EXAMINING THE DISTRIBUTION OF FRAMING IN DESIGN COMMUNICATION

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Abstract. Previous studies have employed statistical methods to identify correlations and significant differences in design activities among different design environments by means of protocol analysis. In our recent papers using the same methods, we identified the occurrences of frames in different design collaboration settings and calculated the proportion of frames occurring. The results have confirmed that problem framing in design activities is not at a disadvantage in digital settings. In this paper, a graphical technique, linkograph, is used to investigate the distribution of different types of frames among different design settings based on the structure of framing activities.

1. Introduction

The concept of problem framing identified by Schön (1985) is a key step in solving wicked problems. When designers involve in such activities, they identify the problem they want to solve and use design information to tame the ‘wicked’ properties. Investigating these activities of framing in more detail, Minsky (1977b) identifies four types of frames, such as “syntactic frames”; “semantic frames”; “thematic frames” and “narrative frames”. A previous study conducted laboratory experiments in three settings (remote, digitally co-located and paper-based co-located), identified that textual supported distal design environments facilitated high-level framing better than co-located environments. The data extracted by statistical analysis of protocols showed that the total proportion of high-level frames in chat-line based remote settings is significantly higher than those in both co-located settings. These statistical reviews do not adequately inform us of the manner in which framing is engaged and whether there are any differences between chat line and verbal communication contexts. Developing earlier findings of significant differences between different frames among three settings, this paper investigates the incidences of those frames within the whole design session using the linkographic representation. The implication of those results will be discussed.
2. Classification of problem framing

Problem framing is the process of identifying and interpreting a design problem. It depends on the designer’s domain-related knowledge and capability of the organization of design knowledge. It is a representation of a problem, through which designers add related domain-specific and general constrains to the problem thus transforming it from an ill-defined to a well-defined problem, such that it can be solved. Minsky (1977b) proposes that a frame-system is the framework of knowledge representation. Frame system is the collection of related frames linked together. Different frames of a system share the same terminals, which are normally already filled with “default” assignments. During the transformation of from one frame to another, a matching process is evoked by placing tentative proposals (values) in the framed situation (terminal). If it fails, the designer has to seek other frames; in other words he has constructed another situation (or terminal). Goodman (1969) attributes depiction and description to pictorial and verbal language. Both concepts interact with each other and with perception and knowledge. According to the definition of Minsky’s four level frames, the depictive frames (figural-language) include syntactic and narrative frames, while the descriptive frames (conceptual-language) include semantic and thematic frames. In depictive frames, syntactic frames refer to colour or shapes of objects and narrative frames refer to story telling and objects imagined. In descriptive frames, the semantic refers to routine and repeated actions learned; and thematic frames refer to the actions changing the norm and value (applying learned information into new format). Thus, narrative and syntactic frames (depictive language) are more relevant with substantial knowledge; semantic and thematic frames with procedural knowledge. Table 1 shows the relation between these kinds of frames.

<table>
<thead>
<tr>
<th>Content</th>
<th>Minsky’s frames</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depiction</td>
<td>Syntactic frames</td>
<td><em>Repeating instructions from the design brief: We need to maximize opportunity for social exchange.</em></td>
</tr>
<tr>
<td></td>
<td>Narrative frames</td>
<td><em>Creating a scenario to fit ideas: So we can place many seats around here in order to have a more pleasant area. I think.</em></td>
</tr>
<tr>
<td>Description</td>
<td>Semantic frames</td>
<td><em>Directly addressing a problem: So the seats can be arranged such a way that face each other.</em></td>
</tr>
<tr>
<td></td>
<td>Thematic frames</td>
<td><em>Constructing contexts in the problem: And seats around here, so I think we have to connect to this one.</em></td>
</tr>
</tbody>
</table>
3. Design media

Designers adopt various design tools to help them engage in design thinking. The introduction of information and communication technologies provides new opportunities for designers. The components of design media are design tools, the humans who are using these tools, and the interactive process between humans and design tools supporting meaningful information carrier and transfer. As information carriers, design media provide different external representations, facilitating different cognitive actions (Zhang and Norman, 1994). Fischer and Ostwald (2003) propose that media can change the nature of learning and communication in designing. Bruner (1979) claims that successful learning and problem solving depend upon the quality and appropriateness of the representational system used. Several studies have been carried out to integrate the cognitive properties of design media with the nature of design process. Herber (1988) claims that sketching as a graphic means provides information from designers’ cognitive experience to aid the solution of the design problem. In a later study Kellett (1996) applies Zeisel’s design theory (1984) into digital design teaching and shows that the media is a powerful influence on design thinking. Different representations can trigger different types of cognition. Our previous studies employed statistical methods to analyze design protocol under different design environments and found that textural supported (chat-line based) remote design setting could support higher proportion of framing than other two co-located settings (digital and paper-based). Through further analysis of existing data this study explores the structure of different types of frames occurring during the design process using different media. This study postulates that there is significant difference in the distributions of different types of frames when using different design media.

4. Data analysis technique

Protocol studies adopted in this research have been recognized in the field of cognitive science and considered as a powerful means to study design thinking under different design environments. A more detailed description of this method was presented in our previous paper (Kvan and Gao, 2004). This section describes a technique called linkographic system, which we adopted to further the analysis of the existing data. We adapt this technique to illuminate the incidences of framing in design communication. The linkograph representation is a graphic system created by Goldschmidt to evaluate design productivity. By using the protocol analysis to examine an expert’s design process, Goldschmidt (1990) classifies three types of design moves and investigates the inter-relationship among those moves. These moves are inter-linked graphically by means of a triangular web. Once this systematic web is composed, we can compare the pattern of design moves in different design
environments. The concept of design moves in Goldschmidt’s term is more general. She classifies design moves as “a succession of acts of reasoning” in the process of architectural design. Framing, as one type of design moves, is more specific. We define several terms generated from this system. A component is the unit in which all design moves are inter-linked. A diameter means the number of the nodes linking two design moves in one component, thus the greater the diameter, the larger the component. By adopting this technique this study analyzes the interconnectivity of different frames.

5. Results and discussion

This study examines the occurrence of frames in the largest component of every design setting. Using this technique we identified the largest component in each setting. The largest component represents a consistent development of design activity in one session. It is the most effective and active part in a design process. Figure 1 shows an example of a largest component from a digital co-located setting. In this component, the total number of design activities is 38; the numbers of the syntactic, semantic, thematic and narrative frame are 3, 4, 3, and 1 respectively. Thus the proportion of description including semantic and thematic frames is 18.4% ((4+3)/38); while the proportion of depiction including syntactic and narrative is 10.5% ((3+1)/38). The proportion of high-level frames including thematic and narrative frames is 10.5% ((3+1)/38); while the proportion of low-level frames including syntactic and semantic frames is 18.4% ((3+4)/38). Table 3 describes the frequency and proportion of each frame in this component.

Figure 1. The largest component in a digital co-located setting.
TABLE 3. The frequency and proportion of different frames within the largest component

<table>
<thead>
<tr>
<th>Digital co-located setting</th>
<th>Syntactic Frame</th>
<th>Semantic Frame</th>
<th>Thematic Frame</th>
<th>Narrative Frame</th>
<th>Total number of Frame</th>
<th>Total number of design activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>11</td>
<td>38</td>
</tr>
<tr>
<td>Proportion</td>
<td>7.9%</td>
<td>10.5%</td>
<td>7.9%</td>
<td>2.6%</td>
<td>28.9%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Figure 2 represents the comparative occurrences of different frames across the three settings. It shows that remote settings better support description and depiction than both co-located settings. In the column of description, it also shows that digital co-located setting better supports the description of frame than paper-based co-located setting. In the remote settings subjects are required to communicate using chat-line. This format therefore could better facilitate descriptive activities. In both digital sessions, due to lack of experience using whiteboard as sketching tool, students prefer verbal and textual communication to identify what they are going to design before using digital sketching to develop their ideas rather than directly jumping into sketching exploration. This might explain why the proportion of description in both digital settings is higher than that in a paper-based format. However the proportion of depiction in the remote setting is also slightly higher than other two co-located settings. This phenomenon will be addressed in a future study. It is also shown that the proportion of high-level frames of the largest components in remote setting is higher than those in both co-located settings, which corresponds to our previous finding (Gao and Kvan, 2004). We found that in the whole design session the proportion of frames in digital co-located session was lower than other two settings. This is however not the case in this study. In this paper we examine the incidences of frame in the largest component of each setting. As mentioned above, the largest component is a design unit consisting of linked design activities. In both digital settings students prefer talking in face to face or talking by typing to drawing on shared whiteboard as perhaps they find it more difficulty to draw on whiteboard compared with on paper. Thus the linked design issues could occur in both digital settings. Through comparing the description and high-level columns of both figures, we find that chat-line based remote setting better facilitate the high-level description of frames (thematic) than verbal communication environments.
6. General discussion

The overall results demonstrate the potential of digital tools in enhancing high-level design cognition compared to paper-based tools. Thematic frames correspond to formal level of awareness. Minsky (1977a) defines thematic frames as “scenarios concerned with topics, activities, setting. Outstanding problems and strategies commonly connected with topics”. Thus when students produce this type of frames, they normally apply learned design knowledge to identify problems or strategies at an abstract conceptual stage with little relation to perceptual depiction. When they engage in these actions they can not only understand the design issue at hand; but can also theorize their learned knowledge that becomes their own knowledge. The above results and our previous studies demonstrate that a chat-line based communication environment can facilitate thematic frames much better than verbal communication environment, or in other words it could augment this type of human cognition (Fischer and Ostwald, 2003). Of course, the process of design is not only concerned with the conceptual ideas, but it might be facilitated in order to allow designers to spend more time on visualization (such as sketching and modeling) to experiment with those ideas. It is believed that only through engaging this visualization process, creation or distinct design actions can occur. In the framing process, visual perceptions are the activities of depiction such as syntactic and narrative frames. In a future study we will investigate the interaction between those frames in these components.

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References


