An Operational Model of Joint Attention – Timing of the Initiate-Act in Interactions with a Virtual Human

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Joint attention has been identified as a foundational skill in human-human interaction. In our research, we use virtual humans to evaluate cognitive models, here, enabling them to egage in joint attention. This requires an operational model with precise information on natural gaze timing. We aim at substantiating our model of joint attention (Pfeiffer-Leßmann & Wachsmuth 2009) by studying human-agent interactions and present results on the timing of referential gaze during the initiation of joint attention.

Our operational model of joint attention covers four phases: initiate-act (1), respond-act (2), feedback phase (3), and focus-state (4). It is implemented in the cognitive architecture of our virtual agent Max. For the evaluation of the model in interaction with humans, investigations on timeframes, human expectations and insights on how humans actually perceive Max' behaviors are indispensable.

In the present study we focus on phase 1. We let the participants engage in joint attention with Max in an immersive virtual reality environment, which provides a highly controlled experimental setup. The experiment had two conditions: in one the participants took the role of the initiator, in the other Max was the initiator. We found that participants accepted the same kind of gaze patterns produced by Max using our model as natural as they themselves performed when they had the initiative. Thus, under both conditions we found a mean dwell time of 1.9s for the referential gaze act, which is compatible with related findings in human-human interaction.

The applicability of our human-agent approach to investigate cognitive modeling was confirmed in three ways. First, the participants attested a high level of presence both to themselves and to the agent. Second, there was no significant difference between produced and accepted timings in the two conditions. And third, the obtained results are compatible with those from literature. Thus Max appears to be accepted as an interaction partner. Motivated by the success of this approach, we will iteratively investigate further phases of our joint attention model.

References

Pfeiffer-Leßmann, N. & Wachsmuth, I. (2009). *Formalizing joint attention in cooperative interaction with a virtual human*. In Mertsching, B., Hund, M. & Aziz, Z.: KI 2009: Advances in Artificial Intelligence, Berlin: Springer, 540-547.