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An analysis of face-to-face drawing activity

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An analysis of face-to-face drawing activity

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Abstract

This paper provides a detailed description of the drawing activities that pairs of product design students working in a "normal" (i.e. face-to face) situation produce. The design students' drawings are analysed with respect to the originator of the drawing, the drawing's content, and whether the drawing was used more than once. The findings suggest that there are certain commonalities in design students' behaviour (i.e. a preference for working on their own drawings) and consistent differences within design pairs (i.e. the design student who produces most combined drawings and one who works on a lower proportion of the partners drawings). An explanation for these differences and commonalities is posited with reference to the notion of "role playing" and its possible educational implications.

INTRODUCTION

The studies described in this paper were carried out as part of a project one aimed at establishing the communication requirements of people who are working together yet remotely located. The intention of this paper is to provide a detailed description of the drawing activities that pairs of student product designers produced when working in a "normal" (i.e. face-to face) situation. These descriptions give an insight into how drawings are used during the design process. This paper focuses on the drawing activities of working pairs rather than the activities of an individual working in isolation. The reasoning behind studying the working activities of pairs stems from the notion that work is essentially a co - operative activity. For example, while working on a design solution co - operation between designers may be evident in the communication by conversational turn taking, the adoption of partner suggested ideas, and the fact that an agreed design solution is reached. An understanding of how the medium of drawing is used to communicate and cooperate can be applied to an education in cooperative and communicative skills, in both face-to-face and technology mediated communications.

Method

The experiments described in this paper involved twelve students of design working in pairs (i.e. six studies). The participants were second year students on the "Design and Technology B.A." course at Loughborough University (i.e. similar skill level and knowledge-base). Though students of design cannot be considered to have equivalent skills, and therefore practices, as experienced designers they can be considered as working in a cooperative and competent fashion towards the resolution of a design problem. Throughout this paper, for brevity, the design students will be referred to as "designers".

Each pair of designers was given a design brief (See Appendix 1) and required to produce a final agreed solution (shared proto-solution) within an hour. Throughout the experiment the designers' activity was video recorded. The video was time stamped to enable an identification of when drawings were created, and if the drawings were revisited. The designers were supplied with a pad of A1 paper and they used their own pens, curves etc. However, the designers were asked not to destroy any of the drawings or use private note pads. It was assumed that restricting the drawing surface to A 1 sheets would not significantly interfere with the cooperation or design activity. Consequently, all the drawings made were evident on the A1 sheets.

Analysis

This paper looks at various proportions of usage (and production) of drawings by each designer as a means of describing the drawing activity. The first stage of the analysis involved coding the drawings into three systems based on the originator of the drawing, the drawing's content, and whether the drawing was used more than once. These coding categories are described below:

Self - Started (SS): When the designer under consideration is the originator of the drawing.

Partner - Started (PS): When the designer under consideration is not the originator of the drawing.

Worked - On (WO): The total number of drawings that a designer works on.

The Drawings were also labelled with respect to one of the following three content categories:

Combined (C): A combination of several design Details. e.g. a button shape on a handle.

Detailed (D): A drawing of one design Detail. e.g. A button shape.

Text (T): Writing e.g. lists and labelling.

The third form of coding was based on whether the drawing was used only once, or revisited within the hour.

Revisited (R): A drawing that is added to on more than one occasion

Used Once: A drawing that is produced in a single occasion,

After coding the data it was obvious that the "Text" category was rarely used (it contained very few data points), thus it seemed reasonable to exclude the data relating to text from the present analysis. For each designer the data is represented in the form of a table structured like this:

	Self Started			Partner Started			Worked On		
	Used Once	Revisited	Total	Used Once	Revisited	Total	Used Once	Revisited	Total
Combined	1	2	3	4	5	6	7	8	9
Detail	10	11	12	13	14	15	16	17	18
Total	19	20	21	22	23	24	25	26	27

For each designer, cell number 1 contains a count of all the Self - started Combined drawings that were used once only by that designer. Cell number 2 contains a count of all the Self-started Combined drawings which were revisited. Cell number 3 contains a count of all the Self-started Combined drawings produced. Cell number 4 contains a count of the Combined drawings that were started by the partner and worked on once by this designer. Cell number 5 contains a count of all the Combined drawings that were started by the partner and worked on more than once by this designer. Cell number 6 contains a count of all the Partner-started Combined drawings that this designer worked on. Cell number 7 contains a count of all the Combined drawings that this designer only used once, while cell number 8 contains a count of all the Combined drawings that the designer worked on more than once. Cell number 9 is a count of all the Combined drawings that this designer worked on. Cells numbered 10 to 18 represent the same counts for Detail drawings. The following analysis sections investigate the data from the 12 designers (See Appendix 2) in the tabular form described above. The analysis is predominantly descriptive in nature because of the complex interdependences of the data. The commentary focuses on the drawings worked on, the Self-started drawings, and the Partner-started drawings. This is followed by an overview of the differences and commonalities between individual designers, and the design pairs', activities.

Worked-on drawings

The overall work done by each designer is represented by the number of drawings that are used once by a designer plus the number of drawings that the designer revisits (cell 27, the total number of drawings worked on). A relevant question of this data is - do all 12 designers work on a similar percentage of the drawings produced?

TABLE 1.00

Study	1		2		3		4		5		6		Avge
Total No of drawings	79		55		72		60		52		62		63
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
Worked on:	52	41	27	38	40	54	33	35	32	29	28	41	37
%	65.8	51.9	49.1	69.1	55.6	75.0	55.0	58.3	61.5	55.8	45.2	66.1	59.0

At the extremes designer 3 B works on 75% of the drawings produced, While designer 6 A works on 45.2%. Ten out of the twelve designers work on more than half of the drawings produced. Only designers 2 A and 6 A work on less than half of the available drawings. Inspection suggests that there is some consistency in the proportion of drawings worked on.

Using a Chi-square Goodness of Fit test with the Null Hypothesis that the percentage of drawings worked on is the same for each designer gives a non-significant (Chi Square = 14.4, $p = 0.01$ with 11 df) result. Consequently, the Null hypothesis that each designer works on the same percentage of drawings can not be rejected. With the exception of Study 3 each design pair contains one designer who works on less than the average proportion of available drawings and one who works on more than the average proportion of available drawings. On a purely speculative level this could be indicative of design pairs working in a symbiotic way rather than mirroring each others input.

The drawings worked on are classified as "Combined" or "Detail". Table 1.01 enables an assessment of how the overall drawing activity is divided between these two types of drawings i.e. the proportions of Combined and Detail drawings Worked-on are shown in Table 1.01

TABLE 1.01

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
C/WO	0.24	0.48	0.28	0.19	0.26	0.19	0.26	0.42	0.28	0.27	0.23	0.38	0.29
D/WO	0.76	0.52	0.72	0.81	0.74	0.81	0.74	0.58	0.72	0.73	0.77	0.62	0.71

All the designers work on more Detail (averaging 71%) than Combined drawings (averaging 29%). The two designers in Study 5 work on almost identical proportions of Combined and Detail (two thirds). In the other Studies one designer in each pair works on a higher proportion of Combined drawings, Studies 1, 4, and 6 showing the largest differences.

Table 1.02 a shows the proportion of Worked-on drawings revisited by each designer. The proportion of drawings revisited is small in general (the average being 27%), the maximum being 41%. Similarly, the difference between the behaviours of designers in each pair is not great, the most notable differences occurring in Studies 1, 2, 3, and 5.

TABLE 1.02 a

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
R/WO	0.22	0.37	0.08	0.25	0.24	0.38	0.29	0.36	0.41	0.15	0.27	0.23	0.27

TABLE 1.02b

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
RC/C	0.36	0.37	0.14	0.71	0.44	0.55	0.37	0.50	0.75	0.29	0.40	0.40	0.44

TABLE 1.02c

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
RD/D	0.18	0.38	0.06	0.13	0.16	0.34	0.26	0.26	0.29	0.11	0.24	0.12	0.21

Table 1.02b shows the proportion of revisited Combined drawings to Combined drawings Worked-on, whilst Table 1.02c shows the proportion of revisited Detail to Detail drawings Worked-on. In almost all cases (designer 1 B an exception by 1%) the proportions in Table 1.02b are greater than the proportions in Table 1.02c, indicating that designers' have a preference for revisiting Combined drawings. This suggests that the Combined drawings are produced through revisits rather than by integrating existing Detail drawings into a Combined drawing on a single occasion.

Self-started drawings

A major feature of all six Studies was that none of the designers worked solely on their own drawings. In this section we consider self-generated drawing behaviour. Table 1.03 shows Self-started drawings as a proportion of the total number that the designer worked on.

TABLE 1.03

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
SS/WO	0.87	0.88	0.72	0.92	0.88	0.70	0.94	0.85	0.86	0.80	0.91	0.88	0.85

On average 85% of the drawings that the designer's work on are Self-started drawings. With 72%, of Self-started drawings worked on, the minimum for any designer it appears that there is a natural preference for working on Self-started drawings.

The Self-started drawings could provide an indication of any bias (towards Combined or Detailed drawings) in production between designers. Table 1.04 shows the proportion of Combined Self-started to Self-started drawings. Each designer produces a higher proportion of Detail drawings than Combined drawings. However, a closer look at the proportions indicates large variations between designers. In all cases except Study 2, where in fact the difference is very small, the most productive Combined draughtsman is also the greatest user of Combined drawings overall, indicating that one in each pair is more focused than the other on Combined drawings.

TABLE 1.04

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
CSS/SS	0.21	0.49	0.17	0.21	0.27	0.10	0.28	0.46	0.32	0.19	0.25	0.43	0.28

It is possible that since the designers choose to work more frequently on Self-started drawings, that they also choose to revisit Self-started drawings more frequently. Table 1.05 shows the proportion of Self-started drawings revisited to Self-started drawings. On average just under a third (27%) of drawings are revisited. This reflects the general revisiting activity (Table 1.02). Comparing Tables 1.02 and 1.05 it can be seen that the proportions are very similar indicating that the designers have no preference for revisiting their own drawings over Partner-started drawings. In Table 1.05, as in Table 1.04, there are imbalances between partners, particularly in Studies 1, 2, 4, and 5. In all Studies, except Studies 3 and 6, the designer producing the highest proportion of Combined drawings also revisits the highest proportion of Self-started drawings.

TABLE 1.05

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
SSR/SS	0.23	0.37	0.11	0.27	0.23	0.30	0.28	0.39	0.44	0.14	0.30	0.21	0.27

Although there does not appear to be a preference for revisiting the drawings produced by partner or self, there may be a preference for revisiting a particular type of drawing. This possibility is examined using the tables that follow.

Tables 1.06 and 1.07 show the proportion of Self-started Combined drawings revisited to Self-started Combined drawings and the proportion of Self-started Detail drawings revisited to Self-started Detail drawings respectively. Comparing these two tables it is clear that, in general, each designer revisits a higher proportion of their Combined drawings than their Detail drawings. This would be expected if Detail drawings are created on one occasion while Combined drawings are produced over time, having Details added as they arise.

TABLE 1.06

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
SSCR/SSC	0.37	0.35	0.33	0.71	0.37	0.67	0.37	0.46	0.75	0.25	0.40	0.40	0.45

TABLE 1.07

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
SSDR/SSD	0.19	0.39	0.07	0.15	0.18	0.27	0.24	0.33	0.29	0.12	0.27	0.08	0.21

In summary, designers work mainly on self generated drawings and most of this work is on Detail drawings. There appears to be no preference for revisiting Self-started drawings over Partner-started drawings, although when revisiting Self-started drawings there is a preference for Combined drawings.

Partner-started drawings

Explicit sharing of drawings is indicated through the use of Partner-started drawings. In each case the number of Partner-started drawings used is small. The proportions of Partner-started Detail to Detail drawings worked on are shown in Table 1.08. The proportions are low and the difference between designers in each design pair is small, however, in all cases except for Studies 2 and 3 the designer who works on a higher proportion of Partner-started Detail drawings is also the most productive Combined draughtsman. Combined drawings represent 55% of shared drawings, compared to 28% of Self-started drawings, indicating that Combined drawings are the focus of shared activity.

TABLE 1.08

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
PSD/D	0.09	0.14	0.17	0.10	0.12	0.21	0.09	0.21	0.19	0.10	0.12	0.19	0.14

Table 1.09 shows the proportion of Partner-started drawings to drawings Worked-on for each designer. Generally the proportions are small and hence the difference in behaviour of designers in a pair is small. However, in all cases apart from Studies 4 and 6, the designer who uses a higher proportion of Partner-started drawings is also the least productive Combined draughtsman. This suggests that the designer who produces less Combined drawings does not necessarily work on less Combined drawings, because they use the Partner-started Combined drawings.

TABLE 1.09

Study	1		2		3		4		5		6		Avge
Designer	A	B	A	B	A	B	A	B	A	B	A	B	
PS/WO	0.13	0.12	0.28	0.08	0.12	0.30	0.06	0.15	0.14	0.19	0.09	0.12	0.15

Profiles of The Design pair Drawing Activity

As a means of summarising the drawing activity represented in the previous Tables, Table 1.10 compares designer A with designer B in each pair by indicating which designer had the higher (+), and lower (-), proportion of usage in each category. For example, in Table 1.00 designer 1 A worked on a higher proportion of drawings than designer 1 B. Similarly, in Table 1.01 designer 1 A worked on a smaller proportion of Combined drawings than designer 1 B. By looking at the data in this fashion it is possible to gain a profile of each design pairs' activity. For clarity, the tables have been re-ordered (i.e. they don't appear in numerical order) and some redundant tables have been omitted (e.g. Table 1.09 is the reciprocal of Table 1.03). A new Table (Table 1.08a: Partner-started Combined drawings/Combined drawings) is included at this stage.

TABLE 1.10

Study	Designer	1		2		3		4		5		6	
		A	B	A	B	A	B	A	B	A	B	A	B
1.00	WO/Drwgs	+	-	-	+	-	+	-	+	+	-	-	+
1.01	C/WO	-	+	+	-	+	-	-	+	+	-	-	+
1.04	CSS/SS	-	+	-	+	+	-	-	+	+	-	-	+
1.03	SS/WO	-	+	-	+	+	-	+	-	+	-	+	-
1.08	PSD/D	-	+	+	-	-	+	-	+	+	-	-	+
1.08a	PSC/C	+	-	+	-	-	+	-	+	-	+	=	=
1.02a	R/WO	-	+	-	+	-	+	-	+	+	-	+	-
1.02b	RC/C	-	+	-	+	-	+	-	+	+	-	=	=
1.02c	RD/D	-	+	-	+	-	+	=	=	+	-	+	-
1.05	SSR/SS	-	+	-	+	-	+	-	+	+	-	+	-
1.06	SSCR/SSC	+	-	-	+	-	+	-	+	+	-	-	+
1.07	SSDR/SSD	-	+	-	+	-	+	-	+	+	-	+	-

The first striking feature of this table is the data with respect to revisiting. In each study one designer tends to revisit drawings more than the other. Furthermore the revisiting of drawings is biased in favour of Combined drawings. The principal overall 'revisitor' also revisits a higher proportion of Self-started drawings indicating that there is no preference by either of the designers for revisiting Self-started drawings at the expense of Partner-started drawings.

Turning to other aspects of Table 1.10, in four out of six cases, the greatest producer of Combined drawings (1.04) also works on a higher proportion of Self-started drawings (1.03). In other words, these designers are focused on their own Combined drawings. This is further supported by the fact that a smaller proportion of Combined drawings used by the "self-focused" designers' are Partner-started drawings (1.08a). In three instances, these designers also revisit more drawings (1.02), including a higher proportion of their own (1.05).

Hence, it would appear that the behaviour of the pairs in Studies 1, 2, 3, and 5 is very similar with one designer focused on Self-started Combined drawings. The difference in the revisiting pattern of Study 3 could be explained by the fact that a high proportion (30%, compared to an average of 15% across studies) of drawings Worked-on by Designer B in Study 3 are Partner-started drawings, and 57% of these are revisited. In Study 3, then, Designer B appears to contribute to a higher proportion (47%) of Partner-started drawings than the corresponding partner in all the other studies. It is perhaps this higher level of explicit sharing that accounts for the difference in revisiting pattern. Studies 4 and 6 stand out from the other four studies because (in both cases) the greatest producer (1.08a, and user - 1.01) of Combined drawings is not the the designer who uses the highest proportion of Self-started drawings (1.03). In addition, there are differences between Studies 4 and 6. In Study 4 the greatest producer of Combined drawings (1.08a) also revisits a higher proportion of drawings (1.02) than the partner, whereas in Study 6 the designer who uses the highest proportion of Self-started drawings (1.03) also

revisits a higher proportion of drawings (1.02). One point of possible explanation for this effect stems from the fact that these studies used the same brief (Duracell). Hence, the brief itself might be a factor that accounts for the difference between these two studies and the other four, and for the differences between Study 4 and Study 6.

Summary of the Differences and Similarities

With a view to establishing consistent patterns of drawing activities this section summarises some of the similarities across designers' behaviour and differences within design pairs.

Starting with the differences within design pairs:-

- * One designer tends to produce a higher proportion of Combined drawings than the other. For clarity we'll refer to this designer as the "*synthesizer*".
- * The *synthesizer* tends to revisit a higher proportion of Self-started drawings.
- * The *synthesizer*, who revisits Self - produced drawings most, also revisits the higher proportion of drawings in general.
- * The *synthesizer* works on a higher proportion of Partner-started Detail drawings.
- * Conversely, the least productive Combined draughtsman worked on a higher proportion of Partner-started drawings overall.

Turning now to the commonalities between all twelve designers behaviour:-

- * Designers produce more Detail than Combined drawings.
- * A higher proportion of Combined (than Detail) drawings are revisited.
- * Combined drawings tend to be the focus of shared activity (i.e. Combined drawings represent 55% of shared drawings, compared to 28% of Self-started drawings).
- * Partner-started drawings (and hence shared drawings) are a small proportion of those Worked-on by a designer.
- * Around a third of the drawings Worked - on by a designer are revisited.
- * There does not seem to be any preference for revisiting Self-started

or Partner-started drawings.

Interpretation

In the following section an explanation is postulated to account for the differences within design pairs, and similarities between designers. Firstly, from the above data we believe that it is possible to identify two fairly coherent roles within each design pair. These roles are probably not the only roles that occur during the drawing activity, however, they are clearly identifiable from the data collected within this set of studies. One role can be described as the "*synthesizer*" and is identified by the fact that this designer produces the most Combined drawings and focuses on Self-started drawings. The other role can be described as an "*appraiser*" and can be viewed as a more reflective role, i.e. generally less active on the drawing surface. We suspect that the *appraiser* is involved in the evaluation of the drawings and ideas expressed by the *synthesizer*. Thus the two designers appear to work in a symbiotic fashion with one designer focusing on the integration of ideas/drawings and the other designer focusing on the appraisal of these ideas/drawings.

Consider a group wishing to design a house. They could each agree to take responsibility for one room. They might end up with a strange house, but each individual would execute all aspects of the design process more or less equally though on different parts of the proposed artifact. The benefit of this approach is that the design process is likely to be completed faster (i.e. theoretically two designers produce the design in half the time of one). Yet, there is no sense here of two heads being better than one.

Alternatively, they could agree to design the entire house together but to take responsibility for different processes. One might be the analyst, another the synthesizer and so on. Analysis of Studies in this paper suggests that, in general, the design pairs adopt the second of these strategies. They appear to distribute process rather than problems (if they were dividing problems we would expect their drawing behaviour to be similar). This is not to say that different parts of the hypothetical artifact were not considered by individual designers, rather that such allocation of parts did not predominate.

Dividing processes between designers requires a high level of communication since stepwise progress depends on the group as a whole rather than the ability of individual designers to provide solutions for parts of the design artifact. However, the strategy does provide for parallelism of processes which would otherwise tend to be carried out sequentially by individuals, each shift to another process (e.g. from synthesis to appraisal) involving the temporary termination of the previous process. When the processes are distributed the time saving may not be that great. However, specific processes need not be interrupted (i.e. the synthesizer can continue even during the analysis being carried out by the other) perhaps allowing more continuity of process type (e.g. synthesis) than could be achieved when work is carried out

independently. Also the potential exists for two concurrent views on the same problem to be held, aired and resolved. In this sense, two heads might prove better than one.

We do not assert that the *synthesizer* works exclusively in the fashion described above, but that this is the predominant nature of the activity. Similarly the *appraiser* may be working as the *synthesizer* during the design process, but the nature of the activity is predominantly that associated with the role of *appraiser*. There may be times when the *synthesiser* is acting as an *appraiser* (and vice versa), there may also be other roles involved that have not been clearly identified by the present analysis. If designers always adopted the same role then this would produce occasions when two *appraisers*, or two *synthesizers*, would be working together. Since this does not appear to occur in the Studies described here it seems reasonable to assume that these roles are adopted by the partners at some stage during the design partnership. Consequently it appears unlikely that the designers will always adopt the same role when working in different design pairs.

THE IMPLICATION OF ROLE ALLOCATION FOR GROUP ACTIVITIES IN DESIGN TEACHING

It is not only possible, but probable, that teachers of product design students encourage students to divide the design processes rather than the physical aspects of the product between themselves when working together. The significance of this set of studies is that they provide empirical support for the notion that product design students adopt roles that divide the design processes in preference to dividing the physical aspects of the product. These roles do not seem to be formally adopted by partners through discussion, but instead emerge during the design process. There is nothing to suggest that individuals have a particular preference for working in one way or the other. However, it is quite possible that individuals may develop a preference as a result of successful working within a group, or repeatedly working in the same group. Working consistently within the same group, or consistently using the same roles, could have a constraining effect on the development of design skills. For instance, if two designers who prefer the appraisal role and have not sufficiently developed the skills associated with synthesis are required to work together, the design process, and therefore outcome, will not be as efficient as when a synthesiser and appraiser work together. The direct implication is that when design students are asked to undertake design tasks in small groups they should be encouraged to work in situations where they can exercise and develop skills relating to both the appraisal and synthesising roles.

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Appendix 1:

Design Brief Number One - Portable Grill

The Directors of a company specialising in the manufacture of sheet metal products have become aware of the growing number of cast iron and sheet metal barbecue products now on the market having been imported from Taiwan and other Far Eastern countries. The smaller versions of those products are often taken on holiday by caravanners and campers, boxed in their original packaging.

The Directors feel that there is a need for a motorised spit fold-up version suitable for transporting from camp-site to camp-site by car. They also consider that it should be provided with a stand since many users will be older people.

Your company has been approached for ideas and a major design proposal based on sheet metal and light weight metal rod for an outdoor powered grill.

Design Brief Number Two - Body Temperature Measuring Product.

You have recently graduated and entered a company, which until recently has specialised in computer repair work nationwide. This company has decided to utilise its expertise in electronics for the manufacture of its own products and to market them through its network of computer suppliers. The management board however feel that with their first product they must be cautious in the size and complexity of the venture. Following a recent incident in his home when the family mercury thermometer was broken, the managing director has suggested that the new product might be a method of measuring body temperature (to determine a persons state of health), and that it should be safe to use and simple to operate.

As the newest members of the design team, without preconceived ideas about the company practices, you are invited to examine the problem, generate any product design ideas for both technological systems and the total product concept, make recommendations for the manufacture, materials, and assembly, convey methods of use, suggest suitable packaging and an appropriate name.

The company Board have not previously had any experience of the way in

which a product designer works so it is particularly important that one main concept is singled out from the idea development sheets and presented professionally in visual and technical drawing form to suit both sales and production personnel who will be present.

Design Brief Number Three - Duracell Product

The firm of Duracell have attempted to raise their profile in the market place through the provision of design conscious products for which their batteries provide the power. The Durabeam torch series is one such example.

The company is now looking for other products to extend this design image while promoting the purchase of Duracell batteries.

You are asked to propose a range of ideas and develop one battery-powered product which fulfils this objective. The company do not wish to retain any elements of their existing "house style" and therefore these considerations will be expected along with those of manufacturing, costing and marketing.

Appendix 2:

Study 1

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	5	3	8	2	1	3	7	4	11
Detail	25	6	31	3	0	3	28	6	34
Total	30	9	39	5	1	6	35	10	45

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	11	6	17	1	1	2	12	7	19
Detail	11	7	18	2	1	3	13	8	21
Total	22	13	35	3	2	5	25	15	40

Study 2

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	2	1	3	4	0	4	6	1	7
Detail	14	1	15	3	0	3	17	1	18
Total	16	2	18	7	0	7	23	2	25

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	2	5	7	0	0	0	2	5	7
Detail	22	4	26	3	0	3	25	4	29
Total	24	9	33	3	0	3	27	9	36

Study 3

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	5	3	8	0	1	1	5	4	9
Detail	18	4	22	3	0	3	21	4	25
Total	23	7	30	3	1	4	26	8	34

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	1	2	3	3	3	6	4	5	9
Detail	22	8	30	3	5	8	25	13	38
Total	23	10	33	6	8	14	29	18	47

Study 4

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	5	3	8	0	0	0	5	3	8
Detail	16	5	21	1	1	2	17	6	23
Total	21	8	29	1	1	2	22	9	31

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	7	6	13	0	1	1	7	7	14
Detail	10	5	15	4	0	4	14	5	19
Total	17	11	28	4	1	5	21	12	33

Study 5

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	2	6	8	0	0	0	2	6	8
Detail	12	5	17	3	1	4	15	6	21
Total	14	11	25	3	1	4	17	12	29

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total

Combined	3	1	4	2	1	3	5	2	7
Detail	15	2	17	2	0	2	17	2	19
Total	18	3	21	4	1	5	22	4	26

Study 6

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	3	2	5	0	0	0	3	2	5
Detail	11	4	15	2	0	2	13	4	17
Total	14	6	20	2	0	2	16	6	22

Designer A	Self Started			Partner Started			Worked On		
	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total	Used 1	Revisit'd	Total
Combined	6	4	10	0	0	0	6	4	10
Detail	12	1	13	2	1	3	14	2	16
Total	18	5	23	2	1	3	20	6	26