

# **Dynamic Designs of Virtual Worlds Using Generative Design Agents**

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## Acknowledgements

On many social occasions I tend to receive the same question from friends and other people I meet: “so, what are you doing in Sydney?” “I am doing a PhD”, I replied. My answer almost guaranteed another question that would follow: “oh ‘wow’, what is it about?” Initially, I was excited by having the opportunity to introduce my work to people outside the field. I immediately told them my thesis topic, and was willing to discuss my research interest about virtual worlds, my agent model and design grammar, using terms that had been carefully chosen, which I considered appealing to the general public. In fact, I had variations of answers for different occasions and audiences. However, it is rather strange, I discovered for most of the time that those variations seemed to have absolutely the same effect: people said “cool” and that concluded the conversation of my PhD, and we changed topics! I suppose I should have learnt that it is not a good idea to talk about agents and grammars over drinks and nibbles, but for quite a while I still persistently refined my answers, always hoping they would be better received next time. One day, I decided to give up. I finally came to realise that perhaps people are not interested... which I still consider highly unlikely, of course they care about ME and MY work. I think... mostly likely, that they encounter difficulty in understanding my work, which is not a bad indication after all, reflecting the level of seriousness of the research. This is a good reason and I like that.

Following the completion of this thesis, I find myself now sitting in front of my laptop writing acknowledgements, and I think of two groups of people, two groups of people who all care about my work. I am delighted! Unfortunately, I know one group must have some difficulties understanding it. If you think you are one of this group, never mind and just keep reading. As some people say, the acknowledgements may be the only part of the thesis that everyone will look at. Therefore, firstly I wish to use the next few paragraphs to thank the people from the other group, the ones who take time to understand my research and perhaps also have an interest in it, especially those who have helped and inspired the formation of this thesis. I feel that in a way we are very connected. The connection has drawn me closer to you, closer than ever. For the rest, who care so much about what I am doing, but may not have much of a clue about what I am really doing, like my parents, you may stop reading now, and you know I love you!

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## Abstract

This research aims at developing a different kind of virtual world that is dynamically designed and implemented as needed. Currently, most virtual world designs are considered static. Similar to the physical world, these worlds are pre-defined prior to their use. The resultant environments serve certain purposes but do not take into consideration possible changes to the purposes during their use, changes which often occur when the occupants interact with the environments and with each other. Virtual worlds as networked environments can be flexibly configured and programmed. This flexibility makes it possible to consider virtual world designs in terms of dynamics and autonomy, reflecting the changing needs of different moments.

To achieve dynamic designs of virtual worlds, this study applies a computational approach using rational design agents. A Generative Design Agent (GDA) model is developed that specifies computational processes for reasoning and designing in virtual worlds. The GDAs serve as personal design agents to the virtual world occupants. Design formalisms for virtual worlds are also addressed. The design component of a GDA is supported by the application of a generative design grammar. On one hand, generative design grammars serve as the generative force to be applied by the GDAs for virtual world design automation. On the other hand, each grammar defines coherent stylistic characterisations shared by the virtual world designs it generates.

The technical outcomes of the research consist of the GDA model and a generative design grammar framework. The framework provides guidelines and strategies to designers for developing generative design grammars that produce different design languages for virtual worlds, rather than predefine every detail of all possible virtual world designs. GDAs monitor the virtual worlds and the various activities that occur in the worlds, interpret the occupants' needs in the virtual worlds and the state of the worlds based on these observations, hypothesise design goals in order to satisfy these needs, and finally apply generative design grammars to provide virtual world designs for the moment, or initiate other actions in the worlds, according to the current design goals, on behalf of the occupants.

The development of the GDA model and the generative design grammar framework provides new perspectives for understanding and developing virtual worlds. The GDA model challenges the conventional way that virtual worlds are designed and implemented, and this leads to dynamic designs of virtual worlds. The generative design grammar framework provides a computational approach to formally defining design languages for virtual worlds.

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