Title
A Soar model of human video-game players

Journal
Proceedings of the Annual Meeting of the Cognitive Science Society, 23(23)

ISSN
1069-7977

Authors
Ogasawara, Hidemi
Ohno, Takehiko

Publication Date
2001

Peer reviewed

A Soar model of human video-game players

Hidemi Ogasawara (hidemi@sccs.chukyo-u.ac.jp)
School of Computer and Cognitive Science, Chukyo University; 101 Tokodate, Kaidu-cho
Toyota, Aichi 470-0393 Japan

Takehiko Ohno (takehiko@brl.ntt.co.jp)
Communication Science Laboratories, NTT; 3-1 Morinosato, Wakamiya
Atsugi, Kanagawa 243-0198 Japan

Introduction

The real world environment around humans is mostly dynamic. Choosing a video-game "Pac-Man" as a representative of the dynamic situation typical of everyday life, we have explored players' behavior through psychological experiments and a case study (Ogasawara & Ohno, 1999). "Pac-Man" is a game where a player controls a character called Pac-Man to eat dots on a maze while escaping from four enemies called ghosts which chase Pac-Man. Also, under some specific conditions, Pac-Man can kill ghosts to get extra points.

In this presentation, we discuss a computational model of the player implemented in the Soar architecture. To model the real time task performance, we extended the Soar architecture by adding perceptual and motor processors, and by synchronizing both the game progress and I/O processor with the cycles of the model. In the following section, we explain our Soar extensions and a player model on the extended Soar architecture.

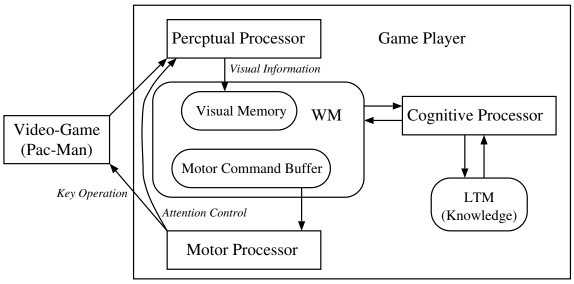

Figure 1: Diagram of the Model

Model

The Soar-8 architecture is the base of our model. The perceptual (input) and motor (output) processors are added to interact with the game (Fig. 1). The basic concept of the architecture is similar to another extended Soar architecture, NOVA (Wiesmeyer, 1992), with a few differences in visual information representation and a synchronization method.

The perceptual processor generates visual information in the working memory (WM). The visual information of the game is represented by relations between static objects (e.g., "road", "corner", etc...), dynamic objects ("Pac-Man", "ghost", etc...), and their state. Some meta-representations like "sequence of dots" are also included in the visual information. The quality of visual information differs between the attended area and the unattended area. This attention mechanism is modeled by controlling "focus" through the motor processor, and by obscuring some relations, like connection information between "roads" and "corners", in the peripheral area.

Synchronization between the game and the model is based on the "decision cycle" of Soar, which is estimated about 100 ms (Newell, 1990). Also, the delay for perceptual and motor processing is implemented by delaying transfer between WM and the processors for one decision cycle.

We test this extended architecture with a player model that uses keystroke level operators and attention control operators directly. The model is based on an "escaping from enemies" strategy that is effective for many action-type video-games. This naive model "looks at" Pac-Man, and attempts to chase dots and avoid ghosts. Our human player data shows that novices mainly depend on this strategy and look at Pac-Man more often than experts do. Though we have not examined its behavior with the human players' data closely, this model earns about the same points as novices do. We will construct another model grounded on our extended GOMS analysis (Ohno & Ogasawara, 1999) of a human player's data.

References

Newell, A. (1990). *Unified Theories of Cognition*. Harvard University Press, Cambridge, Massachusetts.

Ogasawara, H.,& Ohno, T. (1999). Expertise process of human video-game players. In *Proceedings of ICCS/JCSS99*, pages 388–393.

Ohno, T., & Ogasawara, H. (1999). Information acquisition model of the highly interactive tasks. In *Proceedings of ICCS/JCSS99*, pages 288–293.

Wiesmeyer, M. D. (1992). *An Operator-based Model of Human Covert visual Attention*. PhD thesis, University of Michigan.