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EXTENDING THE STRUCTURAL ALIGNMENT MODEL TO SIMILARITY JUDGEMENTS OF DESIGN CONCEPTS

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1. Introduction

Similarity is an important facet of many aspects of human behavior. Similarity has also been identified as an important factor in combinatorial design creativity, specifically analogical reasoning (Chan et al. 2011) and combination of pairs of stimuli (Nagai et al. 2009). Analogical transfer occurs via a cognitive process of structural alignment (Gentner & Markman 1997) and the same is assumed to be true in a design context. Conceptual combination and similarity judgements, however, are both thought to operate via two independent processes of structural alignment and scenario creation (Wisniewski 1997). A number of authors have proposed metrics for similarity in design, however none appear to be supported by human perceptions of similarity. Investigation of the role of similarity in the combination of design concepts requires an understanding of the cognitive mechanisms by which designers perceive similarity. Towards such an understanding, an experiment is conducted to test the applicability of structural alignment as a model of design concept similarity judgement.

2. Similarity and structural alignment

Two forms of similarity processing have been identified (Golonka & Estes 2009). The predominant form is feature-based similarity which results from the comparison of two mental representations and is described by the structural alignment model. Thematic similarity is an important secondary process whereby items are perceived to be similar because an individual relates them together in a 'scenario'. We focus solely on the former kind of processing here.

Perceptions of feature-based similarity are a function of the commonalities and differences between two concepts. The structural alignment model specifies how this works by distinguishing between (i) alignable differences and (ii) nonalignable differences. Alignable differences are related to a commonality shared by two concepts, whereas a nonalignable difference is unrelated to shared relational structure. For example, when comparing a train and a car, both are forms of transport (commonality), a car has four wheels while a train has many more, (alignable difference) and a train runs on tracks but a car does not (non alignable difference). The structural alignment model makes four key predictions; we report on the testing of three of these:

- H1: Similarity increases with commonalities and decreases with differences

- H2: Positive correlation between number of commonalities listed and number of alignable-differences listed

- H3: Participant's should list more alignable differences than nonalignable differences

If the perception of similarity of pairs of design concepts comes from featural similarity, then the above predictions should hold. Alternatively, some design concepts may be compatible with thematic processing and the above predictions may not hold.

3. Method and ongoing work

An experiment has been conducted involving 11 participants tasked with rating the similarity of pairs of design concepts and then listing either the commonalities or the differences of those pairs. Pairs of concepts were formed using early-stage conceptual design concepts created in a prior concept generation experiment. Concepts were paired according to the degree of commonality with regards to (i) need addressed, (ii) sub-need addressed, (iii) function, and (iv) means. Coding of the concepts and testing of the three stated hypotheses is ongoing.

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