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DEVELOPING A TAXONOMY ON DRAWING FOR DESIGN

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ABSTRACT:

An extensive taxonomy was initially developed by the author to characterize the role of drawing in design, and is currently subject to revision with a view to web-based publication linked to a database of designer's drawings. The original taxonomy has been instrumental in helping to characterize the findings of over twenty years of research. Now, prompted not least by the opportunities that web-based publication offers for a wider audience and interactive searching, the taxonomy is being enhanced and extended to meet the needs of today's designers, design students and researchers. In spite of the fundamental changes brought about by professional and technological change, designers still draw. Therefore it is essential to understand the nature of this drawing to inform a new generation of young designers more familiar with digital than paper-based design environments.

KEY WORDS: Drawing Research; Design Process, Design Education

1. INTRODUCTION

This paper is about enhancing and revising an established taxonomy in order to update it to suit both a new purpose and a new, wider audience. The new purpose is essentially to facilitate accessing and searching a database of designers' drawings, thereby linking them to a system of characterization, classification and comparative analysis. The new audience includes today's design students who are different in many respects to the design students of the mid-1980s when the research that led to the original taxonomy was initiated. While interest in research about drawing has intensified, the use of drawing, certainly paper-based drawing, has decreased in the daily practice of many designers. While many design academics still believe that drawing should have a place on the curriculum, they also acknowledge that that place is under pressure (Schenk 2005 a). There are also many differences in the priorities both of the academics for whom the taxonomy was originally intended (Schenk 1989), and of the researchers into drawing studies to whom a conference paper (Schenk 1993) describing the construction of the original taxonomy was addressed.

The taxonomy was developed by the author to characterize the role of drawing in graphic design at a time when there was much evidence of the use of drawing throughout the entire graphic design process (Schenk 2005 b). The characterization of a wide variety of forms of drawing, their use in the design process, and the terminology applied to them by design professionals was systematically investigated and then included in the taxonomy. Now, prompted not least by the opportunities that web-based publication offers for a wider audience and interactive searching, the taxonomy is being revised to meet the needs of today's design students, academics and researchers.

Based originally on the practice of graphic design, the scope of what has become a longitudinal research programme has been extended to encompass the other main forms of design and educational practice, including product and textile design, thereby improving the opportunity for comparative analysis across a wider range of designerly practice. In addition, the huge impact of technological changes in the last 20 years has had a marked influence on the role of drawing in the commercial practice of all forms of design, and the resulting changes have been consistently monitored. There have also been quite profound changes in the profile of the student intake to design courses over the twenty intervening years since the research began, and the implications of these changes on the teaching of drawing have similarly been subject to scrutiny.

In its original form, the taxonomy was a means of characterizing findings from an extensive research programme on the role of drawing in design (Schenk 1989). It was used to set out a detailed description of the relationships between tasks in the design process and the way the act of drawing and the types of drawing produced were utilized throughout that process. As the original research programme was extended, it became the aide memoir of a longitudinal study, a model of the design process that could be used to define a changing situation. It has thus been invaluable in charting the effects of the introduction of computer-based technology into the design studio, specifically the changes such introductions have made to the role of drawing. Now, the opportunities of web-based technology make it possible to extensively search collections of designer's drawings and the taxonomy is being revised to suit that purpose. One view of the drawing process is as a search for meaning (Quantrill M 2002). It is hoped that by providing the opportunity for analysis of the drawn records of the design processes for a wide range of designers, new meanings will emerge. As Menezes (2006) indicates, various researchers have suggested that designers can read more information in drawings than was invested in their making (Schon and Wiggins 1992, Goldsmidt 1994, Suwa et al. 2000). The rapid searching of numerous drawings and their sequence may well provide further data from which to observe that particular phenomenon.

Although it is clear that the opportunity to see the drawings produced by designers while they are engaged in the various phases of design can be of value to both researchers and students (Van der Lugt R 2005), the opportunities to do this have become increasingly scarce as design practice has shifted to the digital domain. Fewer drawings are made than in the pre-digital era, and many of those that are produced remain within the computer and do not emerge into the more 'public' arena once typified by the paper-based design studio. Therefore, although the opportunities to visit design studios still exist, many of today's design students have far less opportunity to see the drawings of expert designers than the students of twenty years ago. The original research mentioned above was devised primarily for educational purposes, intended to provide information about drawing as an essential aspect of designerly practice and to inform curriculum planning for design students. While being software savvy, many of today's potential design students can be inexperienced and unpracticed in drawing, and it is hoped that a web-based publication of the revised taxonomy linked to a database of designers' drawings can assist them to understand the importance drawing still has in the design process. Therefore, the new technology provides the opportunity to demonstrate and demystify a fundamental aspect of design for a wide audience

that includes new kinds of design students, students who are computerate but without any real drawing experience.

While the educational implications of the original investigation attracted interest from design educationalists at the time, it must be acknowledges that today's design courses are very different (Schenk 2005 a). There are also very different kinds of students studying design from those for whose benefit the original work was conducted in the mid-1980s (Schenk 2006). Moreover, there are also different kinds of drawings being produced for design applications, and with imaging tools that did not exist at that time. However, much is still the same, as a comparison of contemporary design drawings with those of the past will indicate.

Crucial to the success of the analysis framework provided by the new taxonomy will be the links to the database of designer's drawings. Already rich in historical examples, the author's existing collection will form the basis of the initial database, which will be regularly supplemented to provide additional examples as research and retrieval progress.

2. THE CHARACTERIZATION OF DRAWINGS

The remit of the original research was to investigate both why and how graphic designers draw, such that the technical skills and the intellectual abilities graphic design students must develop to be able to use drawing appropriately could be clearly identified. Although that remit has now been extended to include a wider range of design disciplines than just graphic design, the purpose, essentially, is the same. Due to developments in technology and changes in the design industry, the role of drawing can be seen to have changed since the first round of investigation (Schenk 2005 b), but it is still important to characterize typical, current drawing usage in order to form a basis for any educational provision.

Even during the mid-1980s it was not easy to gain access to examples of actual graphic designers' drawings. Although the drawings of fine artists' were described in detail in the literature (Rawson P 1983), graphic designers' drawings were not subject to the same degree of analysis. Where examples of graphic designers' drawings did appear in the books of the time, they were reconstructions rather than examples of genuine drawings (Bridgewater P 1987). The real drawings indicating the messy, fuzzy, reiterative design process itself were rarely reproduced. For other disciplines there were notable exceptions, for example within the fields of architectural

and industrial design (Crowe and Laseau 1984, Lawson B 1984, Tovey M 1989). In his seminal work 'Over my Shoulder' (1960), Abram Games provided an early, rare example for graphic design itself, but in general neither the ambiguity not the quantity of the type of drawings actually produced by designers was openly acknowledged at that time. However, there was a source of genuine material for analysis and that was in the 'job bags' stored by most of the design groups and consultancies then operating. This material, for the most part, provided the 'drawn record' of the design process that was accessed by the author when conducting the original research.

With the work of new researchers, particularly that conducted to provide information for the development of drawing software for designers (Verstiijen 1998), more attention has become focused on the nature of drawing for design (Purell and Gero 1998). It has also become apparent that, while computer-aided systems can provide a viable substitute for many of the skill-based drawings associated with the resolution, presentation and production of design solutions, they do not support early ideation. 'Despite their power and beauty, existing computer-aided systems fail to assist visual invention as much as they should' (Fish and Scrivener 1990). Partly because of this, greater research emphasis has been increasingly placed on the analysis of the types of drawings used to generate and explore ideas (Goldsmidt 2003). As Garner (2001) indicates, incompleteness and ambiguity remain essential even in virtual design studios. Although, in an experiment devised by Bilda, Gero and Purcell (2006) [where architects were asked to design without sketching], it has been shown that 'sketching may not be the only way to conceptually design', even those researchers acknowledge that all the expert architects in their study 'believe strongly that sketching is essential'.

It is hoped that by providing opportunity for new kinds of searching, renewed opportunities for research will emerge. For example, although Menes (2006) has proposed that drawing may not be as helpful to novice as it is to expert designers, that notion depends of course on the definition of 'expert'. That expert designers will at times not draw as much as their less experienced counterparts is also evident. The process of talking to a range of designers representing different levels of seniority and watching designers working in studio environments in our investigations, has revealed different evidence from that in Menes investigation.

It appears that the experience of achieving solutions to design problems gives designers knowledge not only of 'types' of design solutions, as Schon (1988) describes the phenomenon, but also of the very drawing activities utilized in solving design problems. Expert designers can

not only short-cut to solution types, they can move through potential visual concepts more quickly than novice designers and thereby, on occasions, draw less. However, whether expert designers draw more when trying to achieve entirely original solutions, i.e. when they are developing solutions beyond their own previous experience, is difficult to establish by research methods like the protocol analysis described by Bilda et al. By linking a database of designers' drawings to the taxonomy, evidence will be provided for the kind of retrospective comparative analysis of designers working with varying degrees of experience that such an inquiry requires.

Evidence gleaned from the study of the drawings made throughout the development of complex solutions indicates that, not only a design team, but also individuals can amass hundreds of drawings while trying to solve complex visual and conceptual issues. Equally, such evidence reveals where minimal drawing activity occurs in certain circumstances. It is important to characterize the shared experience of drawing so that designers may learn from each other. Again, it is important to characterize the various different forms of drawing to enrich our understanding of distinctive practice. It is also important to characterize forms of drawing that are no longer much in use for our historical reference and, in the same way, it is important to recognize and characterize new forms of drawings as they emerge from the technological developments and shifting professional and intellectual perspectives that inform the design professions today. Moreover, it is important, by cross-referencing and conducting comparative analysis facilitated by the characterization of all these different forms of drawing, that we enhance our understanding of the process of design.

3. METHODS OF RESEARCH AND CHARACTERIZATION

Not only the content but also the structure of the original taxonomy was reflective of the approach taken to the original research (Schenk 2005 a). Indeed as indicated above, once developed, the taxonomy became a type of 'aide memoir' for subsequent research, acting as a model of the design process against which change could be measured as the effects of computer-aided design became apparent (Schenk 2005 b). Lawson (2004) concludes 'design expertise cannot be understood by studying actions alone but that our research needs to concentrate on perception and recognition and that we will have to examine conversations and memories as much as drawings'. Graphic designers representing a wide range of areas of specialization and levels of experience and seniority were included in an interview programme as part of the initial research, and in the intervening period of over 20 years numerous additional interviews have been

conducted. This has included a widening range of specialist designers and, in some cases, the same designers as in the original study. The interview script consisted in part of a set of questions that elicited responses about the way drawing was used and the type of drawings that were produced in each stage of the design process, beginning with 'accepting briefing' and ending with 'preparation for production' [the artwork for which was at that time often hand-drawn]. Therefore, the taxonomy was set out as a table to present findings following the order defined by the questions. It was acknowledged at the time that there was reiteration within the design process, but an essentially linear model emerged. The interview script also contained questions about respondents' views about design education and the development of drawing ability, and data collected from these questions was analyzed and integrated with drawing usage in the tabular format of the original taxonomy.

The advantage of the conversational format of a person-to-person interview is that information can be interrogated and attitudes probed (Cohen and Manion 1985). During the many hours spent talking to designers it has been possible for the author to explore the intimate and individual experience of trying to initiate and develop ideas with the informal yet concrete support that drawing gives. It has also been possible to discuss how particular types of drawing ability support ambitions to conceive particular types of visual forms and formats, and how a lack of ability can cause limitations. Moreover, it has been possible to monitor designers shifting opinions of the increasingly ubiquitous use of computer-aided design and the changes in the design process, particularly in the use of drawing, that it has brought about.

In addition to talking to designers about their work, numerous designers' drawings were analyzed, frequently in discussion with the designers themselves. Studio-based practice of different kinds was observed and by monitoring the production of drawings in a manner that was non intrusive, it was possible to observe both the degree of reliance on drawing and the development of the short-hand strategies that designers adopt. By investigating the drawn record of numerous design jobs produced over nearly a quarter of a century it has been possible to determine the types of drawings that all designers have used and still use, the types that are no longer much used and the emergence of new types of drawings.

One of the problems encountered in the original study was the allocation of specific names to particular types of drawings. It was clear that practicing designers themselves have very little need to adopt specific terms for the various drawing types, other than that occasioned by

communicating among themselves. But for the purpose of the research a broadly agreed terminology was deemed essential. In order to arrive finally at a systematic and consistent method of naming drawing types an approach was adopted which, as far as possible, reflected the terminology used in the profession, but at the same time allowed for a greater differentiation between the types. Where possible, terms were identified from the scripts of the interviews conducted in the original study. In some instances, when designers were asked to think more carefully about terminology, many of them were able to contribute terms for either drawing activities or for drawing types, especially when an actual drawing activity or type could be used as a point of reference. Once a list of potential names had been established for all the distinct types of drawing identified in the study, this list was then checked with a number of designers. By this means, 25 distinct types of drawing were identified at that time.

Subsequently, every opportunity has been taken to update this list and redefine terminology. New types of drawing have been identified and new terms have emerged, and this process continues. Indeed, one of the findings of the research programme has been that not only does terminology change from one discipline or specialist area to another but the use of particular terms is also subject to change through time. The taxonomy will be designed to acknowledge this phenomenon and will be inclusive of all terms identified. Where possible the drawings included will be accurately dated and the attendant terminology applied. It is intended that the taxonomy will record this historical shift in terminology as it will record the historical shift in the use of drawing.

4. DEVELOPING THE NEW TAXONOMY: DRAWING FOR DESIGN

Although many of the well-tested features of the original taxonomy have been retained, some additions are planned to make searching clearer and comparison easier to achieve. Based on the changes described below to the original taxonomy, a kind of ‘prototype’ is being developed. Further changes may be required as detailed work continues and there will be an opportunity to accept feedback from experts in the field. However, at this stage a number of significant issues are being taken into account. Although it is important to revise the original taxonomy for repurposing, it is also important that all the types and uses of drawing already identified in the longitudinal and continuing study are still accommodated and that the findings from new research can be added as appropriate. The original taxonomy was based on an analysis of the graphic design process in commercial practice in the 1980s and due consideration must be also be given

to an ongoing analysis of contemporary practice and to providing a structure that is readily intelligible to a non specialist or non-expert audience.

It should be noted that the term *task* has been used to denote a piece of work; a specific undertaking to be carried out. The task represented the level of operation within designerly activity which was the main subject of scrutiny in the original study when 38 distinct tasks were identified. Therefore the use of drawing involved in the performance of tasks represented the core of that taxonomy. In the new taxonomy, the *task* will be maintained as the principle link between the process of design and the use to which drawing is put during that process.

The original taxonomy was entitled 'Taxonomy of the Uses of Drawing, Types of Drawing Produced, and the Drawing Abilities Required for the Graphic Design Process' and was divided into in three main sections. Section One described the use of drawing for managerial tasks, essentially those tasks involving consultation and organization, conducted by senior designers and creative directors. Section Two described the use of drawing for executive tasks by which was meant the preparation of design solutions by members of the design team. In Section Three the use that graphic designers made of drawing for what were termed 'Self development' tasks was set out. The revised taxonomy is not split in this manner. Managerial and executive tasks are grouped together and 'self-development' is subsumed in one of the new sections, namely 'Collecting visual reference material'.

As indicated above, while acknowledging that the design process is reiterative, the original taxonomy was designed to have a linear format because its construction was based on designers' descriptions of their drawing practice throughout the design process, from beginning to end. It was presented in a tabular form and on the left hand side of the table the main *phases* of the design process were indicated and were divided into basic *procedures*. Then, in turn, procedures were divided into individual *tasks*. Movement down the table showed the broad sequence of events followed by graphic designers in developing design solutions. The design process was divided into a series of phases; the 'Preparation Phase', the 'Main Creative Phase'; and the 'Production Phase'.

In addition to this linear model specific tasks are now also grouped according to their general use in the design process rather than just in relation to use in a temporal phase. For example, new sections like 'Drawing for accepting and giving instruction', 'Drawing for collecting visual reference', and 'Drawing for the initiation and development of ideas' will be created, within which

particular tasks and related types of drawings will be subsumed. It is envisaged that further subheadings will be added and thus subdivisions made. For example, the section ‘Drawing for presentation’ will be subdivided into ‘In-house’ and ‘Client’ presentation; ‘Drawing for the initiation of ideas’ will contain a subsection entitled, ‘Drawing to clarify the design problem’, thus acknowledging the importance of research in this area (Purcell and Gero, 1998). Table 1 sets out the headings currently planned.

Table 1 Use of drawing in the design process

Drawing for accepting and giving instruction
Drawing for collecting visual reference material
Drawing for the initiation of ideas
Drawing for the development and refinement of ideas
Drawing for the synthesis and revision of design solutions
Drawing for communication
Drawing for presentation
Drawing for production

Moving across the original table, the ‘Use of drawing', the ‘Type of drawing produced’ and the implied ‘Required drawing ability’ needed to produce such drawings were described for each of the individual tasks. For example, when accepting briefing it was observed that, for the task of ‘Recording information’, the use of drawing was ‘to record visual information’, the type of drawing produced was a ‘Visual note’ and the drawing ability required to produce that visual note included the capacity to ‘Draw quickly’, the understanding of various ‘Visual conventions’, and ‘Recall of visual information’. Hypertext links between ‘task’, ‘use’, ‘type’ and ‘drawing ability’ will be established in the new taxonomy to provide examples.

During the development of the original taxonomy complication occurred in the development of a linear categorization of tasks that are frequently performed simultaneously. For example, during a briefing session, designers were observed to be querying various aspects of the job while, at the same time, making visual notes of the information received and recording the first ideas prompted by the occasion through the same doodles and rapid scribbles. This phenomenon of ‘simultaneity’ or parallel processing was found to be very influential in terms of the designer’s use of drawing, and is of importance in the development of the drawing abilities that graphic designers need. It became clear that not only is it necessary that designers are able to produce a wide range of drawing types but that they are able to combine these ‘strategically’ by producing hybrid types of drawings, or drawings produced to serve several purposes, according to the

circumstances of the particular design procedure in which they are involved. Means of representing this phenomenon will be devised for the new taxonomy.

It is intended that all forms of drawing previously identified, even those that are no longer generally in use, will be included within the new taxonomy. Both historical and emergent types of drawing will be described along with those used in current practice. For example, types of drawing that were referred to as 'Key-line', and were used in the pre-digital era to outline the content of photographic material for printers' specification, will be retained in the taxonomy because, although such drawings are no longer produced by hand, they have an historical relevance. Again, the type of plan or diagram that achieved common usage in the early 1990s to explore the development of interactive functions like web or multi-media design will be also be added.

As indicated above, it was difficult when the original taxonomy was developed to determine agreed terminology for the types of drawing to be categorized. This terminology was eventually developed in discussion with designers by either adopting their own usage or by adopting a name descriptive of the drawing activity in question. Table 2 below identifies and links drawing activities and the associated terms adopted for the types drawings associated with that activity.

Table 2 Drawing activity: Examples of types of drawing produced

To note information	Visual note
To pass on information	Instruction
To produce a schematic representation	Schematic
To express three-dimensions	Projection
To plan approach or to plan production	Plan
To plan out the contents of a magazine or book	Imposition
To plan out the contents of time-based media	Storyboard
To draw from observation	Sketch
To copy	Copy
To trace	Trace
To doodle	Doodle
To scribble	Scribble
To visualize	Visualization

To indicate	Indication
To lay out	Layout
To outline the content of photographic material	Key-line [Outline]
To render	Rendering
To demonstrate type of illustration	Trial illustration
To demonstrate type of lettering	Trial lettering
To produce mock-up of relationship of elements	Dummy
To specify	Specification
To demonstrate for purposes of commissioning	Demonstration
To draw up artwork	Draft
To refine aspects of artwork	Refinement
To produce artwork creatively	Resolution

The final stage of the original categorization was to describe drawing abilities that could be seen to correspond to the particular use and types of drawing that had been identified in the original research. The twenty-three types of ability identified to include both the practical and the intellectual skills needed to use drawing appropriately are set out in Table 3.

Table 3 Drawing Abilities

1	Ability to control a range of specialist equipment
2	Ability to control a range of media
3	Ability to draw accurately
4	Ability to draw quickly
5	Ability to set out or lay out drawn imagery
6	Ability to bring together a synthesis of imagery
7	Ability to imitate the qualities of visual imagery
8	Ability to understand how drawn imagery has been constructed
9	Ability to observe accurately from life
10	Ability to assess the elements of visual style
11	Ability to assess the elements of visual imagery on a cultural or historical basis
12	Ability to judge the appropriateness and quality of drawn images
13	Ability to conceive and depict three-dimensional forms
14	Ability to plan out sequences of actions or images
15	Ability to resolve ideas in a visual form
16	Ability to use drawing to instruct others
17	Ability to communicate visual ideas to others
18	Ability to conceptualize and commission potential images
19	Ability to recall and use conventions and drawing systems
20	Ability to memorize visual material
21	Ability to recall visual material

22 Ability to assess the appropriate use of drawing
23 Ability to use drawing strategically in the context of the design process.

This list of abilities is being up-dated to take cognizance of any changes identified in the ways in which designers use drawing and of the findings of research into the role of drawing, for example, that into sketch cognition (Fish and Scrivener, 1990) and emergence and interpretation (Goldschmidt, 1991). The opportunity provided by the 'fax' to present ideas 'at a distance', by the scanner to move from the paper-based to the digital environment and back, the graphic freedom facilitated by the electronic white board, and the drawn communication made possible by computer supported collaborative work, are all examples of the impact of developments in technology on the use of drawing in design over the last twenty years. By analysis of these relativity new forms of drawing, new insights into related drawing abilities can be achieved.

Therefore, beyond the specific revisions required for repurposing the taxonomy indicated above, capacity for further reflexivity is being built into its construction. Plans for future work also include adding to the design disciplines covered and exploring methods of cross-referencing through the taxonomy. It is also envisaged that additions will be made to the proposed database of designers' drawings that will be linked to the taxonomy, even to the extent that new, distinct databases will be created including, for example, 'novice' drawings and 'digital' drawings.

5. CONCLUSIONS

The role of drawing in the design process continues to develop and change. While the introduction of technology has made some forms of drawing virtually redundant, it is evident that designers still draw and that student designers still need to improve their drawing abilities. A taxonomy developed to describe the graphic design process at a time when it was still an essentially hand-drawn, paper-based process, can be usefully repurposed to form a web-based system of characterization and cross-referencing of designers' drawings that is still relevant today. This is because it can provide a simple method of searching a database of designers' drawings in ways that are analytical, investigative and educational.

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