2024 I-RIM Conference
October 25-27, Rome, Italy
ISBN: 9788894580556
10.5281/zenodo.14731001

Emotions aware framework for intuitive interaction.

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***Abstract*—This research focuses on integrating goal-directed behavior in a Digital Human by incorporating psychological and cognitive factors such as personality dynamics, emotional responses, memory, anticipation of future actions, and associated hedonic experiences. The proposed architecture enables the Digital Human to exhibit personality-driven behaviors and internal reactions to other emotions, influencing the decision-making processes. The Digital Human can interact intuitively with humans by displaying varying degrees of emotional sensitivity and environmental proactivity based on its personality. The framework is tested in a user study involving participants in a dyadic conversation scenario where the Digital Human's behavior is influenced by its assigned personality. The results indicate that the Digital Human's personality is perceptible to humans, and the agent is recognized as having cognitive and emotional intelligence. This demonstrates the potential of the framework to bridge the gap between cognitive and psychological agents.**

***Index Terms*—Artificial personality; Digital Human; Personality-adaptive architecture; Emotions-aware architecture;**

I. Introduction

The study integrates personality, emotional intelligence, and cognitive capabilities into a framework tailored for a digital human. Personality is seen through patterns of thoughts, behaviors, and feelings [9], while emotional intelligence involves recognizing, articulating, and using emotions [1] for decision-making. The research implements an architecture that incorporates these elements, distinguishing itself from existing literature by proposing a taxonomy of artificial personality, modeling personality-influenced behaviors as universal across tasks and platforms [10], and introducing a prospective thinking mechanism [12]. The system allows the digital human to adjust its internal experiences based on personality traits and perceived emotions, enabling proactive decision-making. It also integrates prospection and episodic memory to predict emotional outcomes of actions, reinforcing behaviors that elicit specific emotional responses in users. To validate the framework, the digital human, embodying specific personality traits, engages in conversations with participants. The study measures how well these traits are perceived, whether the digital human is seen as having cognitive and emotional intelligence, and how its personality affects the social dimension.

II. Framework

Figure 1, presented in detail in research [11] depicts the task- and platform-independent architecture designed for

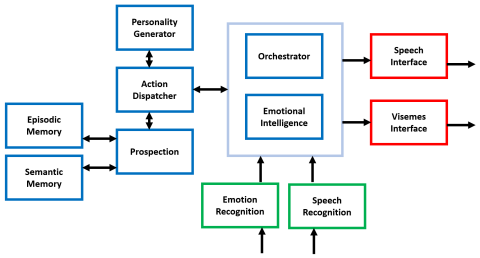

Fig. 1. Personality and Memory based software architecture for emotional intelligent agents. Three different modules can be identified: perception (green), reasoning (blue), and actions (red).

personality-based intuitive interaction tailored for a digital human involved in dyadic conversations (Figure 2). The perception components, in green, include Speech and Face Emotion Recognition. The core cognitive and psychological components, highlighted in blue, are based on the concept of artificial personality, represented as a vector within a three-dimensional space defined by Extroversion, Agreeableness, and Conscientiousness traits [10]. The Personality Generator, built upon this definition of personality, employs a BERT language model [8] to simulate personality-driven behaviors. Semantic Memory stores long-term, language-based descriptions of the world, while Episodic Memory captures past experiences and their outcomes. Prospection is an internal simulation that anticipates future actions by drawing on personality-dependent strategies and past experiences [12], [6]. The Action-Dispatcher coordinates cognitive components and manages information flow. It interacts with the Orchestrator, which manages user conversations, and the Emotional Intelligence module, which monitors the user's emotional state and triggers asynchronous actions, generating proactive behaviors. Finally, red blocks, are designed to generate a contextualized dialogue according to a set of information coming from the perception, cognitive, and psychological components [11].

III. Experimental set-up

The evaluation of the architecture is conducted through testing three key hypotheses:

- (I) The framework can generate distinguishable personality traits in a digital human.
- (II) The digital human is perceived as a cognitive system capable of planning actions and perceiving user emotions.

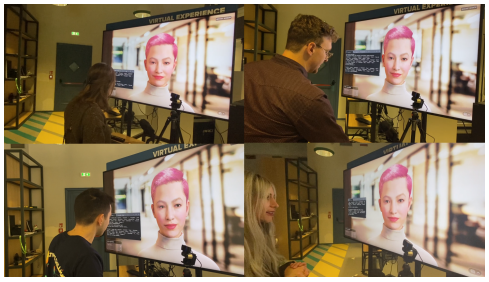

Fig. 2. Experimental set-up

- (III) Different personalities of the digital human may affect the user's enjoyment.

To test these hypotheses, a within-subjects experiment is designed where 18 participants (10 males, 8 females, average age 28.2) engage in dyadic conversations with the digital human. The system enables the management of personality-influenced autonomous conversations on any topic. The task has been designed to avoid biasing the perception of the personalities, allowing the personality to reveal itself autonomously during the dialogue. We tested the 6 opposite poles of Extroversion, Conscientiousness, and Agreeableness traits. Each participant experiences two different personality traits across two sessions, each one lasting 5 minutes. To validate the hypotheses, participants complete three 5-point Likert scale questionnaires after each session. The first assesses the perceived synthetic personality using the Big Five Inventory [7] (I). The second and the third measures respectively the digital human's agency and experience [2] (II) and enjoyability and sociability [5] (III).

IV. Results and Conclusions

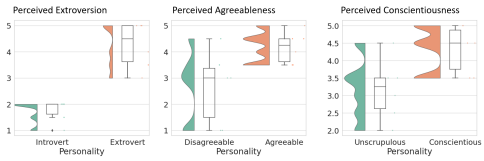

Fig. 3. The raincloud plot concurrently displays data points, a box plot, and a halved violin plot. Each figure is associated with one trait and represents how that trait has been perceived by subjects during the interaction.

We assess the framework's ability to generate synthetic personalities by analyzing the BFI-10 questionnaire through the Mann-Whitney U tests [4]. Participants can significantly distinguish variation along Agreeableness ($p = 0.042$), Extroversion ($p = 0.004$), and Conscientiousness ($p = 0.040$) (I) (Figure 3). The digital human is perceived as a cognitive agent regardless of personality (II), indicating its capability of planning and experiencing emotions. Agency is perceived higher than Experience (Wilcoxon signed-rank test [3], $p < 0.001$) suggesting a lack of emotion generation. All personalities are perceived as equally enjoyable (III), whereas agreeableness significantly influences perceived sociability (Mann-Whitney U test, $p = 0.018$). Overall, the study confirmed that the framework can generate perceivable synthetic personalities in a cognitive and emotionally intelligent digital human. The study's findings offer insights into enhancing human-robot interactions through personality traits, validating the proposed architecture and its task- and platform-independency.

Acknowledgment

This work is supported by: project RAISE-Robotics and AI for Socio-economic Empowerment Spoke I (the European Union - NextGeneration EU), project PROPER (Curiosity-Driven projects, University of Genoa), the Reply Area42 Lab, Lingotto, Turin, Italy https://www.reply.com/en/labs/area-42.

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