The influence of the Design Task Description on the course and outcome of idea generation meetings

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Abstract

This paper presents the results of an explorative, comparative protocol analysis of two design meetings that focused on identifying how the style of the Design Task Description influences the course and the outcome of an idea generation meeting.

A framework is used to allocate potential influencing factors, including the DTD, and to discuss the various relationships and influences in order to understand the differences in course and outcome of the meetings. The style of the DTD was found to influence the length of the analysis phase and lead to differences in the course of the two idea generation meetings and to a higher idea generation rate.

1. Introduction

Design research aims at understanding and improving the design process with the goal of developing better products. Products have to satisfy the needs of all stakeholders. The design task description (DTD) is formulated to address this issue. An important part of the DTD is the set of requirements which play a crucial role throughout the design process (Schmidt-Kretschmer and Blessing 2005, Pahl and Beitz et al. 2007). In this paper, a requirement is defined as a characteristic which a designer is expected to fulfil in the design solution (Chakrabarti and Morgenstern et al. 2004). During the early phases of the design process the DTD is detailed and further requirements formulated. The DTD is a prerequisite for a focused idea generation meeting.

Design literature suggests several generally applicable methods for supporting requirement formulation, e.g. checklists (Pahl and Beitz et al. 2007), matrices (Ward, Shefelbine et al. 2003) and QFD/HoQ to transform customer needs into engineering characteristics (Akao 2004). Requirements management addresses the fact that views of the various stakeholders on needs and requirements can differ, so there can be different perceptions of the value of a particular solution (Schmidt-Kretschmer and Gries 2006).

Requirements and solutions are strongly interrelated, as has been observed in laboratory environments (e.g. Fricke 1993, Nidamarthi and Chakrabarti et al. 1997, Sipilä and Perttula 2006) and in industry (e.g. Almefelt and Andersson et al. 2003, Schmidt-Kretschmer and Blessing 2005). They co-evolve during the design process (see also Reymen, Dorst and Smulders, this volume). The emphasis of some approaches to design on the formulation of a requirements list prior to the generation of solutions thus has to be reconsidered. Almefeldt et al. clearly showed how not checking the fulfilment of requirements throughout the development process can lead to solutions which do not meet the requirements (Almefelt and Andersson et al. 2003).

Fricke's investigations indicated that the depth and breadth of the DTD can have an impact on the solution finding process: a detailed DTD with clearly specified requirements given at the start of the process reduced the number of solutions resulting from the solution finding process (Fricke 1993). Similarly, Hansen and Andreasen (2007) observed that in the early conceptual design activities "a product specification, which contains a lot of specification statements about product properties is not productive to support the synthesis of a product idea". Literature on DTD or on solution finding methods does not lead to a detailed understanding of the relationship between DTD and solution finding. It remains unclear as to which aspects of the DTD influence the process in which way, what the proper level of detail or style of DTD is, or how requirements have to be dealt with during the development process.

2 Research question and hypotheses

This paper discusses the results of an explorative, comparative study using protocol analysis of two design meetings held in an industrial environment, aimed at finding an initial answer to the following research question:

How does the style of the Design Task Description influence the course of the process and the outcome of idea generation meetings?

Our analysis is based on the following hypotheses:

1. The course of the process depends on the style of the DTD. Different behaviour in the task clarification stage of a process will affect the course of the overall process.
2. The number of ideas resulting from the process depends on the amount of time used for task clarification. An extensive analysis leads to more ideas for solving the task.
3. A longer analysis of the task supports the exploration of issues not mentioned in the DTD.

The framework we use to structure the elements of our research is based on the framework proposed by Frankenberger, Badke-Schaub, et al. (1998) to structure the factors influencing teamwork in engineering design practice. We simplified the original framework to highlights the basic relations between the elements addressed (see Figure 1). Elements are groups of influencing factors.

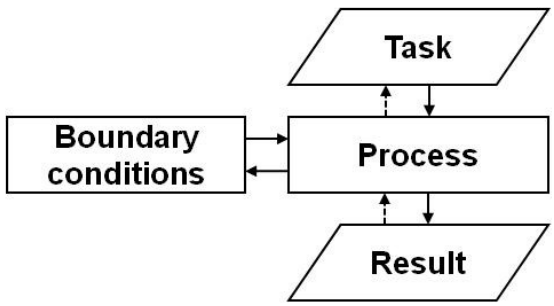

Figure 1. Basic framework for elements of the ideation process, after Frankenberger, Badke-Schaub et al. (1998)

The framework illustrates the relation between the task, the ideation process and the result which are addressed in our hypotheses. The framework also indicates the influence of so called boundary conditions. These contain individual prerequisites, group prerequisites and external conditions.

Our hypotheses concretise the relationship between the elements *task*, *process* and *result*. The *task* comprises the DTD. The *result* comprises the outcome. The factors which are contained in the element *boundary conditions* have to be included in the analysis to identify their influence on the process, as they may provide alternative explanations.

In contrast to the original framework, we modified the relationships between the elements. The modification which is corresponding with the literature (co-evolution of requirements and solutions) refers to possible feedback from results to the process and from the process to the task.

3. Source of Data

Our analysis focused on two meetings of a product development project recorded by the DTRS7 organisation (http://design.open.ac.uk/dtrs7). The two meetings addressed different problems for the same product (E1: mechanical engineering problem, and E2 electrical engineering problem) and the groups at the two meetings differed slightly. The goal of both meetings was to use brainstorming to find solutions for the given design task. Brainstorming is an intuitive solution finding method which is well established in industry. The goal of a brainstorming process is to generate a large number of ideas, without criticising or evaluating the ideas generated through group creativity (Paulus and Nijstad 2003). Most ideas will subsequently be discarded, but with perhaps a few novel ideas being identified as worth following-up (Cross 2000).

The brainstorming method was introduced by the moderator at the beginning of meeting E1. Matthews (Matthews 2008, this volume) notes that "designers' adherence to the rules of brainstorming are noticeably tempered by their orientation to social order". However, this does not alter the fact that the main objectives of brainstorming – the generation of a large number of ideas without criticising or evaluating these – were also the objectives of the two meetings.

The data available for analysis comprises:

- videos, transcripts of the meetings, room layouts and seating plans,
- copies of sketches and photographs of flipcharts generated during the meetings,
- the DTD (design brief and slides of the presentations given to the design teams at the start of the meetings),
- a technical drawing of an existing prototype given to the design teams;
- artefacts (e.g. a prototype, a shaver).

The data contained little about the background of the participants and almost no information about the context of the meetings. These and other limitations are discussed in section 5.5.

The analysis focused on the protocols. The videos were used to verify our interpretation of the in the transcripts. The use of the artefacts and the sketches was not analysed. For this we refer to Medeiros and Gomez (this volume) and Stacey et al. (this volume).

4. Analysis

In the following the research approach is described.

4.1 Method

The analysis focused on the comparison of the two engineering meetings (hereafter called E1 and E2) and consisted of the following steps:

Formulation of hypotheses

First the data was studied by reading the transcripts and viewing the videos to obtain insight into the nature of the meetings, with a particular focus on the DTD. Then factors which may have an influence on the course and the outcome of the observed idea generation meetings were identified. Based on the impressions from this initial review and supported by findings from literature, the framework of Frankenberger and Badke-Schaub was adapted as described earlier and hypotheses formulated.

Codification of events
Coding schemes were developed (see section 4.2) based on the hypotheses and on the boundary conditions, as far as these were known. The coding was executed by two of the authors (see section 4.2).

Inter-encoder reliability tests

As the data was coded by two of the authors it was possible to verify whether the definitions of the coding schemes were clear using inter-encoder reliability tests. The Kappa-coefficient lay between 0.79 and 0.96, with a mean value of 0.93. This is accepted as satisfactory.

Time allocation of events (time-stamp)
The transcriptions of the videos were supplemented with a time–stamp for each coded events (see below) to determine the duration of certain types of events.

Analysis of events
Based on this preparatory work, the numbers of events regarding the defined classes were counted. The distribution of the events was available for each participant of the meetings. Besides the number of events, the time spent on each event category was also calculated.

Comparison of meetings
The meetings were compared using the distribution of events regarding frequency and time. Additionally, the number and allocation of ideas generated during the meetings was analysed.

Because only two meetings were analysed and compared our findings are based on descriptive statistics and do not contain statements about statistical significances.

4.2 Coding scheme
The main sources of the analysis were the transcripts. The utterances were analysed and categorised according to the following definitions:

- Contribution: A contribution is any uninterrupted utterance during the meeting; one contribution may contain several events.
- Event: Any meaningful piece in transcripts, i.e. any piece that contains information relevant for a particular category in a coding scheme.
  Events were categorised as referring to Application, Requirement, Solution or Others.
  - Application event: (part of a) contribution referring to the "use case", which could lead to new requirements (e.g. left-handed user)
    "if you're /right handed\ you drag if you're left handed you push " (E1, 1050)
  - Requirement event: (part of a) contribution referring to a requirement (e.g. age of the user, length of print head 10mm)
    "yes we could just up the age limit it's not a problem" (E1, 1392)
  - Solution event: (part of a) contribution referring to an idea that solves an issue (see below)
    "(…) you could have thumb holes or something like that" (E1, 732)
  - Other event: events that do not belong to one of the other categories, such as moderation remarks, jokes, etc.
    "syringe I can spell that [laugh]" (E1, 1201 – 1202)
- Issue: a particular aspect of the product for which a solution is sought by the designers, which – in the observed meetings – came mainly from the DTD (see Table 1 for details).
- Requirement: characteristic, which a designer is expected to fulfil in the design solution (Chakrabarti and Morgenstern et al. 2004)
- Idea: a creative resolution of an issue

5. Findings

In the following our findings are presented. In section 5.1, the differences in the DTDs of the two meetings are described. In section 5.2, the differences in the courses of the two processes are discussed and linked to the differences in the DTD. The same is done in section 5.3 with respect to the process outcome (result). To identify potential alternative explanations for the findings, section 5.4 discusses the possible influence of the boundary conditions on the process as depicted in Figure 1.

5.1 Design Task Description (DTD)

The DTD given to the designers in the observed idea generation meetings included the issues to be addressed and the requirements to be met by the solution. The DTDs also contained a description of the goal for the meeting, corporate intent and brainstorming rules. The requirements were not listed explicitly but contained within the text. The DTD for meeting E1 differed in style and content from the DTD for meeting E2, as can been seen in Figures 2 and 3. The DTD from meeting E1 contains a list of issues, the DTD from meeting E2 does not.

Focus of generating ideas to overcome specific problems:

Problem	Issue in the concept
Wobbly arm movement of the user (5-11 year old)	Print head needs to stay in contact with thermal paper to print
Keeping the print head within an optimum angle range	The print head needs to activate the paper at the right angle to ensure good quality printing

Figure 2. Extract from the design task description of meeting E1

Product features

- What can we do with it
  - A thermal print head looks like a linear line of dots (about 7mm long)
  - Each of which can be individually addressed
  - Normally moved relative to the media with the dot line held perpendicular to the line of motion.
  - Here, user provides transport
- Control and selection of user features
  - How to provide a suitable UI for the intended user group
  - Select features and control the device in applications envisaged.

Figure 3. Extract from the design task description of meeting E2

The main feature of the DTD of meeting E1 was a table with the issues to be addressed during the brainstorming and the problems related to each issue, as the extract in Figure 2 shows. Hansen and Andreasen state that a detailed product design specification does not support the synthesis of a product idea (Hansen and Andreasen 2007) and we observe that a more formal style of the design task description constrains the possible solution space.

The DTD of meeting E2 did not include an explicit description of the issues. As can be seen from the extract in Figure 3, the style of the DTD of meeting E2 was more informal with a more enquiring character. This would support the expansion of the solution space, which again corresponds with Hansen and Andreasen's finding that a productive product design specification consists of statements which express value, contain context information, and articulate key functions (Hansen and Andreasen 2007).

The DTD's also differed in granularity. The issues to be addressed in meeting E1 are expressed in more detail than in meeting E2. An issue for meeting E1 was e.g.

“Consider ways to detect when the print head should (should not) fire”. This provided a clear focus on one sub-function (print head activation), allowing the participants to find solutions without a reformulation of the problem. The idea generation process can start immediately. The DTD of meeting E2 is less specific. The issue concerned is stated as an open question, such as “How to provide a suitable UI for the intended user group”. To address this issue it is necessary to determine what suitability means and to define functions which have to be fulfilled by the user interface (UI).

5.2 Process

First we analyse which issues and requirements were addressed during the process. Second, the differences in the courses of the processes are analysed by looking at the sequence and frequencies of analysis and synthesis activities. Finally, differences in design time are considered.

Issues addressed

Meeting E1 focused on mechanical issues and meeting E2 on electronic issues. The number of issues given in the DTD’s were five in each case. The issues differ between the two meetings, which could be expected because of the different focus of the meetings, but they also differ in their specificity, as shown in Table 1.

Table 1. Issues addressed

Meeting	Issues
E1	Keeping the print head within an optimum angle range
	Detect when the print head should not fire (overheating)
	Find solutions to save the print against over pressuring
	Ensure contact to paper (print head level, wobbly arm movement)
	Ensure smooth running over contours
E2	Define a suitable user interface
	Select features
	Enable control
	Find options for electronics architecture
	Search other applications, e.g. B2B
	Energy [derived issue]

In meeting E1 only the issues on the agenda were addressed. In meeting E2 one derived issue was also addressed. This could be seen as an indication that the informal and more enquiring character of the DTD of meeting E2 enhances the creativity of the participants by widening the problem space.

Requirements addressed

The requirements that were mentioned in the DTDs and during the introductory presentations were categorised as *given* requirements. Those that were introduced during the meetings were categorised as *derived* requirements.

Table 2. Number of given and derived requirements in meetings E1 and E2

	Requirements					
	Given (DTD)				Derived	
	Design brief		Presentation			
	E1	E2	E1	E2	E1	E2
number	9	9	6	8	12	16

The same numbers of requirements were given in the two DTDs. The number of requirements given in the introductory presentation was 6 in meeting E1 and 8 in meeting E2 (see Table 2). The number of requirements, which were derived during the meetings, was 12 in meeting E1 and 16 in meeting E2. Again, the less formal and less precise formulation of the DTD of meeting E2 could have encouraged the consideration of more requirements.

Course of the process

The conclusions regarding the process only relate to the events of the meetings analysed in this study, and not to the larger design process of which they were a part.

Following the categorisation of Dörner (Dörner 1976) and Fricke (Fricke 1993) problems can be described as dialectic problems (search and application problems) and synthesis problems. To solve these problems, either steps of *analysis* (dialectic problem) or *synthesis* (synthesis problem) have to be undertaken. *Analysis* "is the resolution of anything complex into its elements and the study of these elements and their relationships. …" (Pahl, Beitz et al. 2007). *Synthesis* "… is the fitting together of parts or elements to produce new effects … It involves search and discovery, and also composition and combination. …" (Pahl, Beitz et al. 2007).

To identify analysis and synthesis steps as essential components of the design process, the application and requirement events of the meetings were grouped into the category *analysis* the solutions events into the category *synthesis*. The other events remained in the category *others*. Application events were classified as *analysis* because these events do not describe solutions for the product under development but deliver information by analysing the potential use and aspects of the product.

The sequence of *analysis* and *synthesis* steps in the two meetings is different. In meeting E1, the participants continuously generated ideas (synthesis) and only occasionally dealt with the requirements and applications (analysis) (see Figure 4). Two distinct periods can be observed in meeting E2 (see Figure 5), a long initial *analysis* phase (application and requirements) changing into a very clear *synthesis* phase (solution).

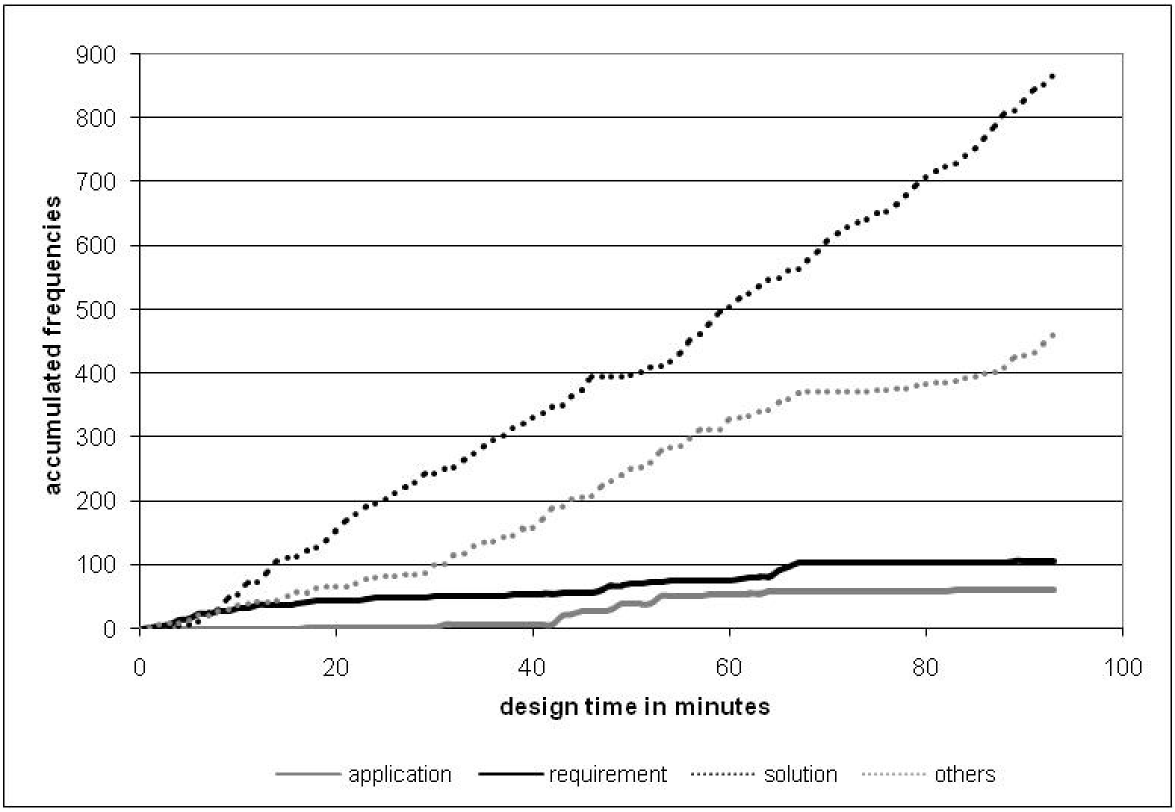

Figure 4. Accumulated events meeting E1

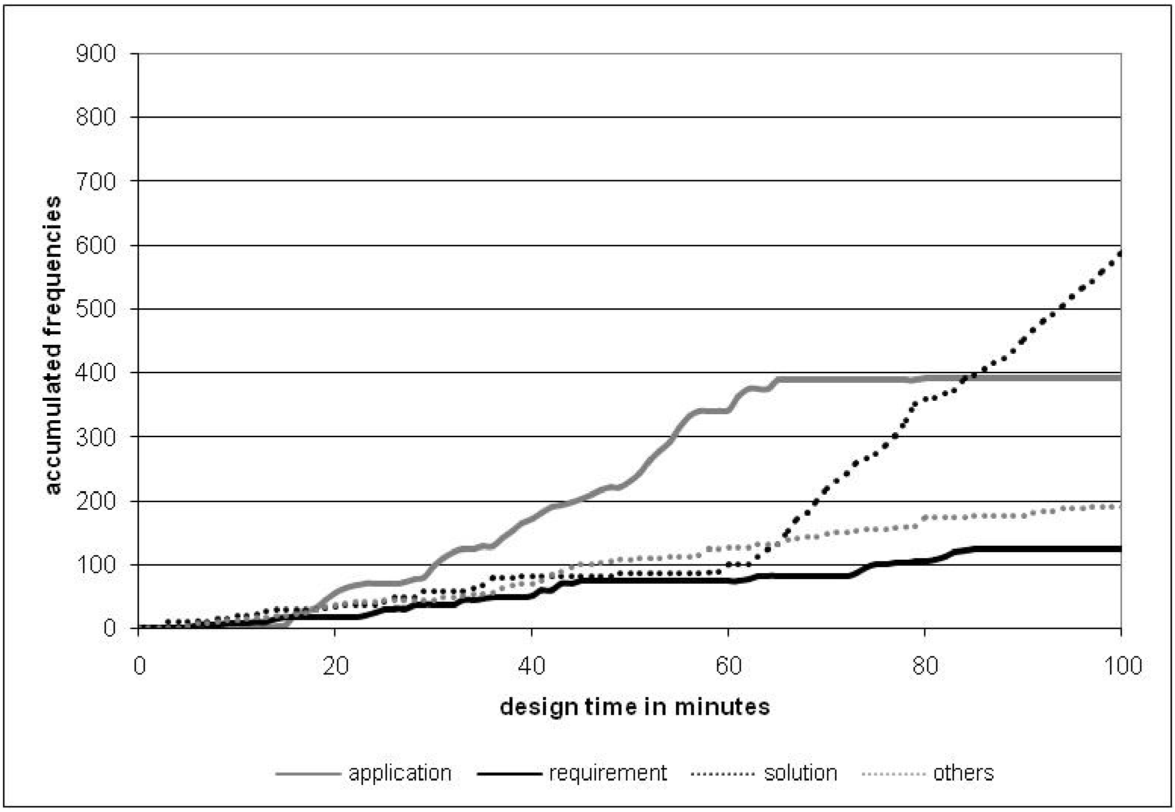

Figure 5. Accumulated events meeting E2

Figures 4 and 5 refer to the occurrence of the events, not to their duration. Each *other* event turned out to be rather short compared to the duration of the *analysis* and *synthesis* events, as can be seen in Figure 7.

The difference between the two processes is illustrated in Figure 6. In meeting E1 issue after issue is addressed, focusing in particular on synthesis. In meeting E2 all issues are addressed together, first by means of analysis and later by means of synthesis. A similar difference was found in the processes studied by Fricke: some designers tend to focus on the functions to be fulfilled, i.e. they tend to go through all steps of the process for each function before addressing another function, others tend to focus on the process, and to address all functions in each step before starting the next step.

The long initial *analysis* in meeting E2 could be the consequence of the style of the DTD. The DTD suggests applications and according to Jansson (Jansson and Maulin 1988) designers tend to stick to principles that have been suggested to them. The participants first analysed the applications to get a better understanding of the problems related to the issues to be addressed. This is the input for the subsequent *synthesis* phase.

In meeting E1, which started with a more formal DTD with specified issues, such an initial *analysis* phase cannot be observed. The *analysis* was separate for each issue.

The *analysis* focus in E2 continued until it changed abruptly due to an intervention of the E2-moderator after 58 minutes (Tommy sums up some requirements and directs the group towards talking about implementation). The course of the process can obviously be strongly influenced by the moderator.

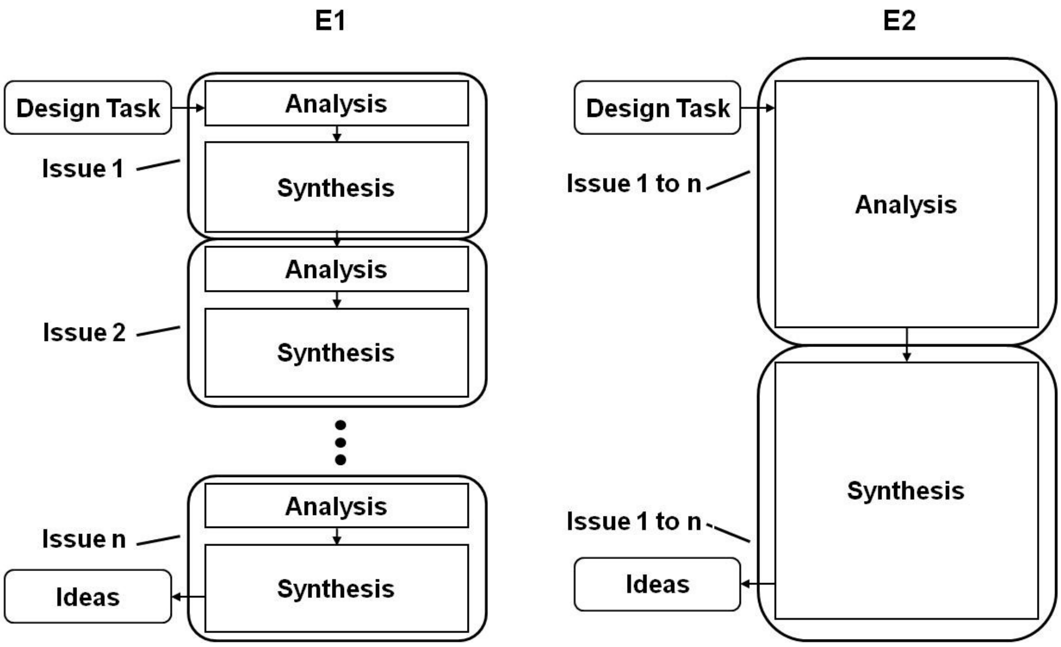

Figure 6. Course of the process

Allocation of design time
The total time for both meetings was similar (E1: 98 minutes, E2: 100 minutes). The total time less the initial moderation is named in the following as design time. The design time was 93 minutes for meeting E1 and 100 minutes for meeting E2. As Figures 4 and 5 suggest, the time spent on *analysis*, *synthesis* and *other* events in the two meetings differs considerably (see Figure 7).

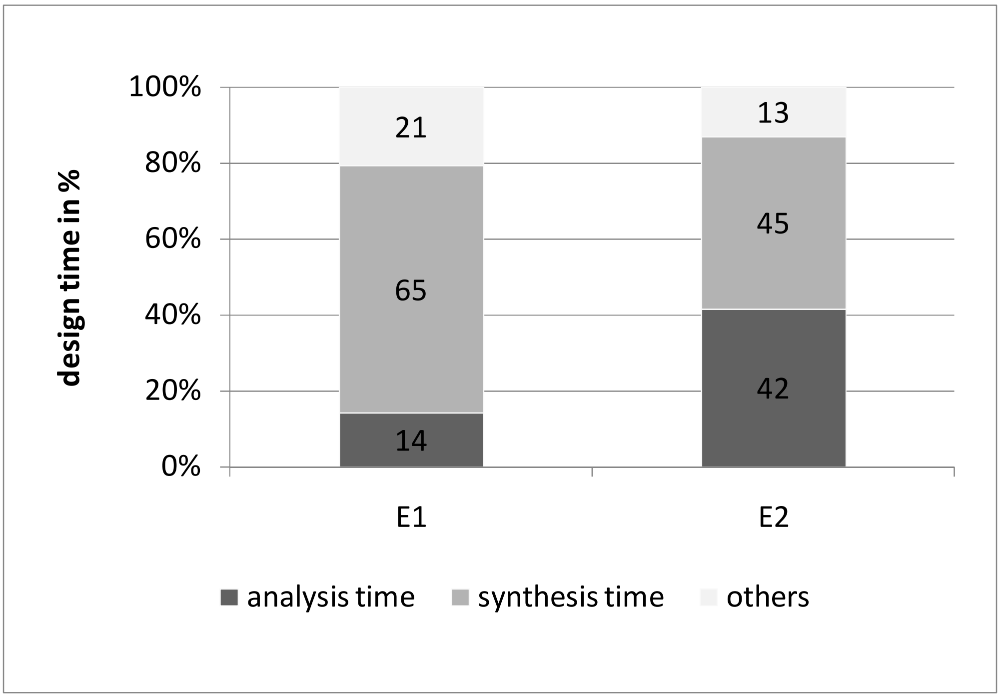

Figure 7. Allocation of design time

The time spent on *analysis* during meeting E2 (42%) was much more than during meeting E1 (14%). Accordingly, in meeting E2 less of the time (45%) was spent on *synthesis* than in meeting E1 (65%). Interestingly, in E2 equal amounts of time were spent on *synthesis* and *analysis*.

5.3 Outcome

Because only two meetings out of a larger process could be analysed, it was not possible to relate the findings to the quality of the solution or other such success criteria. The focus of the analysis, as reflected in the research question, was chosen to be the number of ideas generated during the meetings, as this was the aim of the observed meetings and thus represents the measure of success of the meeting. The underlying assumption is that the chance to generate a good solution increases with the number of ideas generated (van der Lugt 2007).

To obtain an overview of the outcome of both meetings the ideas were identified and categorised according to the issues addressed (see Table 3). In meeting E1, 47 ideas were generated compared with 46 ideas in meeting E2.

Table 3. Distribution of ideas

E1		**E2**	
Issue	**Number**	**Issue**	**Number**
print head angle	16	user interface	9
overheating	3	features	10
overpressuring	22	control	11
smooth running over contours	6	electronics architecture	9
contact to paper (wobbly arm)	2	energy	7
other	1	other	2
Total	**47**	**Total**	**46**

Although the total number of ideas in both meetings is nearly identical, the idea generation rate during the synthesis events of meeting E2 is approximately 20% higher than the rate of meeting E1 (see Table 4, which also shows the design time and the *analysis* time.

A possible explanation is that the long initial *analysis* phase in meeting E2 increased the idea generation rate. A similar phenomenon was observed by Klaubert and Blessing (Klaubert and Blessing 1997).

Both brainstorming meetings lasted longer than the 45 minutes recommended in the literature (Cross 2000, Pahl and Beitz et al. 2007), without a diminishing flow of ideas.

Table 4. Idea generation rates

	Number of ideas	Design time (min)	Analysis time (min)	Synthesis time (min)	Idea generation rate [ideas/min (synthesis time)]
E1	47	93	13.3	60.5	0.78
E2	46	100	41.4	45.3	1.02

5.4 Boundary conditions

We analysed the boundary conditions “design time” and “subjects involved” as influencing factors relevant to our research. Due to the limitations of this study (see section 5.5) only few factors which belong to the boundary conditions could be analysed.

Design time
As mentioned in section 5.2, the design time for meeting E1 was 93 minutes and for meeting E2 100 minutes. An influence of the available design time as an explanation for the observed differences between meeting E1 and E2 can thus be rejected.

Subjects involved
Both meetings involved seven subjects, four of which participated in both meetings. The subjects had different backgrounds and contributions (see Table 5 – contributions of the group are joint contributions such as laughter). An emphasis of the people's backgrounds related to the topic (mechanical, electronical) could be observed.

In both meetings the role of the moderator (mod.) was allocated to the participant with a business consultant background.

Table 5. Participants of the meetings and the distribution of contributions as percentages of the total number of contributions in a particular meeting

Name	**Background**	**E1**	**E2**
Group		5%	2%
AJ	business consultant	26% mod.	
Tommy	electronics, business consultant	18%	32% mod.
Jack	mechanical engineer	14% spec.	12%
Sandra	ergonomics, usability	6%	9%
Rodney	industrial design student	4%	4%
Chad	mechanical engineer	7% spec.	
Todd	mechanical engineer	20% spec.	
Roman	electronics SW		9% spec.
Stuart	electronics		10% spec.
Patrick	electronics SW		22% spec.

(mod.): moderator; (spec.): specialist

Table 5 clearly shows that in both meetings the majority of contributions came from only few participants. The highest percentage of contributions came from the moderators of the meetings (E1: AJ, E2: Tommy). The contributions of the usability specialist and the industrial design student, who attended both meetings, were relatively small, with the contribution of the student being the smallest of all participants.

We could not observe a clear effect on the number of contributions of the fact that someone was a specialist in a meeting or not. For example, Jack, as a specialist for mechanical engineering, made nearly the same percentage of contributions in both meetings (14% in E1 vs. 12% in E2). The specialists Todd (E1) and Patrick (E2) attended only the meeting for which their background was relevant. Their contribution in that meeting was large. However, the other specialists who attended a particular meeting because of their background contributed far less.

Looking at the content of the contributions, it was found that in meeting E1 the distribution over the four event categories of the events of each participant showed a very similar pattern, irrespective of their total number of events or background (see Figure 8). For example, Tommy as a specialist for electronics produced a similar amount of solution events as each of the specialists for mechanical engineering.

In meeting E2, however, clear differences in the contribution of specific categories of events can be seen, depending on background. The majority of the events of Sandra and Rodney are application events. The difference for Sandra in meeting E2 compared to the group average can be explained by the fact that Sandra left the meeting after Tommy introduced the solution finding phase that focused on the issue of electronics architecture. Rodney stayed but contributed hardly anything after this point in the process. Interestingly, Sandra contributed with more events in this second meeting than in the first one, although she attended only 60% of the time. Rodney contributed in this same period only slightly fewer events than in the first meeting. A possible explanation is the type of process that followed from the DTD. The more open formulation of the DTD of E2 and the issues that were suggested led to discussions about applications rather than technical details. For a usability expert and industrial design student, considerations of application are central to their field of expertise. This does not take away their ability to contribute with solution events as shown for E1, in which their relative contributions were the same as the other participants.

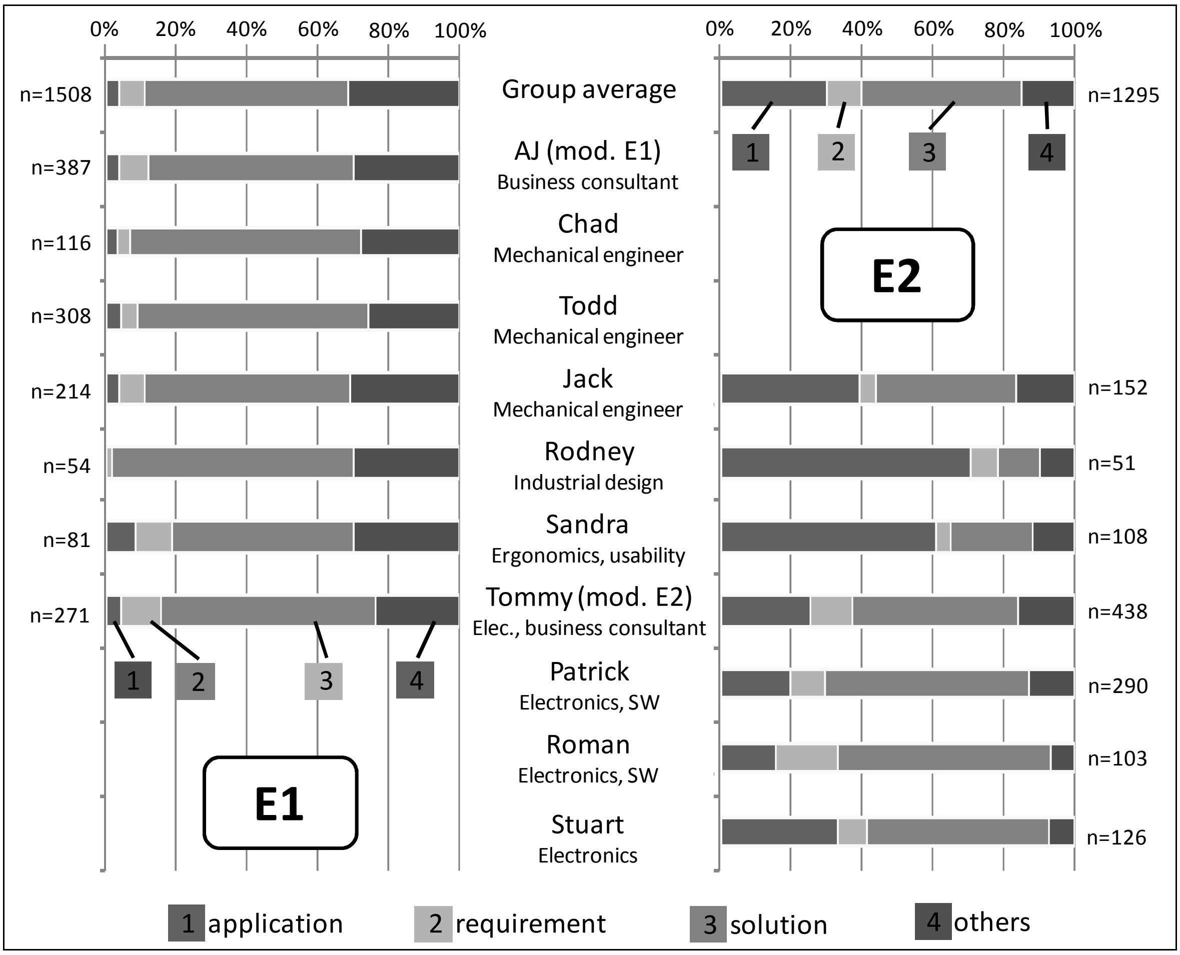

Figure 8. Relative frequencies of events

5.5 Limitations

Protocol analysis as a method of empirical design research can support a deeper understanding of design practice. However, the approach only allows the analysis of a relatively short period and therefore seldom covers a complete design process. The analysis method is detailed, but the view is therefore limited as only few aspects can be analysed.

The results of the comparison described in this paper have to be viewed in the light of the limitations inherent to the setup of the study and the analysis method. Several factors other than the difference in the DTD that could have influenced the process and the outcome could not be observed, e.g. the experience of the participants related to the topic, their motivation, previous work and work on the product outside the meetings, the appropriateness of the available time for solving the issues, and obviously what the participants were thinking while others were speaking. Furthermore, the fact that only two meetings could be observed limits the strength of the statements that we made.

Nevertheless, the study indicates an effect of the DTD on the process and its outcome, which is both plausible and for which corroborating evidence is found in literature.

6. Discussion

Hypothesis 1
The course of the process depends on the style of the DTD. Different behaviour in the task clarification stage of a process will affect the course of the overall process.

The DTDs from the observed idea generation meetings differed in style and granularity. The style of the DTD in meeting E1 is formal, using a list of short statements about the issues which should be addressed during the meeting. The informal style of the DTD in meeting E2 can be described as more questioning (see Figure 2 & 3).

The courses of the processes show a different pattern comparing the accumulated frequencies of events (see Figure 4 &5). During meeting E1 a continuous increment of events regarding *synthesis* (solution) and also *analysis* (application and requirements) occurred. Meeting E2 started with a long initial *analysis* phase which was led over by the moderator into a synthesis phase. In meeting E1 there was no such initial analysis for all issues. The issues were analysed consecutively with a following synthesis phase (see Figure 6).

We trace the long initial *analysis* in meeting E2 back to the more questioning style of the DTD.

Hypothesis 2
The number of ideas resulting from the process depends on the amount of time used for task clarification. An extensive analysis leads to more ideas for solving the task.

In meeting E1 (14%) relatively less time was spent on *analysis* than during meeting E2 (42%).

Using idea generation rate as an indication for the result of the meetings, we found that a preceding analysis phase lead to a higher idea generation rate (approximately 20% higher), but did not result in an increase of the total number of ideas in the meetings.

The observed higher idea generation rate in meeting E2 indicates a potential to enhance the outcome of idea generation meetings by optimising the amount of time spent on *analysis* regarding so as to provide an appropriate balance between *analysis* and *synthesis*.

Hypothesis 3
A longer analysis of the task supports the exploration of issues not mentioned in the DTD.

The *analysis* phase of meeting E2 was longer than in meeting E1. During meeting E2 one additional issue and 4 additional requirements were derived compared to meeting E1.

This is in accordance with the findings of Fricke (Fricke 1993), who states that an informal DTD avoids the impression of comprehensiveness of the DTD and promotes identification of additional requirements.

Based on the observed differences and literature it can be said that the combination of an informal questioning DTD with an adequate duration of the analysis phase supports the exploration of new issues.

The findings related to the boundary conditions do not relativise our discussion of the hypotheses regarding the course of the process and the outcome.

7. Conclusions

The main research question discussed in this paper was:

How does the style of the Design Task Description influence the course of the process and the outcome of idea generation meetings?

Our hypotheses specify the addressed relations between the DTD, the course of the process and the outcome. As observed, an informal style of the DTD leads to a longer analysis phase. This enhances the idea generation rate during a following synthesis phase.

Another observation is that a longer analysis phase supports the identification of additional issues and requirements which are not mentioned in the original DTD. The exploration of further issues may influence the outcome of idea generation meetings. Interestingly, this finding from our observation of a partial, but real engineering project in an industrial context, confirms the findings of Fricke, which were generated in a laboratory environment.

During the observed meetings the outcome measured by the total number of ideas did not differ. We did not recognise a diminishing flow of new ideas during the observed idea generation meetings. Further research should explore the relationship between the DTD and the outcome of ideation meetings such as brainstorming sessions. It would be interesting to compare outcomes in terms of the number of ideas when the amount of time used for *synthesis* was the same.

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