Proceedings of IDETC/CIE 2008
ASME 2008 International Design Engineering Technical Conferences &
Computers and Information in Engineering Conference
August 3-6, 2008, New York City, New York, USA

DETC2008-49372

EFFECTS OF DICHOTOMOUS LEXICAL STIMULI IN CONCEPT GENERATION

I. Chiu and L.H. Shu*
Department of Mechanical & Industrial Engineering
University of Toronto
5 King's College Road
Toronto, ON, M5S 3G8, Canada
*Corresponding author email: shu@mie.utoronto.ca

ABSTRACT

The relationship between language and reasoning motivates us to study the use of language within engineering design. This paper describes our continued investigation of language as stimuli for concept generation. Specifically we investigate dichotomous lexical stimuli that are related to the problem in either a disagreeing, incongruent manner or in an agreeing, congruent manner. This is a follow-up investigation where we extend previous experiments to include both congruent and incongruent stimuli to enable comparison of differences between designer behavior and concepts. A between-subjects think-aloud experiment was performed where participants were presented with a problem and asked to generate concepts to address the problem. Half the participants were provided with incongruent stimuli and the remaining were provided with congruent stimuli.

Participants provided with incongruent stimuli used the stimulus words as verbs more often than the participants provided with congruent stimuli. Verbs possess several properties desirable for use as design stimuli including the increased introduction of new lexicalized concepts to the concept generation process. When two independent raters scored the concepts, there was a positive correlation between the raters that concepts developed with incongruent stimuli were more novel. Understanding the effects of different lexical stimulus types on concept generation contributes to the development of design support tools that exploit the relationship between language and reasoning to increase design novelty.

Keywords: Concept generation, design stimuli, language, dichotomy.

1 INTRODUCTION

Design is challenging because it is ill structured and open-ended (Dym & Little, 2004). To add to the challenge, there is little support for designers in the early stages of design, and designers are often required to rely on experience and intuition (Li & Jin, 2006) rather than on reasoning processes. While there is disagreement on the exact relationship between language and cognitive functions important to design, many agree that there is a connection between language and reasoning (Levinson, 1996; Jackendoff, 1983; Pinker, 2007). While some argue that language influences thought, others maintain that language reflects thought. Regardless of the nature of the relationship, related work suggests that language can be used as a design tool. We have been investigating the use of language in the early stages of design, specifically as related stimuli for concept generation.

Our work focuses primarily on the use of verbs as stimuli, as verbs are the part-of-speech that can often be used to describe functions (Pahl & Beitz, 1996; Stone & Wood, 2000). We use lexical relationships to generate stimulus sets that are related to the problem. In the past, we studied the use of verb taxonomies as stimuli, investigating the use of related verbs that have more specific meaning, i.e., hyponyms, or more general meaning, i.e., hypernyms (Chiu & Shu, 2007b). In this paper, we investigate the effects of dichotomously related stimuli: stimuli that are incongruent with, or disagree with, the problem, and stimuli that are congruent with, or agree with, the given problem. For this investigation, we used think-aloud experiments where participants verbalize their thoughts as they complete the concept generation process.