

WHEN VIRTUAL WORLDS BECOME INTELLIGENT: ARTIFICIAL INTELLIGENCE, VIRTUAL REALITY, AND NEW RESEARCH OPPORTUNITIES

QUANDO OS MUNDOS VIRTUAIS SE TORNAM INTELIGENTES: INTELIGÊNCIA ARTIFICIAL, REALIDADE VIRTUAL E NOVAS OPORTUNIDADES DE INVESTIGAÇÃO

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The recent advances in Artificial Intelligence (AI) and Large Language Models (LLMs) have contributed to a significant visibility of generative AI. Despite the big spotlights being on AI nowadays, the ambition to develop computational systems capable of creating the illusion of intelligent behaviour is not new. One can date AI to the 1950s, when various researchers raised the topic and made remarkable contributions to the field's establishment and evolution. One of the unavoidable names is Alan Turing that, in its paper entitled "Computing Machinery and Intelligence" (Turing, 2007) has raised the question "Can machines think?" where he introduced the idea that a machine could imitate human behaviour to a point where, when interacting with an unseen interlocutor, a person could not distinguish if it was interacting with a machine or with a human - this became later known as the Turing Test.

Since then, AI has evolved gradually into what we know it as today. Given the nature of virtual reality (VR), which aims to transport users into virtual experiences and make them feel as if they are really there, AI provides an important use case for VR. In fact, long before the current AI boom, interactive digital environments such as digital games employed AI techniques to enhance the game experience by controlling non-player characters, determining

opponents' behaviour, supporting decision-making, dynamically adjusting difficulty, and creating experiences that responded to players' actions. Although many such systems would appear relatively simple and have limitations when compared with current AI models, they were effective.

The recent advances in AI enable multi-modal approaches and high-quality mechanisms, allowing the VR experience to interpret users and respond dynamically, creating personalised and unique experiences that can range from generating or modifying content based on user behaviour.

More than just having a chat with an AI model (e.g., ChatGPT or Gemini), VR allows one to interact with virtual agents that embody humanoid characters and assume predetermined roles. In fact, this also adds a new dimension to Turing's question and opens a variety of opportunities across different research fields that extend far beyond Computer Science. The convergence of AI and VR has led to the development of AI virtual agents that can mimic human behaviour, and this ability to create AI-driven human-like agents can leverage VR across different application fields.

For instance, opens opportunities to have virtual humans assuming social roles or more professional roles such as educators or trai-

nees, that can leverage virtual characters to richer social interactions that can benefit fields such as social skills, education or specialised training, where it is possible to add a new level of behavioural and conversational flexibility to the VR application. In health-related contexts, one can use VR and AI to create virtual humans that assume the role of a therapist in ideal exposure scenarios that can be used as a therapeutic medium for different purposes, such as post-traumatic stress disorder or rehabilitation, with the advantage that the treatment plan is personalised and auto-adaptable for the needs of a patient. However, we have to account for the fact that, while this is possible, it also raises a series of questions, ranging from ethical considerations to the use of a therapeutically approved medium with positive clinical outcomes. Also, this VR/AI combination, while opening new possibilities, does not guarantee better results or greater validity. Thus, understanding how these AI-driven agents affect different variables such as social presence, trust, or engagement shall be a research priority. Beyond that, there is a need to establish guidelines in this field and ensure the reliability of AI-powered VR applications.

Given these examples, another challenge that arises concerns the ethical perspective, since these AI mechanisms collect highly granular data from users to the point where it is possible to infer behavioural information even without users explicitly providing it. The AI-powered virtual agents may also become indistinguishable from real people and have an emotional impact on users. As such, questions regarding informed consent, privacy, accountability, and appropriate levels of human oversight are of high importance and should be addressed, particularly in sensitive fields such as psychology and health.

These are only a few examples of what the

convergence of VR and AI may bring. Still, this potential is sufficient to recognise that research that goes well beyond the Computer Science field is required to provide theoretically grounded knowledge of how the synergies between VR and AI technologies can be best exploited without compromising the best interests of their users. Understanding this transformation is highly valuable, and the timing is right to embrace such research opportunities.

REFERENCES

- Turing, A. M. (2007). Computing machinery and intelligence. In *Parsing the Turing test: Philosophical and methodological issues in the quest for the thinking computer* (pp. 23-65). Dordrecht: Springer Netherlands.