Lovely Title for My SMC04 Workshop Paper

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The Agent Chameleon project[1] introduced the concept of an intelligent and autonomous agent that is able to seamlessly migrate between different information spaces. This agent therefore migrates easily between the virtual and the physical.

This capability serves as a strong basis for the agent to be highly adaptive to any tasks, as well as to be adaptive to the specific needs of its user.

Whereas Green et al.[2] limited the power of agent-user interfaces to modifying "their behaviour to maximise the productivity of the current user's interaction with the system", we introduce a new dimension of adaptivity by modifying the system itself.

I. 3D Interactive Worlds

With the advent of programming languages that support the generation of 3D graphics, a large variety of 3D worlds arose. This includes games[3], as well as scientific applications like the ECHOS system[4], interactive chat rooms like the activeworlds project[5], CAD systems and other visualisation tools.

Within 3D games or chat rooms users are given several alternative views on the world, i.e. a top view, a first person view, a map of the complete environment, etc. This is to ensure that users get familiar with the presented world and to facilitate their navigation within the environment. It is certainly desirable that users experience a sense of presence and immerse in order to enjoy being in this specific environment. This will lead users to revisiting this particular chat room or to keep on playing a certain game.

A major drawback to a split view approach is that users are forced to focus on more than one window at a time or to constantly switch their attention to different views of the world. This might confuse especially inexperienced users and users that are yet unfamiliar with the environment, which in turn, works against the desired sense of presence.

Finding mechanisms to facilitate navigation within these worlds has hence been a steady effort within various research groups. [references to various research groups still to be included]

Within the ECHOS system for instance, an intelligent agent is used to monitor users' motions within the 3D environment. The agent then applies techniques such as Bayesian networks on the data set in order to characterise a user's trail. Once the user's trail is characterised guidance through the system is offered according to the user's needs[6].

The final achievement of this work is a rich set of guidelines for the design of 3D worlds, which includes a high level of adaptivity for the environment at the design stage of the its creation[7].

Within the Agent Chameleon project we adopt this idea of tracking a user's motion within the 3D environment by an intelligent and autonomous agent. We use this data to generate a measure upon which the Agent Chameleon will determine weather the user needs help.

We apply a masking approach in order to generate a value of the user's performance within the environment. Such an approach was introduced by Foster et.al. [8] to recognise gait patterns in extracted silhouettes of movement sequences.

An area-based approach is a light-weight method in order to classify different areas within the environment. It can therefore easily be applied online by the Agent Chameleon to monitor the user's performance, as the computational costs are relatively low.

II. An Agent Chameleon's 3D World

Figure 1 illustrates the 3D world used within the Agent Chameleon project in order to run several system adaptivity experiments. It consists of a rectangular grid, where several objects like pyramids and trees are places upon. The Earth in the middle of the environment is the only orientation help users face when entering the world.

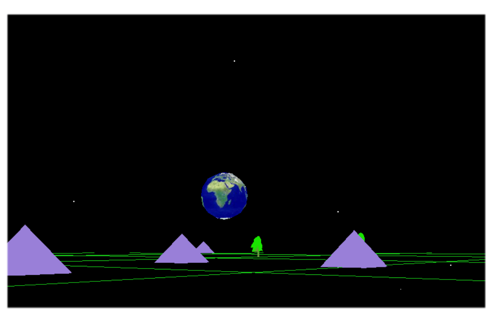

Fig. 1. An Agent Chameleon World

Users navigate within the environment by using the arrow keys on a keyboard.

The given task within at the first experiment is to find a small, pink diamond shape. The object itself is not explicitly hidden. Therefore, one might believe, that the task to find this pink shape is rather trivial and should not take long. But the experiment has proven, that due to the complete lack of orientation information, users tend to move hectically and too quickly. They tend to pass by the target object several times without even realising this.

III. Masking the User's Trajectory

We apply an area-based mask onto the trajectory image. A mask filters certain information about the user's movements.

We assess the user's performance and efficiency within each area. By generating the ratio between these two values, the agent knows when to interfere and to adjust the system.

Figures 2 and 3 present the illustration of a user's trajectory while fulfilling the task. Both subjects achieve the goal to find the pink shape, but are not equally efficient.

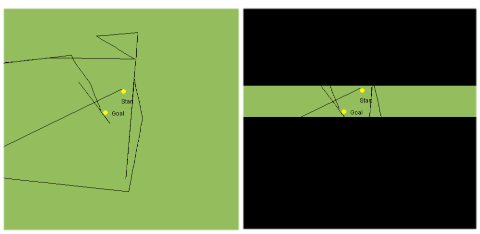

Fig. 2. Graphical presentation of a mediocre performance

The green area represents the grid area on the world. The right side of the image represents the masked information.

The user in figure 2 has had some initial problems at the start of the task, but found the target object eventually.

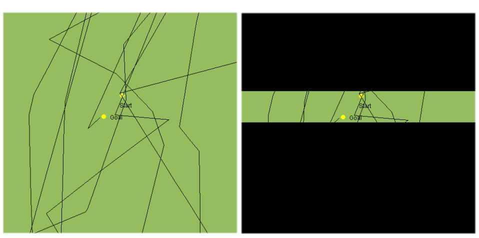

Fig. 3. Graphical presentation of a low performance

The user in figure 3 has had difficulties moving within the environment. After walking past the borders of the grid several times, this user tries to systematically explore the environment by walking from one end to the other in parallel lines. Due to the fact that this user is walking too fast, he passes by the target object several times without recognising it.

These examples demonstrate users' performances within a certain 3D environment without any interference by the agent. The next step within the project is to accumulate the performance and efficiency value online and to adjust the environment accordingly.

Such adjustments can consist in the active change of the environment's presentation. New objects can be introduced or information about the direction can be incorporated. Another possible approach is to adjust the user's control device when moving through the world, i.e. adjusting the sensitivity of the arrow keys.

IV. Conclusion

The research presented here describes the concept of obtaining a reliable measure to determine a user's performance within a 3D world.

By not restraining the artificial system to constraints of the real world, where an environmental change underlies distinct restrictions, a deeper sense of presence can be achieved, even within a complicated or unfamiliar environment.

Acknowledgement

The Agent Chameleon project is a collaborative project undertaken by the Department of Computer Science, University College Dublin, and Media Lab Europe, Dublin. We gratefully acknowledge the financial support of the Higher Research Authority(HEA), Ireland.

References

[1] B. R. Duffy, G. M. P. O'Hare, A. N. Martin, J. F. Bradley, and B. Schön, "Agent chameleons: Moving minds," in *Proceedings of The IEEE Systems, Man & Cybernetics Workshop (UK & ROI Chapter)*, Reading, UK, September 2003.

[2] S. Green, L. Hurst, B. Nangle, D. P. Cunningham, F. Somers, and D. R. Evans, "Software agents: A review," Trinity College Dublin and Broadcom ireann Research Ltd., Tech. Rep., November 1997.

[3] "Counterstrike." [Online]. Available: http://www.counter-strike.net/

[4] A. Pasquarelli, G. M. P. O'Hare, and A. J. Murphy, "Echoes: Educational hypermed ia on-line system," in *Proceedings of IEEE MultiMedia Conference*, Firenze, Italy, June 1999.

[5] (January 1997) activeworlds. [Online]. Available: http://www.activeworlds.com/

[6] C. Sas, G. M. P. O'Hare, and R. Reilly, "A performance analysis of movement patterns," in *Proc. of International Conference on Computational Science, Workshop on Scientific Visualisation and Human-Machine Interaction in a Problem-Solving Environment*, Krakow, Poland, June 2004.

[7] C. Sas, "Individual differences in navigating and experiencing presence in virtual environments," Ph.D. dissertation, Department of Computer Science, National University of Ireland, Dublin, January 2004.

[8] J. P. Foster, M. S. Nixon, and A. P. Prugel-Bennet, "Recognising movement and gait by masking functions," in *Proceedings of Audio-Visual Biometric Person Authentication*, Halmstadt, Sweden, 2001.