Virtual or Real Pedestrian: Evaluating Avoidance Strategies in VR

Type d'offre : Master Recherche
Lieu de travail : Rennes, équipe MimeTIC
Thème de recherche : Perception, cognition, interaction
Projet : MIMETIC - http://www.irisa.fr/mimetic/
Responsables scientifiques : Ludovic Hoyet, Anne-Hélène Olivier, Julien Pettré

Subject

This internship is at the crossroad of several topics related to computer graphics, namely crowd simulation, perception of biological motions, biomechanics and perception in Virtual Reality. In particular, the goal is to explore how human walkers adapt their trajectories in ecological Virtual Reality situations compared to the same situations in the real world.

The MimeTIC team has a long history of studying human behaviours in order to create more natural virtual humans. In particular, several studies have been conducted in the past to understand the strategies developed by human walkers to avoid another individual [OMCP12,OMC+13], whose insights have been used to develop new crowd simulation models [POO+09]. Because of the complexity of studying such behaviours, experimental conditions are often simplified to interactions between two pedestrians [KWH+16], which leads to a general lack of knowledge about such behaviours in ecological situations. For this reason Virtual Reality seems to be a promising tool for exploring more complex situations in an experimentally controlled environment, e.g., involving large numbers or persons, or more natural situations. In particular, the technology was used to evaluate locomotion interfaces [OBCP14,OBKP17] (Fig. 1), as well as individual avoidance of groups [OBCP14]. However, it is well known that VR also creates other experimental limitations in comparison to the same real situations, as it can potentially affect our decisions and behaviours. It is particularly the case for instance when evaluating distances in virtual environments, which users tend to underestimate [SCTW05]. However, other more complex behaviours are also affected, such as users exhibiting different locomotion behaviours in the presence of real and virtual obstacles [FFW07,GRF+08,AOB+15].

Fig. 1. Left: real experimental situation where two individuals walking at a 90° angle have to avoid each other. Right: virtual experimental situation where a real participant has to avoid a virtual pedestrian in VR application [OBKP17].

For these reasons, we are interested in this internship in exploring how faithful avoidance strategies are when immersed in a VR context compared to the same real situations. The goal is to

replicate the experiments presented in Fig. 1, left, with both participants being immersed in the same virtual environment (VE). In contrary, previous experiments, using a VR Cave system (Fig. 1, left) or HMDs, typically involved one user walking in the VE and avoiding a virtual pedestrian. The originality of the work will be to immerse both participants in the same VE using a VR Head Mounted Display, while simultaneously displaying each participant's motions on a virtual character in real-time using an Xsens motion capture system. In particular, our goal is to explore the following questions:

1. When users are immersed in a VE and have to avoid another real user (represented through his/her virtual character), do they display the same avoidance strategies than in real situations?
2. When users are immersed in a VE and have to avoid another virtual character, can they determine if the character is a real user or a computer-controlled character. Do they present different avoidance strategies ?
3. When users are immersed in a VE and have to avoid both another real user and a virtual character, which character do they avoid in priority, and what information is used for deciding an avoidance strategy?

One of the question raised by this work is related to how using consumer-level HMD devices would influence participants' behaviours. Their usage typically introduces the question of one's representation in the VE (compared to CAVE systems where users see their own physical body), and of the amount of visual information available to participants as they provide a limited field of view. While experiments were conducted in the past using HMDs [FFW07,GRF+08], they used at that time systems with lower fields of view (usually 50°), and did not display self-motions. However, the goal here is to combine the use of a high quality HMD with real-time motion capture to display each participant's motions on a virtual character, which was demonstrated to be beneficial in VR situations, for instance on distance judgement [MCTB10].

Therefore, this internship involves:

- Developing an experimental framework to integrate two users sharing a VE, while wearing each an HTC Vive HMD and a real-time motion capture system (Xsens)
- Designing experimental protocols and scenarios to evaluate the questions above
- Participate in the analysis of the results to determine if different avoidance strategies are used in VR and real situations (using data from previous real experimental situations), and if participants use different cues to avoid real and virtual characters.

Environment

The candidate will work in the joined Inria / IRISA research centre located in Rennes. Inria (www.inria.fr) and IRISA (http://www.irisa.fr/) are amongst the leading research centres in Computer Sciences in France. The work will be supervised by members of the MimeTIC team, internationally recognised in the fields of Computer Graphics and Virtual Human Simulation, as well as by members of the Lagadic team, internationally recognised in the fields of Robotics and Computer Vision.

Requirements for candidacy

- C/C++/C# recommended
- Previous experience in Computer Graphics would be beneficial (e.g., with Unity)
- Interest in User Evaluations

Keywords and References

Crowd Simulation, Character Animation, Virtual Reality, Perception, User Experimentation

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Contacts

We are looking for motivated candidates, please send CV, motivation letter and any relevant material to: ludovic.hoyet@inria.fr, anne-helene.olivier@inria.fr and julien.pettre@inria.fr

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