Sense of presence when surrounded by virtual humans

USER STUDY THROUGH AN IMMERSIVE VOLLEYBALL GAME

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Defining Presence and Immersion

- Presence:
  - "*a state of consciousness, the (psychological) sense of being in the virtual environment*" [Slater 1997]
  - "*a psychological state in which virtual objects are experienced as actual objects in either sensory or nonsensory ways*" [Lee 2004]

- Immersion:
  - "*How a technology can deliver illusion of reality to the scenes of a human participant*" [Slater 1997]
  - Requires a matching between the participant's body movement and the information generated on displays in real time

Necessary conditions for presence

- The sensory motor loop:
  a consistent low latency sensorimotor loop between sensory data and proprioception.

- Statistical plausibility:
  images must be statistically plausible in relation to the probability distribution of images over natural scenes.

- Behaviour-response correlations:
  appropriate correlations between the state and behaviour of participants and responses within the environment.

  [Slater 2009]

- Involvement:
  "a psychological state experienced as a consequence of focusing one's energy and attention on a coherent set of stimuli or meaningfully related activities"

  [Witmer 1998]

Measuring Presence

Throughout participant's involvement

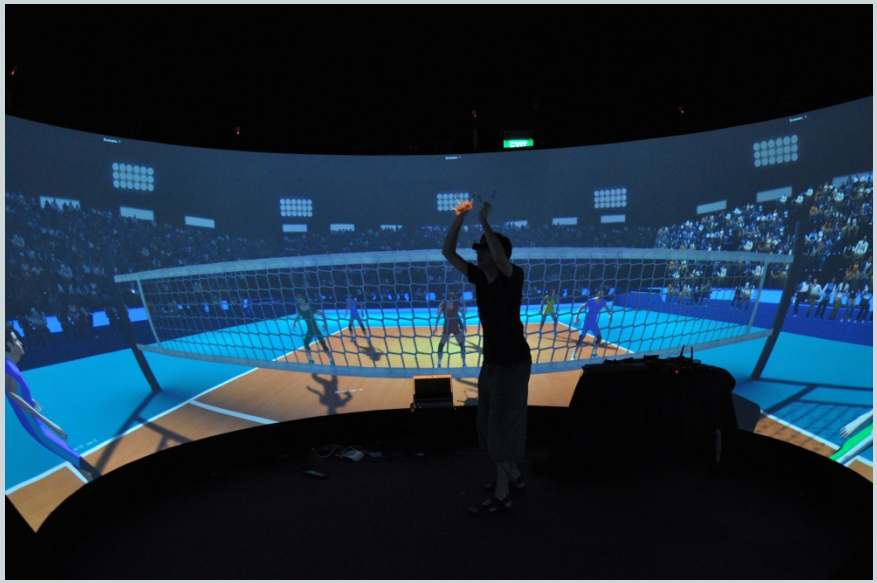
- Questionnaires
- Analyse participant's behaviour
- Analyse physiological measures
  - Electrocardiography or electrodermal activity
  - Requires dedicated equipment

Virtual Humans and Virtual Reality

- Virtual humans and presence
  - Show that virtual humans can modify the sense of presence throughout their behaviour or even only their presence [Zambaka2004, Garau2005]
  - Also studied in social phobia treatment [Krijn 2004, Grillon 2006]
- Collaboration with virtual humans
  - Virtual human mainly shows to the user what to do [Gerbaud 2007, Hanna 2012]
- Ball games in Virtual Reality
  - Racket games [Rusdorf 2007, Lee 2010]
  - Handball for goalkeeper training [Bideau 2003]

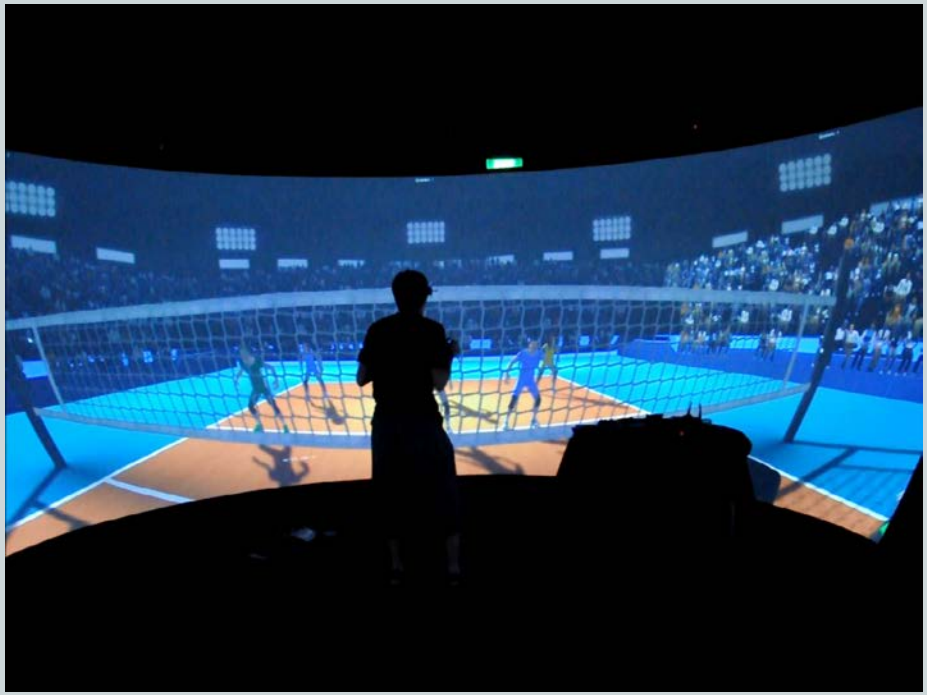
Research questions and motivation

- Does interacting with virtual humans when they are located on the side improve the user's sensation of presence?
- What is the impact of the field of view when interacting with surrounding virtual humans?



Experimental procedure – Task and Apparatus

- User plays a virtual volleyball game in an immersive environment (IMI Immersive Room)
  - Pass the ball to virtual humans according to the experimental conditions
- Tracking with motion capture:
  - Head to control de camera
  - Hands to interact with the ball
- Tactile feedback:
  - Provided inside the hand by a vibration device



Experimental procedure – Experimental conditions

- 4 Experimental conditions:

	3 screens/ 3 players	5 screens/ 6 players
Pass on the side	**Passes:** Right Left	**Passes:** Right Left Back right Back left
No pass – throw back	Team-mates on the side and no collaboration	Team-mates on the side and on the back but no collaboration

Experimental procedure – experimental plan

- Each participant participates to each condition
- Random order for each condition
- Questions were asked at the end of each achieved condition

Experimental procedure – Data collection

- 9 Participants so far
- Questionnaire:
  - General quality of the environmnet
  - Quality of interactions
  - Degree of involvement
- Behaviour analysis
  - Gesture/posture adaptation
  - No gazing when no pass to the team-mates

Limitations

- Interaction limitations

  Some participants had difficulties to throw the virtual ball as desired, particularly participants not familiar with Virtual Reality

- Breaks of presence
  - Mainly due to screens dimensions
    - The virtual ball was going over the screen
    - Height of pass performed by virtual humans needed to be reduced, as well as the height of the net
    - Ball comes fast and almost horizontally when coming from the side
    - Increase the difficulty of the interaction

First results

- No stronger involvement has been reported on the questionnaire when interacting with virtual humans located on the side (pass to team-mates)

  => Can be due to the limitations

  - Interactions issues -> participants mainly focused on the way to interact with the ball
  - Ball coming too fast from the side

    => increase the difficulty when interacting on the side

- Not following the ball when no interaction on the side => less involvement when no pass

- A statistical analysis is required to verify any improvement when also interacting on the side

Conclusion

- A user study about presence and virtual humans
- Impact on presence when interacting with virtual humans located on the side
- Analysis of results need to be continued
- More participants may be required

Future works

- Integration in Occulus Rift
  - Would remove the limitations regarding screen dimensions issues
- Improve the behaviour of the virtual humans
- Towards a tele-presence game for several players playing in different places