searching for that 'feel' directly. The participant used text-based queries followed by long browsing sessions as a solution to the problem, effectively trying to identify the qualities desired in images through manual inspection of their content.

Participant 13 described retrieval of previous design works created within the same company as being prohibitively difficult and often avoided, despite a recognised value in accessing such content. In discussion with this participant, past works were mentioned as containing information that may be considered relevant to current projects, particularly solutions that had been proposed but not used. However the systems in place for discovering and accessing that information relied on word of mouth and the memory of other co-workers. Past work also existed in a variety of media forms and on different storage media further complicating any retrieval efforts.

During the interviews with participants 5 and 6 there was a clear demonstration that digital filing systems afforded by current computer platforms such as Windows or Mac OS do not support the specific usage needs of designers. When asked about a collection of electronic resources that were kept on a computer, participant 6 was observed to struggle with a fairly free-form and flat hierarchy of folders containing files identified by default names. Participant 6 explained that content such as images saved from the web are usually kept with their default names, and no renaming strategy was used. The resulting collection was therefore not searchable using text-based methods as it lacked relevant meaning or meta-data, forcing reliance on direct browsing of the content.

Discussion with various interview participants also revealed issues relating to the collection of physical artefacts, both in terms of storage as well as retrieval. Some of the collections of physical material cause problems, as the ongoing collection habit causes them to expand within a typically constrained space environment. For example, participant 15 described a situation in which designers within the same workspace each developed collections of inspirational objects, causing storage space issues. Management of the company had to therefore limit the amount of collected material that each designer could store on the premises to control the problem. Other interview participants described their collections as spreading throughout their professional and personal environments. These distributed and expanding collections also lead to access problems, specially when the designer works in

different locations. In these cases the collections are not always available to be accessed, limiting their usefulness. This specific problem was mentioned in the interviews with participants 5 and 6, where the designers were working between regular premises and a temporary office space, and therefore not all of their regular reference and inspirational material was available or accessible under such circumstances.

5.2. **Time and cost.** Our study participants worked on a variety of different sized projects, varying in length from a few hours to several weeks: consequently the amount of time available for ideation also varied. Many of the designers expressed a desire for more time to explore design problems during ideation, but commercial realities such as time, budgets and clients were limiting factors on the amount of exploration that was possible. Participant 15 described this desire for exploration thus: "a creative will always have another idea the next day in the shower, they are always going to have something else that they think of afterwards that is perfect, or they are not easily satisfied generally in what they do, they will always think there is room for improvement".

Participants also expressed a preference for first hand experience of environments, contexts, products or services to better inform their ideation process for a given project, which is consistent with the design literature. Unfortunately first hand experience is not always possible, particularly in cases where the designer is working remotely relative to the market.

5.3. **Outdated resources.** Books and other printed materials are observed to be held in high regard, however they are also quickly outdated and superseded by new material. During the interviews, life spans for books were identified as being perhaps six months. As an example, participant 7 made up for this by browsing bookstores, avoiding purchase because of pricing and limited useful lifespan. Other participants such as participant 9 deliberately sought older material through online stores as a source of inspiration.

5.4. **Fixation, confusion and noise.** Sometimes the designers are concerned about exposure to work that is not their own while they are involved in ideation for a project. Some of

the study participants prefer other works or inspiration sources to be kept well away from their working space. Some designers described how at times a feeling of clutter impinged on their ability to reason through design problems, leading to seeking neutral spaces in which to work. It was noted in visits to the various studios that designers frequently worked in different locations or spaces within the environment, often leaving what would be recognised as a regular workstation in order to work on projects. Some of those interviewed described extending the workspace to include their home, often to seek quiet spaces free from distractions from the problem at hand.

5.5. **Provenance.** Knowing where an inspirational image or artefact is from is an important part of determining the value of such an artefact. Our participants expressed an interest in where information is coming from, with obvious preferences emerging among the designers for different resources. When asked about the possibility of a computer system providing assistance in the discovery of inspirational work, participant 11 responded that "to be most useful it would have to validate itself by showing and reflecting upon what has gone before in a similar vein. What a similar vein is, that is the rub, because what is similar for somebody is not necessarily similar for somebody else".

There is a great deal of interest in what happens in particular markets, and a desire to maintain relevance across geographic boundaries. Many of the designers spoken to maintain an interest in trends that had their genesis in countries that are a long way removed, creating a reliance on intermediate sources to help discover the essential elements of those trends. The United Kingdom was popular as a source of design trends, mentioned by several of the designers. Clearly gaining first hand experience of such remote places is a costly and time consuming process which is not economically feasible for many employees.

5.6. **Diversity of media and devices.** There is a real diversity of information collected and used by the designers interviewed, covering a variety of media forms, and including both physical and digital media. Some of our study participants collect physical objects as well,

FIGURE 3. An example of a mood board for an interior design showing examples of the look and feel that is being sought. Image from Dame (2011)

including toys, models and various products. Pieces are collected and utilised either directly, or to aid thought in the design process. There is also a diversity of digital devices involved in accessing content, such as laptops, tablets and phones. Despite the presence of other computing devices in some of the studios visited, desktop computers still took a large and significant role in the design process and production of work.

5.7. **Mood boards.** Many of our interview participants referred to the use or creation of mood boards (5, 6, 9, 10, 12, 14, 15). One of the designers (15) mentioned using mood boards at the start of the conceptual design work, as a space that provided "... one idea, or an idea and series of pictures that demonstrate what we are thinking, that we could talk through". Similarly, participant 12 spoke of mood boards as providing a starting point for a project, though the size of the project may determine whether or not such a tool is used. Participant 12 also mentioned that more than one mood board may be utilised in the context of a single project.

Mood boards are intended to inspire and give direction to the design work, and incorporate a variety of information in them depending on the specific use of the board, e.g. to try to discover the aesthetic of the client or to illustrate the state of the market. Mood boards were labelled and considered as a CA for the designer.

6. Requirements of an ideation support system

As mentioned earlier, one of the main reasons for conducting our study has been to better understand the process of ideation, and the issues related to access and use of visual material during the ideation phase, with the aim of developing guidelines to assist the design of future systems to support the ideation process.

In the following sections we identify a broad range of requirements for such a system, beginning with general requirements of the ideation process, and then we present more specific requirements for collection and use of different categories of visual information discussed earlier.

6.1. **General requirements of ideation.**

Although text-based search is a common feature in all modern computer systems, image-based search is much less common. None of the interview participants in our study seemed to know about, or used, image-based search systems. This effectively limits the scope of non-indexed visual information that the designer is able to access when trying to discover the tastes of the audience, competitors, or the market, or when seeking cognitive aids to inform different design ideas. The system must therefore provide an effective range of content search mechanisms, including image-based techniques.

Support should be provided to help browse and retrieve examples from collections of design work that are kept by individual designers and their colleagues. This is a problem related to information visualisation, in which the user needs to be supported in understanding the content of the collection, formulating queries of the system, and interpreting the results

returned from it. Collections of past design work are potentially untapped resources which are not readily available to designers, because most existing software are unable to provide useful overview or query mechanisms to their users.

Furthermore, although many design companies already make use of formal repositories of visual material such as stock photography collections and image banks, support for accessing image content in social media is limited, despite the fact that such material is potentially very important to some design projects. Access to such collections should ideally be enabled for the designer, perhaps through the aggregation of different collections into a single accessible meta collection.

Finally, the diversity of visual material and media forms used by designers necessitates a system that supports both physical and digital media collections. A system to support ideation must also recognise and allow for differing modes of use, including the ability for the user to determine the level of interaction with it to accommodate differing working habits. Some of the participants interviewed expressed a desire to work in isolation from external influences, while others delighted in surrounding themselves with a variety of inspirational material. The proximity of the support system to the working place of the designer, where they craft their potential solutions is an important consideration. Some of the information, such as CA material may be required in or near working documents, as the designer works on potential solutions. Other information such as AM material may be required at evaluation points determined by the individual designer's workflow.

6.2. **Supporting Personal Development (PD) collection activities.** To be useful to designers, their collection habits need to be supported or at least accounted for in an ideation system. The kinds of PD collections that were discussed consisted of a wide variety of different media types, including physical and digital media. It is therefore important that all of these media types are considered in an ideation support system. Designers will likely continue to collect all kinds of media, including digital images, movies, clippings, books,

magazines, artworks, objects and toys. It is likely that such information is not going to be accompanied with metadata, tags and appropriate filenames, and therefore it falls to the system to either facilitate the adding of such information by the user or else attempt to discover the information from the appearance of the objects as they are added.

Physical collection activities are constrained by storage space, while digital collection activities are less concerned with physical storage space but rather with conceptual space. Larger collections incur problems with maintaining overview and allowing efficient retrieval of their contents.

6.3. **Supporting Cognitive Aid (CA) collection activities.** As designers use imagery to help them think visually about their design problems, tools should support association between images and certain conceptual ideas. Images can have meaning, and that meaning is significant to designers. Although it must also be pointed out that identifying meaning in images is a difficult problem, as meaning is often complex, open to variation, and not static (Dondis, 1973; Maclennan, 1902; Novitz, 1977).

Our study participants discussed how designers use visual resources to support their cognition based on many different needs, for instance some were motivated to select images not for their overall meaning but for certain visual qualities that they had, like textures, typography or layout. It would be useful therefore to allow designers to seek images based on certain visual characteristics within the process. Although ideation is not an exact science, even some assistance in this process would be an improvement over existing text-based search or browsing methods.

6.4. **Supporting Communication of an Idea (CI) collection activities.** The process of design involves communication between different parties, both within the design company and with the clients and external contractors. Images are both created and used to support communication during ideation, leading into ideation, and following ideation into production. An ideal tool would support the retrieval and use of images to assist the communication

process, particularly as ideation progresses. Again the imprecise nature of ideation and designers' attitude to exploration suggests that designers would benefit from even partial assistance in the storage and retrieval of visual material for such purposes.

6.5. **Supporting Aesthetic of the Client (AC) collection activities.** Given that designers note and make effort to understand the visual tastes of their clients, tools to support ideation activities should account for, or at least allow, such activities to occur. Such allowance could be achieved in a variety of ways. Currently some clients are asked directly to supply information about their tastes, while others are observed indirectly for clues as to their tastes. As an input into the ideation process, such information can be of high significance. Systems should therefore support gathering, representation and retrieval of AC material at relevant points in the ideation process to guide the thinking of the designer.

6.6. **Supporting Aesthetic of the Audience (AA) collection activities.** Knowing the aesthetic of the audience is acknowledged as an important part of the design process. As mentioned before, some of this type of information is gathered from the PD collections, while additional external sources of information may also be sought. Therefore accessing this kind of material involves retrieval from a potentially wide variety of sources. In the case of accessing material from earlier PD collections, there is generally a lack of labelling and formal categorisation of the collected material, which means that designers rely on a personal knowledge of their collections in order to usefully interact with them. Information about the aesthetic of the audience is not often incorporated into existing collections.

What is needed therefore, is the ability to retrieve visual information that provides insight into the visual language that is appropriate to the defined audience. Questions about the audience would likely be about their fashion and style, would likely change frequently, and would therefore need to be quickly adaptable or discoverable. Information that appeals to the audience is also likely to be sought directly, through excursions into the general environment and interactions with identified representatives of the audience. Ideation support

systems would need to allow for information gathered in such a way to become associated with particular groups or audiences. The system should allow for the smooth acquisition of such content into the system, with appropriate indexing or annotation as necessary.

6.7. **Supporting Aesthetic of the Market (AM) collection activities.** Some of the information that supports knowing the market and competitors also comes from material in PD collections. Further information about the market is sought from the clients directly, and from excursions into the market place. Our study participants pointed out that currently they find this type of information through web searches (e.g. using Google), from information supplied by the client, or from their own reconnaissance. There appears to be an expectation of manual discovery and recognition of appropriate content by the designer. As with AC or AA material, the support system should assist the process of collection and retrieval of AM material.

6.8. **Existing ideation support systems.** We have carried out a review of the existing software tools that are currently used to support the ideation phase of the design process. Table 3 provides an overview of some of the most commonly used systems. Our review however, shows that none of these systems fully support the requirements that we have identified. Future systems are therefore needed to facilitate collection and retrieval of the type of collection needed by graphic designers.

7. Conclusion

The study presented here has identified a range of visual information seeking behaviours demonstrated by our interview participants in terms of collection, management, and access to different kinds of digital and physical material that contribute towards the ideation phase of their graphic design process. The study has further revealed what type of visual information the designers seek, where they attempt to gather this information from, and what type of tools and methods they adopt for these tasks. What is also clear from our findings is

TABLE 3. Systems supporting the use of images in the design process

SAMPLE OF EXISTING SYSTEMS SUPPORTING IMAGE USE		
Name	Actions supported	Description
Freed	Layout assistance	Allows force-based layout of collection information providing visualisation of the state of a project (Mendels et al., 2011)
The Digital Scrapbook	Automatic aggregation, browsing	Prototype departmental scrapbook system for tracking works produced by students and aggregating into a web browsable interface. (Swan et al., 2010)
Prezi	Manual layout, presentation	Zooming user interface system with presentation focus (Arvai et al., 2009)
Cabinet	Augmented reality, visualization	System for capturing and organising collections of visual material. (Keller et al., 2006a)
Funky Wall	Mood board presentation, review	System to capture and playback gestures related to mood boards. Facilitates client designer interaction, team interaction. (**?**)
Adobe Collage	Mood board creation, mobile support	Cloud-based service facilitating sharing and transference of mood boards between devices. Online search support using text searching. (Adobe, 2012)
Moodboard 2	Mood board creation, mobile support	Tool to create mood boards on iPad™(Tress and Nurre, 2010)
Moodshare	Mood board creation, beta software	Web based service supporting sharing and collaboration. Facilitates searching of multiple online resources simultaneously. (Mooooodle Limited, 2012)
Polyvore	Online mood board creation	Fashion design focussed, community based creation and sharing tool. (http://www.polyvore.com/)
Sampleboard	Online mood board creation	Design focussed mood board creation tool. Uses tools similar to the Adobe Creative Suite. Allows sharing, universal access. (http://www.sampleboard.com/)
Adobe Bridge	Asset management	Software included in the Adobe Creative Suite. Supports tagging and retrieval of information through text-based searching. (http://www.adobe.com/nz/products/)

that none of the existing computer systems fully support this process of ideation in graphic design.

Our study is based upon limited observation of behaviours as well as claims by our participants. We acknowledge that there is a need to better understand if these reported behaviours are indeed what designers actually do, or whether they represent an idealised perception of design activities. It is only possible to ascertain true behaviour through ethnographic and observational type studies.

Considering some of the tools and prototypes that have been produced to date to support ideation in the graphic design process, there is an assumption that the designer will select the source material for inspiration largely based on keyword searches and browsing, and that it is the designers' task to then arrange the retrieved information as they come to know the design problem. What appears to be missing are any attempts by the system to aid the designer in the discovery of new information, despite the fact that the conceptual space for visual design is continually populated with content from professionals and amateurs alike. Current tools are not supporting the collection forming habits that designers are encouraged to have, and are demonstrated as having through our study. The designers themselves appear to establish coping mechanisms, typically through enforcing small limits on the collected visual material, which is not a particularly sustainable or beneficial approach.

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