

Appendix 3

Selected Publications Arising from this Research: Two Journal Papers and Four Conference/Workshop Papers

Designing Virtual Architecture: from Place to User-Centred Design

Gu, N. and Maher, M.L. (2002), Designing Virtual Architecture: from Place to User-Centred Design, *International Journal of Design Computing* (vol 4), <http://www.arch.usyd.edu.au/kcdc/journal>

The paper was published at the early stage of this research. By analysing the current state of designing virtual worlds the paper presents various directions that can be considered for developing this research.

- This paper reviews and analyses the conventional virtual worlds as place-centred virtual architecture because most virtual world examples are currently pre-defined to include various virtual places with persistent infrastructures. In these place-centred environments, changes can rarely be made to the worlds by the users during their interactions with the environments or with each other. The paper further proposes a different kind of virtual world that is user-centred and where the design of the virtual world reflects the changing needs of users in the world. This idea of virtual worlds being dynamically designed as needed is carried onto the later development of this research.
- This paper applies an agent-based approach to designing virtual worlds that are user-centred. The User-centred Virtual Architecture (UcVA) agent model developed and illustrated in this paper later becomes the base for developing the Generative Design Agent (GDA) model for this research.

Design Agents in Virtual Worlds: a User-centred Virtual Architecture Agent

Maher, M.L. and Gu, N. (2002), Design Agents in Virtual Worlds: a User-centred Virtual Architecture Agent, in J.S. Gero (ed), *Proceedings of the Workshop on Agents in Design*, MIT, Cambridge, MA, pp. 23-38.

This paper reports the further development of the UcVA agent model. The agent components and the reasoning processes of a UcVA agent are defined and illustrated. The application of the agent model for designing virtual worlds is described here using a design scenario. The technical implementation using a virtual world design platform and a rule-based scripting language is also discussed.

A Grammar for the Dynamic Design of Virtual Architecture Using Rational Agents

Gu, N. and Maher, M.L. (2003), A Grammar for the Dynamic Design of Virtual Architecture Using Rational Agents, *International Journal of Architectural Computing* 4(1), pp. 489-501.

This paper presents the design component of a UcVA agent supported by the application of a design grammar developed using the notion of the shape grammar formalism. The development of this research in year 2003 focused on the agent's design process, and various design formalisms were examined for designing virtual worlds. The main research outcome of the period was highlighted by adopting the shape grammar formalism for designing virtual worlds. In this paper, an example grammar is designed based on the analysis of an existing virtual world design, and the application of the example grammar for generating virtual world designs is demonstrated using a design scenario.

Situated Design of Virtual Worlds Using Rational Agents

Maher, M.L. and Gu, N. (2003), Situated Design of Virtual Worlds Using Rational Agents, *Proceedings of the 2nd International Conference on Entertainment Computing*, Carnegie-Mellon University, Pittsburgh.

Inspired by the notion of situatedness, this paper discusses how virtual worlds can be dynamically designed for different situations during their use, by applying a rational design agent model that includes a design grammar.

Generating Virtual Architecture with Style

Gu, N. and Maher, M.L. (2004), Generating Virtual Architecture with Style, *Proceedings of ANZAScA 2004*, University of Tasmania, Launceston, Australia, pp. 141-147.

Virtual world designs can inherit many visual and spatial qualities from the physical built environment, due to the use of the architectural metaphor. Going beyond this metaphor, virtual worlds also have unique characteristics that are different from their physical counterparts. This paper analyses the stylistic characterisations of virtual world designs in terms of visualisation, navigation and interaction. The findings of the paper contribute to the development of design formalisms for virtual worlds.

Based on the stylistic characterisations of virtual world designs presented in this paper, this research details and refines the design grammars developed earlier, and later develops the generative design grammars for dynamic designs of virtual worlds. Currently, each generative design grammar has four sets of design rules. By applying these four sets of rules virtual world designs can be generated, capturing certain stylistic characterisations in terms of visualisation, navigation and interaction.

Dynamic Designs of Virtual Worlds Using Generative Design Agents

Gu, N. and Maher, M.L. (2005), Dynamic Designs of Virtual Worlds Using Generative Design Agents, *Proceedings of CAAD Futures 2005*, pp. 239-248.

This paper presents a computational approach to dynamic designs of virtual worlds using rational design agents. The paper was published at the final stage of this research, and the content of the paper most closely reflects the final outcomes of the research. In the paper:

- The term Generative Design Agent (GDA) is first introduced. The GDA model is developed and illustrated. GDAs are introduced as personal design agents to virtual world occupants. As rational design agents, they are capable of reasoning about the virtual worlds, and dynamically design, implement and manipulate the worlds as needed, on behalf of the occupants.
- A GDA's design component is supported by the application of a generative design grammar. The main structure of a generative design grammar is defined, and each set of the design rules is elaborated and demonstrated using examples. This paper also starts drawing attention to the unique characteristics of generative design grammars that distinguish them from shape grammars.

By applying the GDA model, virtual worlds become a different kind of architecture that is dynamically designed as needed, for the "moment".