IN SPACE, NO ONE CAN HEAR YOU SCREAM

— BUT AI —

CONVERSATIONAL AGENTS IN IMMERSIVE VISUALIZATION SOFTWARE

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We explore how LLM-powered conversational agents can help museum vistitors to interact with scientific visualization. We focus on OpenSpace, an astrophysics visualization software used in science museums. Furthermore, we study how LLM agents can complement a human guide during a museum show, to enhance active public participation.

An AI Assistant for museum guides

In Science museums, interactive visualization can enhance visitors' engagement and learning, promoting **active participation and personalized experience**. [1]

An LLM assistant could help museum guides make more engaging experiences by **improvising scenarios** based on the current circumstances (targeted public, the news, guest speakers...). [2, 3]

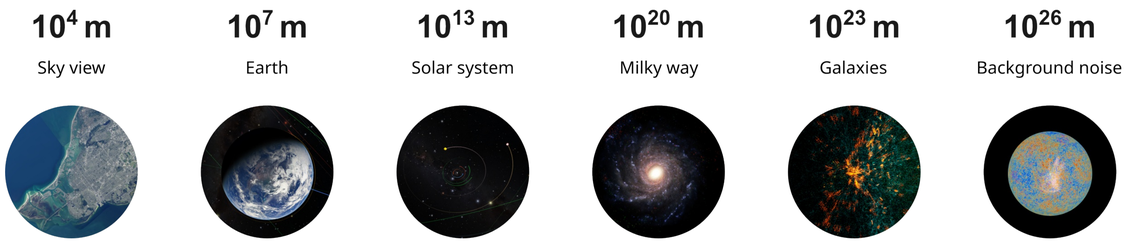
➢ We explore how an LLM can pilot a visualization for museum guides.

Example: swedish astronaut Marcus Wandt was invited to the *Wisdome planetarium (Sweden)* to talk about his journey aboard the ISS. What if he could react to questions from the audience, with an immersive visualization in the background following its narrative?

Our implementation

We use the **astrophysics visualization software** *OpenSpace*, used in several science museums and planetariums. [4]

The software is versatile and can navigate the whole universe. It can be controlled *via* an API.



Navigating accross levels of detail in OpenSpace.

① We perform a text-to-speech conversion with *OpenAI Whisper*. A remote can be used to trigger recording.

② We feed the text prompt to an *OpenAI GPT4-o LLM*, with a sub-set of the OpenSpace API and documentation..

③ A python program forwards the LLM function calls to OpenSpace and sends the results back to the LLM.

Voice recording (mp4 files) → Text-To-Speech AI (OpenAI Whisper) → LLM Assistant (OpenAI GPT4-o) ↔ OpenSpace API (Lua function calls)

Our Speech-to-visualization and Interaction pipeline.

Results

Our system is excellent at navigating between landmarks in OpenSpace, manipulating time and providing explanations.

Work reliably: Go to Mars • Fly to St. Pete Beach • set the time to next Monday

It understands well indirect inquiries, decomposing them into chains of simple commands.

Mostly work: Show me the Moon landing • Visit the planets of the solar system

However, it does not see the visuals, and has a poor sense of spatiality.

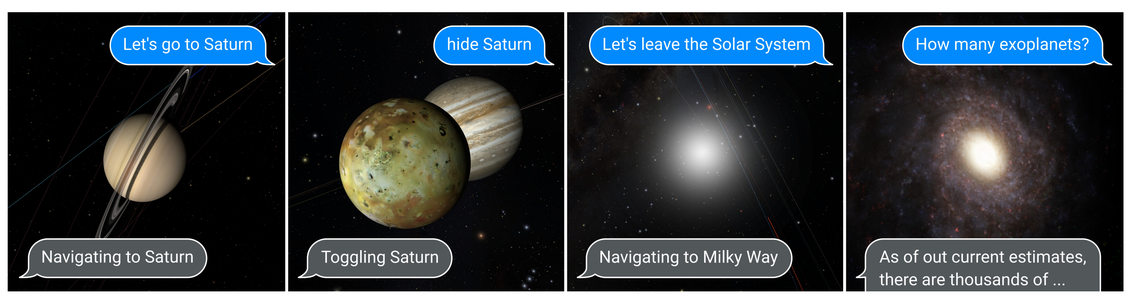
Never work: What is the red dot? • Show it at night • Get X in focus

Future Work

The LLM has room for improvement:

➢ Fine-tuning • prompt engineering • multi-modal LLMs

We woud like to evaluate the pedagogical merits of such conversational agents with an *in-situ* study at the Norrköping Visualization Center C (Sweden).



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