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Relating Argument to Design Problem Framing

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Abstract. Descriptive models of the design process have received increasing attention over the last few years. Recent work analysing design behaviour, using a notation based on Schön's model of design as 'reflective practice', has shown promise for gaining new insights into the team design process. However, the description of design as a reflective practice model is not without its problems, specifically concerning the reliable and replicable identification of frames. In this paper, a conversational-level approach, based on theories of argumentation, is outlined as a means to detect frames and frame shifts.

Keywords. design teams, reflective practice, argumentation, framing

Introduction

Our understanding of the design process has undergone a number of radical and more subtle shifts over the past thirty years. The view of designing as problem-solving and the design process as problem space exploration resulted in, among other things, a collection of design methods often set in the prescriptive contexts of a variety of essentially similar design process models. But there have always been alternative views. As long ago as 1970, Kunz and Rittel called for a new generation of design methods to deal with problems where the problem-setting is at least as important as the problem-solving.

Descriptive models of the design process have received much more attention in recent years. These try to account for the interplay of problem-setting and solving that we can see taking place in carefully observed design activity, for example the work presented at the Delft workshop (Cross et al, 1996) and the Istanbul Symposium (Akin et al, 1996). Recent work analysing design behaviour, using a notation based on Schön's model of design as 'reflective practice', has indicated that this representation can be successfully applied to gain new insights into the design process of both individual designers and design teams (Dorst, 1997). Furthermore, the action of framing and exploring the situation within the frame appears to be a powerful indicator of successful designing (Valkenburg and Dorst, 1998).

The Reflective Practice Design Model

A model of the design process organised around the notion of 'reflective practice' has received more and more research interest in recent years. The basis for such a model is as follows.

It is proposed (Schön, 1991) that individual designers selectively attend to the design environment in order to form a problem situation (naming and framing), develop a solution out of local experiments (moving) and evaluate the outcome of these local experiments (reflecting). Surprise at the outcome of these experiments allows the designer to surface his understanding of the situation and develop a new framing of the situation or new experiments. In this model, designers use frames as "structures of belief, perception and appreciation" (Schön and Rein, 1994, p.23), within which they construct a view of the problem and attempt to solve it. Emphasis is placed on a constructed, hermeneutical basis to design problem framing, taking place in a 'conversation with the situation'.

Although Schön's works refer mainly to individual designers, working in teams also caught his attention, albeit in the field of policy setting. He pays particular attention when a frame conflict is resolved by a frame shift, allowing policy controversies to be resolved. Since frames determine what evidence can be used, which claims can be made and which arguments hold in the context of values established through the frame, Schön struggled to find a rational basis for sharing common frames after a conflict has arisen. Even within shared frames, interpretations might differ; these he terms frame disputes. It is important to note that there are various levels of complexity of interaction. Firstly there is the individual interaction between designer and the object to be designed, the original focus of Schön's attention. Interaction increases in complexity in a team, when another level is added by the social process that sustains the communication with others. There is, in a sense, a design context and a social (negotiation) context (Strauss, 1978). In a team situation, a distinction needs to be made between individual team members' conversations with the situation and conversation within a 'designing system', the first resulting through frames and the latter through social communication which enables the use of frames.

Research Issues

The problems that face researchers in the reflective practice model are many-fold. We would like to highlight a few of these issues concerning the notion of frames that need attention to move our understanding forward.

First of all, it is important to notice that although Schön's account seems intuitively appealing, the definition of a frame is not at all formally presented. If we are interested in how frames are used, we need to ask questions about what a frame is and isn't, how we understand it and whether our understanding is becoming removed from Schön's original intention. Furthermore, we need to recognise the scale of a frame. On the one hand, there is the possibility that a shift in perspective becomes so minor that it no longer can be usefully seen as a frame shift, whilst on the other hand our notion of frame may be on too large a scale to provide any useful description of progression during the design process. At the moment, it is left to individual researchers to come to their own working interpretation of terminology until a consensus exists.

Secondly, as interest has grown to extend observations of reflective practice to design teams, we will need a description of frames which will allow us to analyse not only designers working individually, but also designers working together. Some steps in this direction have already been taken with the notation developed by Valkenburg and Dorst (1998). Moreover, when designers work in teams, we will need to distinguish between a shared frame which allows communication between the members and a personal frame of individual participants, especially taking into account the various levels of interaction outlined above.

This in turn leads us into the issue of reproducibility. A lack of formality and consensus in the definitions makes replicable analyses very difficult. Without common definitions and means to apply these definitions in the practice of observations, inter- or intra-coder reliability is sacrificed. One of the central issues that confront us is the identification of a frame. Can we find any reliable markers that allow us to tell when a frame starts or shifts? Whilst it may seem paradoxical to look for something that has no formal definition, it

may be the case that closer examination of design team interaction will help to clarify the phenomenon of frames and its instances.

Interaction in Design Teams

Our interest lies in studying the interaction within design teams at the conceptual design stage. We believe that the notion of framing offers a useful construct to describe and abstract what is going on when designers work together. Consequently, our focus is on developing means of identifying frames and investigate how frames get established in design teams, taking into account the unfolding nature of the design process (McDonnell, 1997).

Our data is primarily the verbal interaction between design team members. Clearly much of design is an intrinsically visual activity, which cannot be captured by relying on utterances alone. Sketching, and pointing to either sketches or physical objects, is not usually documented in a transcript. In our approach we are supplementing the verbal information with other contextual material, where necessary, to enrich the picture we are building. The rationale for looking at the conversational level of team interaction is that team members need to externalise in some way what they are thinking or doing to be able to design with others.

In the past, argumentation has been used as a window to look onto the design process. Trousse and Christiaans (1996) have suggested that design proceeds in a series of argumentative moves between designers sharing a discursive space. Brereton et al (1996) and Cross et al (1996) have also commented on the persuasion that can be observed throughout design team practice. Furthermore, Fleming (1997), observing student designers working together, noted that arguments were used to explain, predict, justify and warrant their artefacts. In an extension of this observation (Fleming, 1998), he highlighted the use of language in object-laden versus language-laden talk. Object-laden talk often involves pointing, indexing and naming, showing how language is constrained and enabled by the objects that are part of the design. In contrast, language-laden talk shows evidence of the use of, amongst others, argument, indicating language's independence from the object and dependence on values, community, etc. Further points to note are that talk is used to create, manipulate and revise an object throughout a conversation. An active role is taken by the project supervisor to train students in the use of argumentation.

The focus of these approaches has been to investigate the nature of problem-solving or social processes in a design team. In our case the focus is to investigate how rhetorical schemes can help us develop means of identifying frames and show how designing proceeds by shifting frames. In particular, we are interested in the role that argumentation plays in problem-framing in small design teams and how problem-framing informs the way designers justify their actions and use argument. To use argumentation to inform these concerns, we need a theory of argumentation that allows for the hermeneutical nature of reflective practice.

Narrowly conceived notions of argumentation are not recognisable as descriptions of what is going on during design conversations[1]. However, we suggest that a theory of argumentation that accounts for its everyday use (just as Wittgenstein's work accounts for language in its everyday use) can provide us with a fuller understanding of how team members interact. We now introduce such a theory, giving first a brief, and by no means complete, history of argumentation which provides its backdrop.

[1] An example of a practical consequence of this for us is that in our negotiations to observe design teams in professional practice situations we avoid the term altogether in explaining what our interests are.

Argumentation and its Relations to Frames

Argumentation Theory

Most of the origins of argumentation theory can be traced back to Aristotle, with his treatises on Analytic, Dialectic and Rhetoric. These are infused by the view that knowledge is only gained from existing knowledge and that arguments facilitate the inference of new knowledge from that which already exists.

Analytic argumentation concerns knowledge guaranteed to be absolutely certain and reliable. This is achieved through the use of syllogisms and the modes of formal logic. Generally accepted opinions are covered under *Dialectic* which describes the 'moves' (*topoi*) and the conduct of debates to argue for and against a standpoint by a proponent and opponent. Finally, *Rhetoric* is used by an orator to persuade an audience.

Historically, Dialectic and Rhetoric have been pushed to the background and taught in separation to the 'superior' art of Analytic. Furthermore, formal logic was used prescriptively in relation to argumentation as the way a rational argument was to be conducted.

Since the early part of this century, the dominance of formal logic as a normative representation of argument has been challenged. In dialectic theory, Toulmin (1958) has without a doubt been the most influential of the argumentation theorists outside the field itself. His main work was conceived to be a challenge to the dominance, until then, of formal logic. Rather than prescribing a formal logic form as the basis of our rationality, Toulmin draws our attention to the issue that rationality can be claimed for arguments sustained by reasons which do not follow rigid and context-free rules. Instead, he argues, validity depends on the soundness criteria applied within a certain *field of argument* (such as jurisdiction, medicine, arts, etc.).

More recently, interest in Rhetoric has been given a new impetus. Perelman and Olbrechts-Tyteca (1971) endeavoured to carry out an investigation which was not normative but instead provided a description of ordinary use of argumentation. Central to their work is Perelman's interest in values and value judgements around which social groups form. Criteria to evaluate arguments are therefore to be understood in terms of value judgements, rather than being reduced to 'rational' evaluation in the narrowly defined sense. By their opinions, beliefs and the values underlying them, an audience creates a context in which certain premises, also called points of departure, are valid. Perelman and Olbrechts-Tyteca provided a classification of argumentation schemes based on their observations. These argumentation schemes are used to persuade the audience to accept new items in addition to the points of departure.

Today, argumentation theory offers the potential to describe interaction in different ways. It is up to the researcher to choose a description which suits. We have chosen, the New Rhetoric (op. cit.), with other theoretical support (Crawshay-Williams, 1957; Freeman, 1991), as an appropriate basis to investigate the nature of problem framing, as we believe that the argumentation schemes offered by the New Rhetoric are ideally suited to describing reflective practice.

Problem Framing and its Relation to Argumentation

Frames exist not only the minds of individual designers but also need to be shared within a team (Schön and Rein, 1994). It has been suggested that 'intractable policy controversies' are due to frame conflict. By holding different frames that are not reconcilable, the members of a team bring differing interpretations to facts and what actions need to be taken. Similarly, Crawshay-Williams (1957) stressed that controversies arise when the group of people taking part in an argument do not in fact share the same context of statements or the context has shifted, resulting in individual members interpreting statements in these different contexts.

Contrary to dialectical theories of argumentation which are based on a two-person game between a proponent and opponent, the New Rhetoric allows us to view the design process as a social interaction of persuasion between an arguer and an audience. It should be noted that the role of arguer can switch between the individual members of the team, in effect creating a dual role of arguer/audience at one time. In the New Rhetoric, the argument that is employed is critically dependent on the shared background of the audience, therefore the arguer needs to be aware of the premises or 'points of departure' that the evaluating audience accepts as valid.

This shared background of premises is distinguished by Perelman and Olbrechts-Tyteca into the 'real' and the 'preferable'. **Real premises** are defined as **facts**, **truths** or **presumptions** held by the audience which are often axiomatically understood. **Preferable premises** are **values**, **value hierarchies** and **loci** (preferences of one abstraction over another, forming the basis of value hierarchies), which are used as guidelines to make choices and form opinions by both the audience and the arguer. This characterisation of shared background can be linked to the notion that frames set a boundary of attention and select what we treat as 'things' of the situation. Through shared points of departure, the way we perceive reality and see things is shaped. Hence, it is not possible to falsify a frame by reference to objective facts since is only the premises that the audience as a whole accepts which are counted as facts - "there are no objective observers" (Schön and Rein, 1994, p.30). Furthermore, the inclusion of values, value hierarchies and loci gives us the ability to consider the role of an appreciative system (Vickers, 1968) in the definition of a frame.

Frames also impose an order on a situation, allowing us to see and solve a problem. Translated into the notions of the New Rhetoric this means that starting from the shared premises that the audience accepts as a frame, the arguer can construct links to other concepts that she would like to have accepted by the audience. This rhetorical structure, an argumentation scheme, is called an **association**. By using this argumentation scheme, a chain of arguments can be constructed to persuade the audience towards the adoption of a solution. The connection of an already accepted concept to a concept that the arguer wishes to be accepted can occur by various means. One of these is by moulding the argument into a quasi-logical appearance. However, we have not concentrated on quasi-logical arguments as they are based only on form and pose, in effect, an anomaly in the argumentation schemes proposed by Perelman and Olbrechts-Tyteca. Of more importance, we feel, are **associations based on the structure of reality** and **associations to establish the structure of reality**.

Association based on the structure of reality tries to exploit the reality as constructed by the audience. This can occur, for example, by providing a causal or coexistential association between two already accepted facts, or by drawing an association between two concepts in a value hierarchy. Association to establish the structure of reality tries to draw a new link to a new claim. This is achieved by way of examples, analogy, metaphor or illustration, allowing the new claim to be established by drawing on accepted facts.

Another important notion in Schön's work is that of frame shift. The discernment of a dilemma of incompatible or inconsistent demands, where the perception of a misfit (Alexander, 1964) brings in new dimensions of the problem situation, triggers surprise in the designer. Surprise provides an opportunity to reflect and allows the designer's understanding to be examined, leading potentially to a shift of frame to resolve the incompatibilities. In the New Rhetoric coding scheme, we find an argumentation scheme that fits this characteristic. The argumentation scheme of **dissociation** is introduced to overcome an incompatibility by separating an established concept into new concepts. This must not however be understood as decomposition; rather, a dissociation is used to bring about a change in the conceptual data - the way we perceive things - that is used in the argument.

The notion of dissociation can also be understood as describing Schön's suggestion that generative metaphors, involving 'normative dualisms', are underlying frames. The definition of a dissociation stipulates that a distinction is created between the original concept, term I, and the new concept, term II. Furthermore, term II can only be understood *in comparison* with term I. Term II is constructed to allow the arguer to remove the incompatibilities that appear within term I. In effect, term II involves the establishment of a norm which may allow some parts of term I to be carried over.

The argumentation schemes of association and dissociation work in tandem. By introducing a dissociation we have created a new conception of reality and what we see as facts or values. Associations develop the new notion of reality, providing a chain of arguments that work with the recently dissociated concept and norms established through the dissociation. In terms of a process of argumentation this finds echoes in Freeman (1991). He puts forward the notion of 'gappiness' – to show that further arguments are only required when a gap of connection is perceived and added reasons to support a new concept are needed. This in turn implies that arguments are only needed when what we could call the intersubjective agreement of what constitutes the situation has not been reached.

It appears that definitions of frames in the sense of Schön and the concepts in the New Rhetoric are sufficiently close to allow us to use rhetorical structures as markers for *potential* frame shifts. We now provide a worked example to show the application of the coding scheme.

A Worked Example Using Argumentation

We have developed a coding scheme based on the New Rhetoric. Specifically, association based on the structure of reality (ABS in our coding scheme), association establishing the structure of reality (AES in or coding scheme) and dissociation (D in our coding scheme) are drawn out from the underlying theory.

It is suggested that an incompatibility sets up a potential for a frame shift, which is strengthened by the use of a dissociation. The dissociation is then developed and negotiated by association, working with the new concept and norms established through the separation of concepts.

In figure 1, we present an excerpt of a team design exercise, drawn from the Delft workshops (Cross et al, 1996). The exercise concerned the design of a backpack attachment to a mountain bike. At the point where the excerpt is taken, the team is working on finding a design that fits at the back of the bicycle, toying with a 'bag' idea on top of a rack which enables the backpack to be contained and cinched down. But although they have worked for almost forty minutes since the first time 'bag' was mentioned, one participant of the team notes an incompatibility and opens up the problem of what to do with the straps of the backpack (annotated by a 1 in figure 1).

This incompatibility is removed by a dissociation (annotation 2 in figure 1). In effect, the 'tray' concept and the 'bag' concept get separated from one another, drawing out the value of containing the straps of the backpack and establishing a norm which allows some elements of the 'bag' concept to be taken over. One of these elements, for example, is that the 'tray' concept would also solve the 'rooster tail' problem, when rain water picked up by the tyres splashes onto the bicyclist's back. This was something originally identified with the 'bag' concept, but is now incorporated into the new frame. Once the new concept is created, a negotiation ensues where the concept is developed and justified. This is achieved by the use of association, both based on the structure of reality and establishing the structure of reality (see annotation 3, fig.1).

During the negotiation another incompatibility is arrived at (annotation 4, fig.1). The concept 'tray' gets dissociated (annotation 5) to remove the incompatibility of a big backpack with the original concept, this time by the suggestion of a net-like construction. It can observed is that the proposer of the idea puts forward further grounds to strengthen his suggestion and a negotiation ensues which defines the boundaries under which the name 'tray' can be used in the team.

Transcript		New Rhetoric	Remarks
Ivan	we'll just call it that for now, er, bag, put it in a bag, we're gonna need some sort of thing to do something with those straps		1
Kerry	to get this out of the way		
John	yeah		
Ivan	yeah, either the		
John	so it's either a bag or maybe it's like a little vacuum formed tray kinda for it to sit in	D	2
Ivan	yeah, a tray, that's right, OK	AES	
John	'cos it would be nice, I think, I mean just from a positioning standpoint if we've got this frame outline and we know that they're gonna stick with that, you can vacuum form a a tray or a (inaudible)	ABS	
Ivan	right or even just a small part of the tray or I guess they have these		
Kerry	(inaudible) so something to dress this in		
John	yeah		
Ivan	or even just em		
John	maybe the tray could have plastic snap features in it, so you just like kkkkkk, snap your backpack down in it	AES	3
Ivan	mmmm, I was thinking of, er		
Kerry	snap in these rails	AES	
John	it's a multifunction part, huh		
Kerry	you just snap in these rails	AES	
John	yeah, snap the rails into the tray there	AES	
Kerry	mm mm		
Ivan	OK		
John	it takes care of the easy, it takes care of the rooster tail problem on your pack	ABS	
Ivan	uh uh, what if your bag were big, er, what if you're you're on,		4
	er, in this tray were not plastic but like a big net, you just sorta like pulled it around and zipped there, I dunno	D	5
John	maybe it could be part, maybe it could be a tray with a with a net and a drawstring on the top of it, I like that	AES	
Ivan	yeah, I mean, em	ABS	
John	that's a cool idea		
Ivan	a tray with sort of just hanging down net, you can pull it around and and zip it closed	AES	
John	(inaudible)		
Kerry	it could be like a a a window shade, so you can kinda, it sinks back in, so it just	AES	6
John	oh yeah	AES	
Ivan	it retracts yeah		
Kerry	you pull down, it retracts in	AES	
John	a retracting shade		
Ivan	right right	AES	
Kerry	so that that's not dragging in the spokes if you don't have anything attached	ABS	

Fig. 1 Except from Delft Design team exercise

In figure 1, we have shaded the areas between dissociations in differing shades to indicate where concepts are established and developed. This, however, is not to be taken as a linear process where previously gained information is discarded. Rather, as frame shifts are essentially hermeneutical, elements from previous concepts are be carried over and used to inform the design. This might be better understood in the light of shifts of focus, which are used in the interpretation of discourse processes (LeCoeuche et al, 1998).

We suggest that dissociations and ensuing associations can be used as rhetorical identifiers of potential frame shifts. An arising incompatibility sets up a potential for a frame shift, which is resolved by the introduction of a dissociation. At the same time, the dissociation introduces a new way of 'seeing' which is then developed and negotiated by association, working with the newly established concept and norms.

Conclusion

Reflective practice as a model of design is a relatively new area. We have highlighted that the lack of formal definitions and the resulting difficulties in reliable and replicable analysis present a problem in any research that tries to describe design within this model. Hence, our attention has been focussed on closer examination of design team interaction, in particular frame shifts, in the hope of clarifying the phenomenon of frames and its instances.

As a means of detecting frame shifts, the use of argumentative structures, based on the theory of the New Rhetoric, were introduced. Using the close relationship between the definitions of association and dissociation on one hand and the notion of frames and frame shifts on the other, we were able to demonstrate how a design team exercise can be coded and structured into episodes that show the development and negotiation of concepts.

To add to our understanding of the reflective practice model, we are in the process of gathering observations of real-life design practice. At a theoretical level, it is hoped that the analysis of design team practice will add to an understanding of the design process in a way which is distinct from the problem-solving view, showing design's intricate connection to language, specifically argumentation, and community. Furthermore, observation will also allow us to test and refine an argumentation-based approach to the identification of frame shifts. As an immediate move forward, however, it is hoped that this paper will contribute to a discussion that will lead to the formalisation of frames and frame shifts.

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