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UNDERSTANDING THE USE OF LANGUAGE STIMULI IN CONCEPT GENERATION

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ABSTRACT

Natural language, which is closely linked to thought and reasoning, has been recognized as important to the design process. However, there is little work specifically on understanding the use of language as design stimuli. This paper presents the results of an experiment where verbal protocols were used to elicit information on how designers used semantic stimuli presented as words related to the problem during concept generation. We examined stimulus use at the word level with respect to part-of-speech classes, e.g., verbs, nouns and noun modifiers, and also how stimuli syntactically relate to other words and phrases that represent ideas produced by the participant.

While all stimuli were provided in verb form, we found that participants often used stimuli in noun form, but that more new ideas were introduced while using stimuli as verbs and noun modifiers. Frequent use of stimuli in noun form appears to confirm that people tend to think in terms of objects. However, noun use of stimuli introduced fewer new ideas and therefore contributed less to concept formation in our study. This work highlights a possible gap between how people may tend to think, e.g., in terms of nouns, and how new ideas may be more frequently introduced e.g., through verbs and noun modifiers. Addressing this gap may enable development of a language-based concept generation support system to encourage innovative and creative solutions for engineering problems.

Keywords: Conceptual design, design stimuli, language, verbal protocols.

1 INTRODUCTION

Many researchers recognize that natural language plays important roles in conceptual design. Natural language can be used in requirement specification (Burg, 1997; Nuseibeh & Easterbrook, 2000), concept generation (Segers, 2004; Chiu & Shu, 2007a,b), design representation (Pahl & Beitz, 1996; Stone & Wood, 2000), design retrieval and reuse (Stone & Wood, 2000; Yang et al., 2005) and outcome analysis (Mabogunje & Leifer, 1997; Dong et al., 2003).

While natural language is not usually considered an engineering or design tool per se, language innateness in humans makes it difficult to avoid language in the study of the human designer. Language is highly structured and closely related to reasoning (Levinson, 1996; Li & Gleitman, 2002), which suggests that it may be possible to use language itself as a design tool. Within design, the relationship between language and thought in spatial reasoning and decision-making has been acknowledged (Gero et al., 1994; Dentsoras, 2005).

Conceptual design, being an early stage of the design process, is characterized by its lack of complete information and informal nature. Many of the outcomes rest on the designer's intuition and prior design experience (Li & Jin, 2006). Many conceptual design methods encourage designers to go with their "gut feelings" to expand the solution space, but do not attempt to tap into and guide the designer's thought processes.

Language may provide ideal stimuli for conceptual design. While language and words impose a structured and predetermined symbol system on the user (Bruner, 1964), the interpretation of words is still ambiguous and words are not always fixed to a particular form, which is ideal for conceptual