



We are exploring possibility of using computer design agents that can perform in a manner loosely resembling that of human designers, and conform their performance to the participants in a brainstorming session during a design process. Key words: CAAD, design methodology, subjective evaluation

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1. Brainstorming

Creative design process is comprised of 1) Fact-finding (problem definition), 2) Idea-finding, and 3) Solution finding. "Brainstorming" is a creative conference which purpose is to produce a quantity of ideas that can serve as leads to development of possible design alternatives. All ideas are accepted and evaluated later. The basis for idea-finding is "association of ideas" ([Osborn 1963](#)).

2. Computer Agents

An agent as a "system that tries to fulfill a set of goals in a complex, dynamic environment. An agent is called autonomous if it decides how to relate its (sensor) data to (motor) commands in such a way that its goals are attended successfully ... adaptive if it is able to improve over time..." Software agents inhabit the "cyberspace" environments consisting of computers and networks. "Synthetic actors" are software agents that inhabit simulated physical environments in a computer-animated world ([Maes 1994](#)). Our "computer" agents are software agents.

3. Design Agents

Design agents perform one or more elementary design processes needed to accomplish a design task. The result of their action is the transformation of the model of the object being designed. Each resulting model state may be considered as a (temporary) design solution. Design agents may be computer agents and humans. The set of design agents developed at the IMS Institute allow the design of individual houses built in the IMS system ([Petrovic 1994](#)).

4. Design Agents with Personality

Computer design agents may perform the technical tasks but their most intricate use is to simulate human designers and exhibit such as having 'personality', 'character', 'motivation' and the like ([Rousseau et al. 1996](#)). By the same token, we may assume that different personalities (people) shall also have the different world outlooks, value systems, etc.

5. Collaboration and Cooperation of Agents

The collaboration of software agents - synthetic actors has been applied in virtual environments (e.g.: in architecture, [Engeli et al. 1995](#), in improvisational theater [Hayes-Roth et al. 1995](#), in entertainment [Maes 1995](#)). The collaboration of agents depends on the language of communication and use of the language in their 'roles' within a 'scenario'. A brainstorming session can be performed with various sets of 'actors' and scenarios.

6. The Brainstorming Participants: PDP-AAM

PDP-AAM is a semi-autonomous, adaptive computer design agent that associates visually represented 3D object with the verbal description of the object ([Svetel 1993](#)). It is comprised of two feed-forward neural networks, that simulate the bi-directional association. The neural net mechanism is based on the back-propagation algorithm ([Rumelhart et al. 1986](#)). The programme "learns" the examples and generalises its experience ([Figures 1 and 2](#)). It can answer the typical queries: What is the semantic differential of this building? and What is the building that is associated with the given semantic differential? In cases when the buildings or semantic differentials are new to the program, the neural net shall nevertheless produce the answers ([Figure 3](#)).

7. Brainstorming Session Roles and 'Scenarios'

The elementary action in the brainstorming session consists of an exchange between two agents, whereby one agents output becomes another agent's input and vice versa. At present, the session leader is a human participant, and the input/output procedures are not automated. The present work investigates the participation of more different participants and their engagement on the 'creative side' of design process ([Petrovic 1995, 1996](#)).

8. Finding Alternatives (and Variations)

This is the simplest design task that is achieved by changing and adapting various PDP-AAM parameters. This may involve: (a) system parameters (adjusting weights, and other tolerances), (b) 2D and 3D input parameters (plan and roof shapes), and (c) semantic differential input parameters (assessment of scale values of verbal cues). Expectedly, the computer design agents brainstorming produces a quantity of alternatives of a given theme in an effective way ([Figure 4](#)).

9. Changing Attitudes and Perceptions During Design Process

PDP-AAM allows "invention a new conceptual system that introduces perceptions that cannot form part of existing perceptual world" ([Feyerabend 1975](#)) either by changing some or all the verbal cues of the semantic differential, changing 'designers personalities' (participation of different people), or both. We endorse that meanings in design are obtained through a social process of ever-lasting dialogs and continuous categorisations and generalisations ([Winograd et al. 1985](#)). Design participation here is a natural process ([Figure 5](#)). Also, the introduction of computer-assisted of qualitative assessment of possible designs now becomes nearer to practical applications.

10. Computer-Aided Passionate Search for New Designs

In creative design, the playful activity is an essential prerequisite of preparation for 'creative jumps.' Computer design agents PDP-AAM and human beings in 'full contact' may do it simply, by random generation of alternatives (Figures 6), or more complicatedly, by an involved process of sudden changes of directions, introduction of unexpected parameters and the like. It is interesting to note that the present trials have shown that the results depend on the human participant's emotional involvement. As if these searches depended on ... as Kirkegaard says about scientists ... a vague urge, a passion? A passion for CAAD? Perhaps this might prove to be one of the needed links between CAAD and architectural practice in future.

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