Towards Precedent Based Design Foundations for Parametric Design Systems

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Parametric design systems serve as powerful assistive technologies in the design process by aiding the generation of a vast number of design alternatives. However, with their focus on low-level engineering and structural form, parametric systems do not automatically fulfil cognitively founded people-centred behavioural design criteria. We propose a precedent-based design approach for parametric systems that introduces people-centred criteria according to empirical behavioural evidence. As an example, we identify people-centred precedents for navigation design in large-scale buildings, and verify a number of them through perceptual data analysis based on cognitive vision theory and high-level semantic analysis of multimodal data as part of an empirical study conducted in two healthcare environments. As running examples, we present design constraints about visibility and the morphology of decision points in navigation routes, and an example of integrating precedents into parametric modelling.

1 A People-Centred Parametric Approach to Design

Parametric design is a well-established method in several engineering and manufacturing design domains such as architecture, product design, construction [Gun et al., 2010]. Decoupling *form* from physical *structure*, parametric and generative approaches offer the ability to rigorously explore many design alternatives and reveal new solutions during design problem-solving process [Rybczynski, 2013, Boucherie et al., 2012]. They are used to replace traditional shapes with eccentric morphologies and provide adaptability and flexibility in the design procedure [Boucherie et al., 2012]. The Trade Fair ceiling project (Fig. 1(a)) and the Walt Disney Concert Hall (Fig. 1(b)), are some examples of optimisation of the construction, while the Al Bahr Towers project, incorporates environmental variables dynamically into design process (Fig. 1(c)).

Whereas parametric design leads itself well to the manipulation of numerical, geometric features and relationships between object parameters (e.g. width, height, positions), it currently fails to integrate the dimension of human behaviour as a variable of morphological formulation. For instance, the geometric form of the London Aquatics Centre failed to take into consideration the dynamic performance of users and predict specifically a perception-related problem concerning visibility. According to reports, the curve of the roof obscure the view for a vast number of the audience (Fig. 1(d)). This experience,