Development of a Human-Agent Interaction System including Norm and Emotion in an Evacuation Situation (Student Abstract)

Ephraim Sinyabe Pagou[1], **Vivient Corneille Kamla**[1], **Igor Tchappi**[2], **Amro Najjar**[3]
[1] University of Ngaoundere, PO Box 454, Cameroon
[2] University of Luxembourg, 4365 Esch-sur-Alzette, Luxembourg
[3] Luxembourg Institute of Science and Technology, 4362 Esch-sur-Alzette, Luxembourg
ephraimpagou@gmail.com, vckamla@gmail.com, igor.tchappi@uni.lu, amro.najjar@uni.lu

Abstract

Agent-based modeling and simulation can provide a powerful test environment for crisis management scenarios. Human-agent interaction has limitations in representing norms issued by an agent to a human agent that has emotions. In this study, we present an approach to the interaction between a virtual normative agent and a human agent in an evacuation scenario. Through simulation comparisons, it is shown that the method used in this study can more fully simulate the real-life outcome of an emergency situation and also improves the authenticity of the agent interaction.

Introduction

Agents are increasingly able to work closely with humans in a variety of ways (Cila 2022). The norms operate on the behavior of a human (Frantz and Pigozzi 2018) as well as the emotions (Rodríguez and Ramos 2014). Moral norms play an essential role in the regulation of human interactions (Malle et al. 2015). However, human-agent interaction has not fully integrated the relationship between an agent that issues norms to a human agent possessing emotions and most normative agents do not take into account both private and social norms. In this study, a methodology for the interaction of an agent with a human is proposed, specifically in the domain of emergency evacuation planning in a building as a case model. The approach consists of two main components: a normative virtual agent, and a human agent. The model has been implemented under GAMA and includes several modules dedicated to emotions and norms. The GAMA simulation platform has its own modeling language called GAML which has proven to be easy to learn and implement for multi-agent modeling of GIS data as inputs. We measured the relevance of the model using an evacuation scenario, where in a first step the people in the simulation do not interact and in a second step the intervention of a normative virtual agent interacting with humans by combining behavioral data. These results highlight the importance of a human-computer interaction approach, as explicit and implicit perceptions and behaviors contribute to the success of the interaction.

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The Behavioral Human-Agent Interaction Approach

The behavioral architecture developed in this research is based on the cognitive agent architecture (Bratman 1991), the normative life cycle (Frantz and Pigozzi 2018) and the life cycle of emotional functioning (Rodríguez and Ramos 2014) applied in evacuation situation. The human agent can accept a norm, thus becoming an agent of execution of the norm itself. The agent's affective influences the process of deliberating the agent's intentions relative to the norms in the environment.

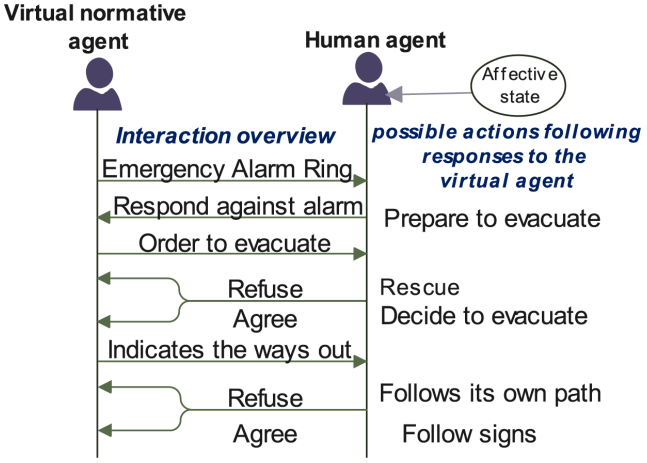

Figure 1: The scheme of the behavioral human-agent interaction approach

The first step to make the behavior of agents in decision making more similar to human behavior is to reason about the environment.

Experiment

The case study we propose to use as a basis for evaluating our model concerns the Station Night club fire in Rhode Island, U.S.A., which burned on February 20, 2003 (Grosshandler et al. 2005).

At the beginning of the simulation, all agents and variables are created and initialized. The initial number of

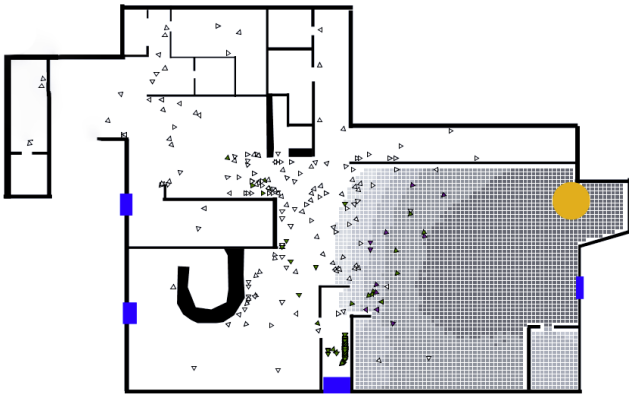

Figure 2: Trigerring the evacuation

clients is created, the social links are determined, based on real data (Grosshandler et al. 2005).

Scenario 1

We model the agents according to the blind obligation BDI control (Wooldridge 2009) with no interaction with the virtual normative agent. The agent first checks if the position is the same as the exit route. If it is, the agents stop. If not, the agents execute the walking plan.

Scenario 2

This scenario is based on the open minded commitment strategy (Wooldridge 2009) which means that the agent maintains his intentions as long as these intentions are also his desires. We include fear in the simulation and the virtual normative agent that transmits the *private norm of helping a friend*, *social norm of following directions*, *passing through a window* and *passing through the door of the platform* (which was exclusively reserved for staff and musicians (Grosshandler et al. 2005)) that can be complied or violated.

Results and Discussions

In the first scenario, 218 agents evacuate via the main exit, 240 agents are deceased and 209 agents are injured.The number of dead agents is higher than the actual case because these agents without fear effect and without interaction are ignited by the spread of smoke. In addition, evacuating agents mostly exit through the main door and do not force the north door window. In the second scenario, (figure 3) based on the open minded commitment strategy, especially at the beginning of the fire, the evacuee is still able to find the direction to evacuate because there is not much smoke. In this case, including the virtual normative agent with the interaction skills leads to a lower number of deceased agents. The results of this scenario have been rounded. In this case, human agents react differently since the virtual normative agent always plays a leading role, guiding the other agents to the nearest exit, reducing congestion at the main exit door and influencing the final evacuation time.

The results of the simulation are closer to the real event.

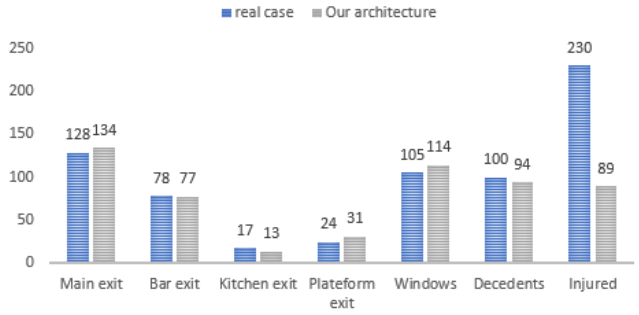

Figure 3: Comparison between the estimation of the real results and the calibrated results of our architecture

Conclusion

In this study, we argue that norms influence the interaction with a human agent. Taking into account private and social norms, we have proposed a model illustrating the interaction between a virtual agent and a human. The implementation of this approach is close to the outcome of a real event. In future work, we plan to extend the model by introducing execution mechanisms in a real environment and to perform tests with a physical robot capable of interacting with humans.

Acknowledgments

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