Sarah the Virtual Advisor to Reduce Study Stress

Demonstration[†]

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ABSTRACT

Understanding users could help Intelligent Virtual Agents (IVAs) to provide supportive tailored behaviours. To exhibit appropriate behaviours, the IVA needs to adapt based on features of the human that are important for the current context and the purpose of the agent. Towards creation of a user model that the agent can reason over and adapt accordingly, we have created the "Reduce Study Stress" scenario to identify possible relationships and rules based on personality, character preferences and the emotional state of the user. We measured preferences, helpfulness, rapport and emotional feeling and responses to some of the IVAs dialogue. We found differences in preferences and the emotional feeling reported by participants based on individual differences and groups.

CCS CONCEPTS

• **Computing methodologies** → Intelligent agents

KEYWORDS

Intelligent virtual agents; user modelling

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1 INTRODUCTION

Intelligent Virtual Agent (IVA)[1] technology has reached a level of sophistication that allows IVAs to exhibit congruent and socially plausible behaviours through having situation awareness [1], verbal and non-verbal communication skills and their own memories [2], personality [2], cultural norms [3] and emotion appraisal systems [4]. This state of the art has been achieved through a focus on IVA believability. We want to focus on the value delivered to the human through interaction with the IVA.

To build Intelligent Virtual Agents (IVAs) that improve the lives of humans based on the human's needs, IVAs will need to understand how their goals and plans can be adapted based on deep knowledge of the user including their preferences, beliefs, biases, psychological profiles, home context, friends and family, educational level, medical history, knowledge and skills. This will involve advanced user models that observe and utilize users' behaviour patterns, perhaps through big data analysis, and IVA cognitive architectures that reason over these user models to guide the IVA how to adapt. Towards this ambitious goal, we conducted an experiment using Sarah the virtual advisor who offered study tips to students. We measured their preferences and responses to Sarah to answer the research questions:

1) Does the users' gender, age, personality or psychological state effect their preferences and responses to IVAs?

2) Do these differences suggest variations in IVAs and how IVAs should adapt to their user?

2 SCENARIO & TECHNOLOGY USED

As our goal determines the relationship between individual responses to the IVA according to its intended role, we created a meaningful scenario for our population concerning "Reducing Study Stress". In previous work we identified that some individuals developed more rapport with our IVA that verbally expressed empathy, while others built more rapport with our IVA whose dialogue was neutral (i.e. without empathic cues). These differences depended on the intensity of the emotional state of the user. Thus, to explore this finding further, for this study we designed and developed two different virtual advisors (empathic/neutral) named Sarah to provide tips to students for reducing their study stress. The empathic Sarah exhibited empathic and social cues whereas the neutral advisor did not include empathic cues.

Sarah (Fig. 1), the virtual advisor was developed based on the FAtiMA agent architecture and the Unity3D game engine. We chose FAtiMA [5] because it is a cognitive agent architecture for creating autonomous, engaging and believable characters. Following better understanding of differences between cohorts of users, we aim to extend FAtiMA to include an explicit user model and rules and/or modules that will allow the IVA to make decisions regarding its behaviour that are tailored to that user.

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In our experimental scenario "Reducing Study Stress", after logging in, Sarah introduced herself and provided study tips in two rounds. We created two dialogues (scenario 1 and scenario 2), with two versions (empathic and neutral). The content of the dialogues was derived from the campus wellbeing and support service of our university, which included work, study and life balance, exercise and healthy eating, overcome exam stress and socialising tips. For consistency and comparison, these tips were structured into two documents and presented in the same order as in the dialogues to the control group. Using Fatima's state-based dialogue engine, interaction with Sarah involved her speaking via text boxes/speech bubbles and text-to-speech (TTS), with participant's responses through keyboard selection of options provided. To design Sarah's empathic dialogue we used the empathic cues identified from the literature [6].

Figure 1: Sarah, the virtual advisor

3 Evaluation

To address the research questions, we designed an experiment consisting of one within-subjects factor (empathic and neutral virtual advisor) and one between-subjects factor (different order of the experimental sequence), forming two experimental groups and one control group. The experiment was approved by the Macquarie University's Human Research Ethics Committee. A total number of 137 participants aged between 17-46 (99 females, 37 males, 1 didn't identify as either; mean age=20.03, SD=4.14) completed the experiment. 97.8% of participants were aged 17-30. Group 1 (empathic-neutral) had 36 participants (30 females, 6 males), Group 2 (neutral-empathic) had 37 participants (28 females, 9 males) and Group 3 (control group) had 64 participants (41 females, 37 males, 1 other).

As can be seen in Fig. 2, the change in stress levels is significantly larger for the agent treatments compared to the control. But since we used a crossover for the first two groups, we then separated the analysis into the two treatments (Empathetic and Neutral). To compare the score mean differences between the groups we performed mixed Anova test. Fig. 2 indicates that the variable group is an important factor.

The within subject test indicates that each interaction has a significant effect on the score, $F(2,136) = 28.07$, $p<0.005$, partial $\eta 2= 0.292$; in other words, the scores do change over time. Moreover, the interaction of score and group is statistically significant $F(4,136) = 6.47$, $p <0.005$, partial $\eta 2= 0.16$) which means that the scores are changing over time.

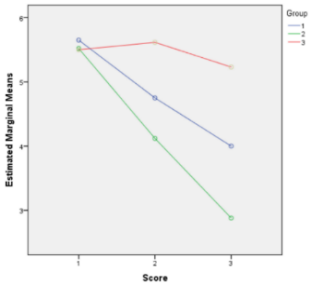

Figure 2: Stress score mean changes over the time

4 CONCLUSIONS

Our participants were fairly equally distributed across the categories within each personality dimension and there were no significant gender differences. This adds validity to our data, as personality is considered a fundamental individual trait, not restricted or connected to a particular gender or other individual factor. Moreover, our study found individual differences and suggest, for example, that IVAs dealing with emotionally unstable, or more neurotic individuals, may need to take into account possibly higher levels of stress and exhibit more empathic or other stress reducing behaviours. Neutral advisor was also beneficial for students. An adaptive IVA, based on the user's personality, character preferences and emotional state may need to show more empathic or neutral behaviours to minimise their stress level.

In answer to our first research question we did find some differences in preferences for and response to the IVAs based on the participants' gender, personality and psychological state. In answer to our second research which lead us to have the user model and tailored IVAs, we found more differences. Differences were found in preferences for characters and rapport established according to the individual's personality and emotional psychological state. For example, high levels of stress (reported via DASS21) showed significant differences regarding ethnicity preferences. However, there is no preferences for the character's ethnicity or similarity to the participants and most of the participants (74.5%) preferred an IVA of the same gender.

The FAtiMA model allows researchers to develop rules of user interaction in relation to the agents emotional state (which can be empathetic or otherwise), the state of the environment they are in and various social norms, values and rituals that can be designed to mimic various cultural protocols and human-human interaction styles [4, 7]. We intend to use datamining methods on the dataset from this study (and another dataset) to discover IVA preference rules based on participant features and whether the document, neutral or empathic delivery of study tips was most useful for certain combination of individual features.

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REFERENCES

[1] D. DeVault, R. Artstein, G. Benn, T. Dey, E. Fast, A. Gainer, K. Georgila, J. Gratch, A. Hartholt, M. Lhommet, G. Lucas, S. Marsella, F. Morbini, A. Nazarian, S. Scherer, G. Stratou, A. Suri, D. Traum, R. Wood, Y. Xu, A. Rizzo and L.-P. Morency. 2014. SimSensei kiosk: a virtual human interviewer for healthcare decision support. In *Proceedings of the Proceedings of the 2014 international conference on Autonomous agents and multi-agent systems* (Paris, France, 2014). International Foundation for Autonomous Agents and Multiagent Systems, p. 1061-1068.

[2] A. Cerekovic, O. Aran and D. Gatica-Perez. 2017. Rapport with virtual agents: What do human social cues and personality explain? *IEEE Transactions on Affective Computing*, 8, 3(2017),382-395.

[3] M. Y. Lim, J. Dias, R. Aylett and A. Paiva. 2008. *Improving adaptiveness in autonomous characters.* In: Prendinger H., Lester J., Ishizuka M. (eds) Intelligent Virtual Agents. IVA 2008. Lecture Notes in Computer Science, vol 5208. Springer, Berlin, Heidelberg.

[4] C. Kutay, S. Mascarenhas, A. Paiva and R. Prada. 2013. *Intercultural-role Plays for e-Learning using Emotive Agents.* In ICAART 2013 - Proceedings of the 5th International Conference on Agents and Artificial Intelligence, 2013, 2: 395 - 400.,

[5] J. Dias, S. Mascarenhas and A. Paiva. 2014. *Fatima modular: Towards an agent architecture with a generic appraisal framework.* In: Bosse T., Broekens J., Dias J., van der Zwaan J. (eds) Emotion Modeling. Lecture Notes in Computer Science, vol 8750. Springer, Cham.

[6] T. Bickmore, A. Gruber and R. Picard. 2005. Establishing the computer–patient working alliance in automated health behavior change interventions. *Patient education and counseling*, 59, 1(2005), 21-30.

[7] S. Mascarenhas, R. Prada, A. Paiva and G. J. Hofstede. 2013. *Social importance dynamics: A model for culturally-adaptive agents.* In: Aylett R., Krenn B., Pelachaud C., Shimodaira H. (eds) Intelligent Virtual Agents. IVA 2013. Lecture Notes in Computer Science, vol 8108. Springer, Berlin, Heidelberg.