# Autonomous Positioning of Avatars at a Guided Virtual Educational Trip

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## Abstract
We describe a method to position avatars during a guided tour in a virtual environment. The method serves to assist participants by autonomously positioning their avatars on each stop of the virtual tour guide. Evidently the position of the agent that acts as a tour guide and the set up of the environment are key input, but also the engagement of the participants and possible social networks are taken into account. The method aims at a group setting that seems natural for a group of people attending a guided tour and may be used to position avatars in similar type of situations.

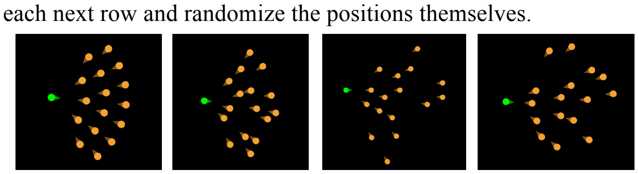
**Keywords:** affect, educational trip, engagement, navigation, virtual environment, positioning, social network.

## 1 Introduction
We created virtual environments in which a group of students is on a virtual educational trip where an autonomous agent provides an organized guided tour. For user comfort our system can help to reposition the students' avatars at each stage of the tour. The positions, assigned by the system each time the tour guide stops to continue his narrative, should be positions the students in nature might have headed for themselves: each participant's avatar should navigate towards a position that has a clear view on the tour guide, not hindered by obstacles and preferably related to the participant's engagement and social network.

## 2 Procedure for autonomous positioning
The procedure for autonomous positioning of avatars starts when the tour guide receives an instruction to navigate towards the next location in the tour. This procedure involves the following steps:

- Generate candidate positions;
- Assign positions to avatars;
- Initiate navigation.

Generated positions lie in front of the tour guide at a preferred interpersonal distance [Bailenson, 2003] on circular sections that span an angular range a human's gaze can reach comfortably. To avoid regularity we increase a chance of skipping positions for each next row and randomize the positions themselves.



a) b) c) d)

**Figure 1:** *Followers (orange) are positioned on a circular grid-like structure facing the tour guide (green). We avoid regularity a) by skipping positions b), randomizing positions c), or both d).*

A candidate position is checked for accessibility and visibility:

- it should be beyond a minimum distance to obstacles,
- there should be an uninterrupted path leading to it,
- there should be an unobstructed view on the tour guide.

If one of the checks fails the position is rejected and the chance of skipping positions is reduced (leading to a more compact setting).

When the space in front of the tour guide is too small to position all followers, we first fill positions that were skipped and if that is not enough we also fill the rest of the space around the tour guide. As before, based on accessibility and visibility checks, positions may be rejected. Nevertheless, potentially the entire virtual environment can be used to position followers.

**Figure 2:** *The method accounts for obstacles in the virtual space that block the line of sight (white) and the ones that are below the line of sight (grey). When the space in front of the tour guide is limited the algorithm positions followers around the tour guide.*

After sufficient positions have been generated, they are assigned to the avatars. We use two input parameters to assign positions on a human-like strategy, being social relations and engagement. Couples that we believe to have a social relation will be treated as one entity for placement: the partners of a couple will be assigned to adjacent places. Furthermore, the most engaged participants (as detected by the system) get the best upfront positions; the least engaged will be placed on more distant positions.

The last step in the procedure is to make the avatars navigate towards the position that has been assigned to them. For navigation in the virtual environment our system makes use of path planning and obstacle avoidance software based on Explicit Corridors [Geraerts, 2010]. The level of engagement influences walking speed and start of the navigation (highly engaged: high pace and quick start, not engaged: lower pace and later start).

## 3 Conclusion
We developed a method for autonomous positioning of avatars participating in a guided tour in a virtual environment. The method generates realistic positions with preferred interpersonal distance and unobstructed view on the tour guide. Avatars of more engaged participants get the best upfront positions and are made to move to these positions in a more enthusiastic way. Participants that made virtual personal contact are taken to be buddies of whom the avatars get a position next to each other. The method has been integrated in our tele-immersion system and was verified in field trials. Verification for large groups has been simulated and demonstrated its potential to fill up the entire virtual environment. The method may be appropriate for other situations where positioning of avatars relative to a location is needed.

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