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# Towards a method for documenting industrial design activity from the designer's perspective

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## Abstract

*Design researchers have recorded design activity most often on a microscopic level, enabling some conclusions on the structure of design processes to be reached through analysing trains of thought. An alternative, rarely attempted, is to undertake a macroscopic study of designing on a focused topic. A macroscopic study will aim to reveal designers' approaches to their work and the kinds of resources they use in relation to that topic. For such a study it is stressed that a designer needs to be involved in a long-term 'live' design project.*

*This paper argues that a diary written by the designer, either during or at some point after designing, is valuable to researchers studying designing on a macroscopic level. The two key reasons for using a diary are (a) only designers themselves can describe the thinking that accompanies their designing and (b) accounts can be written chronologically and in direct relation to the development of a particular product.*

*The merits of both concurrent and end-of-the-day diaries are discussed in relation to some initial trials.*

## Introduction

It is unfortunate that practising industrial designers have not found the time to write about the knowledge, skills and values they use in their designing. Design researchers too have made surprisingly little headway into explaining (or even describing) industrial designers' approaches to the most basic elements of their activity (such as methods for selecting materials or the use of different sketching styles). Hence, it comes as no surprise that literature on some topics of industrial design activity rarely discusses 'whens', 'hows' and 'whys' of designing, preferring to concentrate on descriptions of 'what' to know or be aware of. A need exists to research the most basic aspects of professional industrial design activity but the lack of past studies means that, in order to do this, issues relating to research methods must first be tackled.

An investigation of designing falls into a category of research "pursued through action in and on the real world, in all its complexity", where findings "only reliably apply to the place, time, persons and circumstances in which that action took place" <sup>1</sup>. To make

general conclusions on how industrial designers design, a "series of concordant subjective judgements by different scholars" <sup>2</sup> would need to be reached.

For the research project that this paper supports, the work of a small, manageable number of designers (approximately ten) will be investigated, with findings being presented and discussed as case-studies. Case-studies such as those by Roy<sup>3</sup> serve as a valuable bridge between people practising design and people involved in teaching and learning design. From case-studies, design educators and suppliers of information for use in industrial design practices can judge how best to approach their roles.

## Studying industrial design activity

Literature by Bessant<sup>4</sup>, Burroughs<sup>5</sup>, Magee<sup>6</sup>, Stauffer *et al*<sup>7</sup> and Yeomans<sup>8</sup>, under a variety of subject classifications, form a starting-point for studying design activity but do not take into account some of the rich evidence of designing already produced by an industrial designer in the course of working. A set of development sheets, for instance, holds a wealth of documentary evidence on how a

design has evolved, but no attempts have yet been made to research how accurate or how comprehensive a record of design thoughts these sheets might be.

On a similar note, only a few attempts have been made to describe the graphical language found on industrial designers' development sheets (Tovey<sup>9,10</sup>, Garner<sup>11</sup>). Future studies in this area may show some similarities between individuals' styles, perhaps even correlating the style of drawing to the facility it brings the designer. Such a task is complicated because development sheets need not be comprehensible to anyone other than the designer. Consider the following statement.

If a designer is sketching a curve for a plastic component, his/her accompanying thoughts may be to do with form in an aesthetic sense or they may be to do with making sure the component could come out of a mould-tool. For some designers, these thoughts may occur simultaneously. Simply by looking at the sketch it is not possible to tell what was being thought.

Only the designer can describe with authority what was (or is) being thought during the designing. Observation of designing, either by a human observer or by a video camera, cannot record what a designer is thinking.

#### **Limitations of accounts given by the designer**

##### *Completeness of accounts*

No account given by a designer will be comprehensive, but at the same time no measure of a 'comprehensive account of designing' can be made. It may be difficult, especially at first, for the designer to give accounts of thinking. It is not something that is normally asked. Accounts may become increasingly complete as experience of giving them is gained. The critical point for researchers is to determine whether the reports being made are usable for answering the chief questions posed by their research.

##### *Accuracy of accounts; timing of giving an account*

Few people would disagree that the most accurate reports will be given in the immediate

shadow of events occurring though, problematically, reports made close to the activity (up to the point where they are made whilst working) increase the likelihood of disturbing the activity. Asking for recollections weeks after the activity has passed will result in details becoming lost and, without intention, inaccuracies becoming more prominent. To avoid storytelling and reconstruction of events, accounts need to be given close to the time of the activity being performed.

Asking designers to give accounts means placing faith in their honesty; the opportunity to provide misinformation is always open. Honesty can be verified, to a degree, by assessing whether accounts tie in with the designer's actions or, for instance, the content of development sheets. Designers are unlikely to agree to give accounts in the first place if they fear undesirable exposure. There is no reasonable incentive for designers to give made-up reports once they have agreed to participate. Confidentiality or anonymity could be given if it was felt necessary to do so.

#### **Studying designers' approaches to their work**

The following questions are taken from the author's research project, as examples of the sorts of topic-focused questions a design researcher might want to address.

- When do some industrial designers attend to materials and manufacturing processes in their work?
- How does the level of detail of this attendance change?
- What information sources are consulted to aid the process of selecting materials and manufacturing processes?
- What 'forms of thinking' and 'ways of seeing' accompany the selection of materials and manufacturing processes?

To provide some answers to questions such as these, a designer does not need to be involved in a design project. There are, however, compelling reasons why designers should give accounts of their thinking and approaches to their work in the context of a 'live' long-term design project.

- Accounts of designing made *during* rather than *after* a design project are more likely to be complete and accurate.
- It does not follow that an approach used in one design project will be usable in the next. Changes in approach are likely to be caused by some difficulties presented by designing a particular product. 'Approaches' and 'the product' should not become separated if their interaction is to be understood.
- The attendance to a specific topic can be shown, if designing has been appropriately documented, to have sequence and to evolve.
- The length of time spent addressing a specific topic can be documented.
- The designer's interaction with information sources related to the topic can be recorded.

The above statements obviously do not hold true if designers are placed in experiments or asked to perform tasks that are only part of what would be done in practice. A naturalistic approach should be taken which allows as far as possible for designing to follow its normal course. This means the designer under study will be in a normal working environment, progressing from a project brief to a final proposal (probably for a client). The duration of the project is likely to be weeks if not months.

### Concurrent verbalisation

The most commonly used method for revealing designers' thoughts whilst designing is 'concurrent verbalisation' (speaking whilst working). A designer is asked to speak aloud his/her thoughts for the duration of designing whilst being video-recorded. The spoken words are later transcribed for subsequent 'protocol analysis' (analysis of the transcript). Concurrent verbalisation does not ask the designer to speak aloud thoughts on any particular topic. This is so that the designer's train of thought, covering many topics, can be tracked.

The only way to analyse a single topic of designing when using concurrent verbalisation is to extract usable information from the transcript. Transcripts produced

from concurrent verbalisation, such as those from the 1994 Delft University study<sup>12</sup>, are dilute in information for answering questions such as those listed previously. It follows that concurrent verbalisation is not a good choice for a macroscopic study of designing. Doubts have also been expressed over the effectiveness of concurrent verbalisation for revealing 'design thinking' (Lloyd *et al*<sup>13</sup>, Oxman<sup>14</sup>) and attention has been drawn to undesirable effects of concurrent verbalisation on designing (Davies<sup>15</sup>, Akin and Lin<sup>16</sup>).

Two additional factors make concurrent verbalisation unworkable for a small-scale research project: (a) to conduct parallel studies, a video camera would be required for each designer and (b) transcription of, say, ten two-month design projects is a prohibitively large task.

### A concurrently-produced diary

If accounts on a focused topic are to be given during designing, questions on the focused topic need to be persistently posed. An interviewer could do this, but the annoyance felt by the designer would be unbearable. Similarly, questionnaires could be supplied to fill in, but the frequency at which this would need to be done makes it unthinkable. In both cases, before too long the designer would be able to keep the questions in the back of the mind and know when to ask them, eliminating the need for an interviewer or a questionnaire. It is on this premise that the feasibility of a concurrently-produced diary is based. A diary is produced by the designer effectively holding an interview with themselves.

For the designer to reach a heightened state of awareness for the topic, effectively to determine when and how an account should be given, he/she needs to be acquainted with some example diaries, or at least shown thoroughly how to produce a diary whose contents will be of use to the researcher.

Diaries have been used to collect autobiographical information in other academic disciplines but, until now, industrial designers have not been asked to write them.

It has been well reported that some thoughts prominent during designing, such as pattern

recognition or those drawing upon tacit knowing, are difficult to explain in words. Written accounts during designing have the advantage that they can incorporate diagrams or graphics, allowing for succinct explanations of designing that would otherwise become long-winded if presented verbally. Since written reports require no transcription, a great deal of research effort is avoided.

### Distortion of the activity by giving concurrent accounts

To make an entry into a concurrent diary the designer must break from the designing (the term 'concurrent diary' is, therefore, not strictly true since the entry is made as soon as possible after the event rather than during the event). Besides taking some time to do (found for one designer to be around one minute per entry), there are some questions over how such interruptions affect designing. It is useful to return to the distinction between research aiming to reveal *trains of thought* and, as in the case of producing a diary, research aiming to reveal *approaches to designing*.

Trains of thought cannot help but be upset by the interruptions of making written concurrent accounts. For this reason, spoken accounts (concurrent verbalisation) are favoured for a *microscopic* study of designing. In contrast, a *macroscopic* study is not concerned with recording trains of thought. Are, therefore, changes in approaches to work likely to come about by trains of thought occasionally becoming upset? I do not believe this to be so because in my experience designers' approaches to their work are akin to long-term plans- ideas on how to tackle a design project that extend beyond any single episode of designing. 'Approaches to work' reflect knowledge, skills and values that cross different design projects and run throughout designing.

### An end-of-the-day diary

For some designers, the production of a concurrent diary may not be workable. This is because the designer is too actively concerned with the questions; they are not being kept sufficiently in the back of the mind. Or, the 'stop-start' nature of a concurrent diary

workable method is to ask for a diary to be produced at the day's end, outside of the activity so that it does not intrude on designing but close enough for thoughts to be fresh in the mind.

For end-of-the day reporting, development sheets can be used as a reference and a reminder for designers when they are giving accounts of how their thinking evolved. This is likely to be a good method of obtaining accurate information, from the designer's perspective, out of development sheets. Up to thirty minutes at the end of the day needs to be set aside to make a diary entry.

The extent to which a concurrent report provides more usable information than an end-of-the-day report needs to be assessed. The completeness and accuracy of an end-of-the-day report could be insignificantly lower than a concurrent report, making it the preferred choice because it does not intrude onto the design activity.

Figure 1 shows the two types of diary, concurrent (on the left) and end-of-the-day (on the right). Entries for the concurrent diary typically consist of a few annotated sketches or brief lines of text.

### Summary

Based on trials, diaries on a focused topic of designing have been shown to provide usable information where industrial designers' *approaches to their work* rather than intricate *trains of thought* are of interest to the researcher. To conduct a study of industrial design activity on a macroscopic level, the following should be observed:

- insist on studying long-term 'live' design projects;
- promote the designer's account of thoughts over an outsider's inferences;
- limit the scope of the study to an aspect of the activity, thereby limiting the content of diaries so that they may be deep rather than broad.

The content of diaries are suitable for the analysis, in conjunction with development sheets, of occurrences, patterns, trends, peculiarities, expectations and surprises. It is

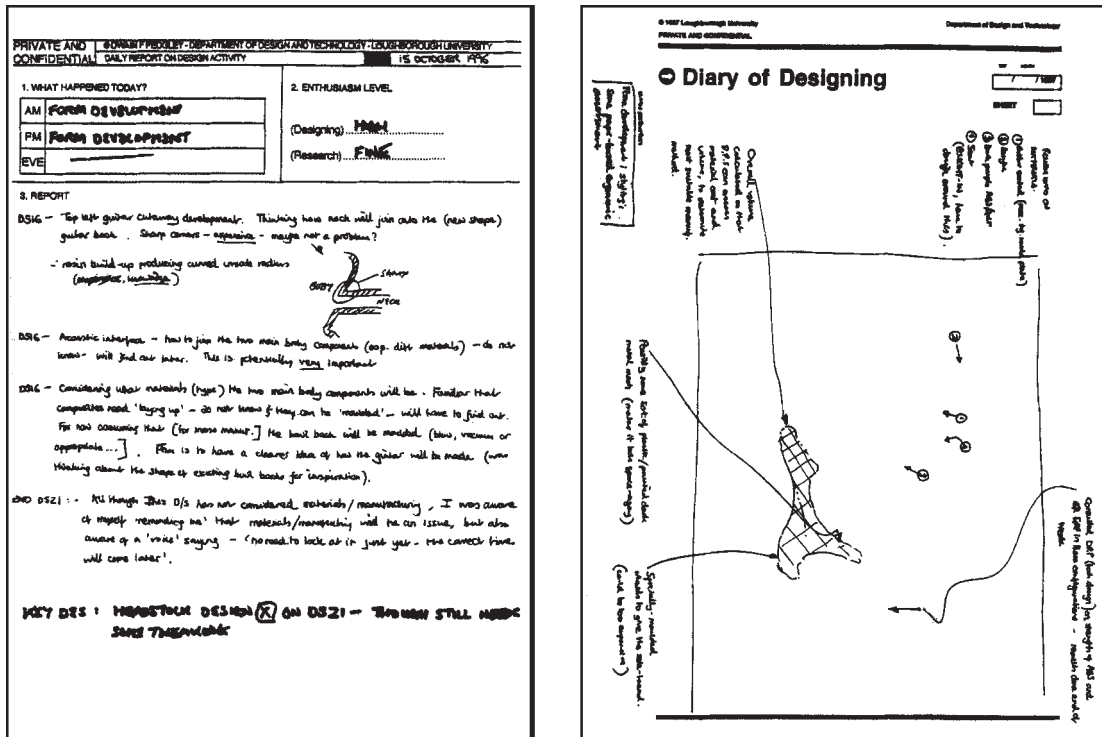


Figure 1: Two types of diary - concurrent and end-of-the-day

conceded that documenting design activity in such a detailed manner has drawbacks.

- It requires the production of some documents which are not normally expected of a designer; the production of these documents may be considered obtrusive by some designers.
- Diaries rely on honesty; the completeness and accuracy of accounts given in this way will always be limited.

Some compromises will have to be accepted by both the researcher and the designer being studied as the price for taking part in gaining research data.

Diaries produced for the author's research project show great potential for revealing when, how and why materials and manufacturing processes are attended to during designing. A great variety of designers' activities have the potential to be studied through the production of a diary. By assembling the results of diary research projects on a number of industrial design topics, a broad view of designing from designers' perspectives could be constructed.

## References

- 1 Archer, B. *Action Research: Research through art action, research through design action*, Internal research seminar paper, Department of Design and Technology, Loughborough University, 1995, p4
- 2 Archer, B. *The humanities tradition of research*, Internal research seminar paper, Department of Design and Technology, Loughborough University, 1995, p4
- 3 Roy, R. Case studies of creativity in innovative product development, *Design Studies*, Vol 14, No 4, 1993, pp423-443
- 4 Bessant, J. Preparing for design studies: ways of watching, *Design Studies*, Vol 1, No 2, 1979, pp77-83
- 5 Burroughs, G. *Design and Analysis in Educational Research*, Birmingham: University of Birmingham, 1971

- 6 Magee, K. The elicitation of knowledge from designers, *Design Studies*, Vol 8, No 2, 1987, pp125-140
- 7 Stauffer, L. Dietman M and Hyde R, Eliciting and analysing subjective data about engineering design, *Journal of Engineering Design*, Vol 2, No 4, 1991, pp351-366
- 8 Yeomans, D. Monitoring design processes in Evans B, Powell J and Talbot R (eds), *Changing Design*, Chichester: John Wiley, 1982, pp109-124
- 9 Tovey, M. Thinking styles and modelling systems, *Design Studies*, Vol 7, No 1, 1986, pp20-30
- 10 Tovey, M. Intuitive and objective processes in automotive design, *Design Studies*, Vol 13, No 1, 1992, pp23-41
- 11 Garner, S. The undervalued role of drawing in design' in Thistlewood D ed., *Drawing: Research and Development*, Harlow: Longman, 1992, pp98-109
- 12 Cross, N. Christiaans H and Dorst K eds, *Analysing Design Activity*, Chichester: John Wiley, 1996
- 13 Lloyd, P. Lawson B and Scott P, Can concurrent verbalization reveal design cognition?, *Design Studies*, Vol 16, No 2, 1995, pp237-259
- 14 Oxman, R. *Observing the observers: analysing design activity*, Internal paper, Faculty of Architecture and Town Planning, Technion University, Israel, 1995
- 15 Davies, S. Effects of concurrent verbalization on design problem solving, *Design Studies*, Vol 16, No 1, 1995, pp102-116
- 16 Akin, Ö. and Lin, C. Design protocol data and novel design decisions, *Design Studies*, Vol 16, No 2, 1995, pp211-236