Voices from the Lagoon

An Interactive Experience for Climate Awareness

Zofia Milczarek
Institut Systèmes Intelligents et de Robotique
Sorbonne Université
Paris, Ile-de-France, France
milczarek@isir.upmc.fr

Joy Ciliani*
University of Siena
Siena, Italy
University of Campania Luigi Vanvitelli
Caserta, Italy
joy.ciliani@student.unisi.it



Figure 1: 3 screenshots showing the interface of the game Voices from the Lagoon: Starting page (Left), Talking to the Crab (Center), Talking to the Guide (Right). Graphics generated and edited with Adobe Firefly.

Abstract

In this study, we developed Voices from the Lagoon, a narrative discovery game designed to explore ecological transformations in the Venetian Lagoon through voice-based interaction. The system enables players to engage in conversations with both human and non-human characters using speech. Player input is processed through speech recognition, while a large language model generates contextual responses that are returned through synthesized voice and simple character animations. This paper presents the design concept, narrative structure, and system architecture of the game prototype.

CCS Concepts

• **Applied computing** → *Media arts*; • **Human-centered computing** → **Natural language interfaces**.

Keywords

Spoken Dialogue Systems, Natural Language Processing, Narrative Games

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*Research completed while being a visting researcher at ISIR.

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1 Introduction

Digital games are increasingly explored as a medium for addressing complex social and environmental issues, particularly through discovery games in which players investigate systems and problems through exploration [1], engaging them in environmental storytelling that reveals relationships between actors, environments, and events [3]. However, many of these experiences still rely on scripted dialog systems for interactions with non-player characters (NPCs), often implemented as branching dialog trees [13] and combined with traditional visual interfaces, which can constrain conversational flexibility and limit more exploratory forms of engagement with complex environments. Recent advances in large language models (LLMs) and speech technologies open new possibilities for voice-based interaction in games, enabling players to be engaged in more dynamic conversations [16]. To explore these possibilities, we present Voices from the Lagoon, a narrative discovery game set in the Venetian Lagoon that invites players to investigate ecological transformations affecting the lagoon ecosystem through voice-based interaction with both human and non-human characters.

2 Related Works

Recent studies have explored the use of games and interactive narratives to investigate ecological systems and represent environmental issues through multispecies perspectives [8]. For example, Game Changers [4] is an online narrative game that uses interactive storytelling to encourage players to explore possible climate futures and stimulate discussion about environmental actions. Similarly, OceanChat [12] introduces conversational AI agents represented by marine creatures that engage users in dialogue about ocean-related environmental issues.

3 Voices from the Lagoon

The Venetian Lagoon forms one of the largest coastal lagoon systems in the Mediterranean and hosts a complex mosaic of habitats (e.g.salt marshes, tidal flats, shallow channels) that support biodiversity and traditional economic activities. However, climate change, sea-level rise [14], and human interventions increasingly threaten this fragile ecosystem, accelerating salt-marsh erosion, altering hydrodynamics, and reshaping species dynamics in ways that favor the spread of invasive species, in particular the Atlantic blue crab (Callinectes sapidus), which disrupts ecological balance and impacts local fisheries [6] [2]. Within this context we have created Voices from the Lagoon, an investigative game set in the Venetian Lagoon where players can explore the ecological transformations of the lagoon by multiple perspectives using voice-based interaction. By adopting a game approach, we aim to raise awareness of these climate-related changes, building on prior literature on serious games showing that games designed for purposes beyond entertainment can enhance learning opportunities and promote reflection on environmental issues [5] [15].

3.1 Game Design

In this research, we adopted the More-Than-Human design approach and interactive digital narratives theoretical framework [9]. This combination allowed us to explore the lagoon beyond a purely human-centered perspective by considering the system composed of multiple interacting agents, both humans and non humans [11]. By presenting these viewpoints through voice dialogues, the design encourages players to interact with the lagoon as a network of interdependent actors in which there is no linear plot, because the narrative emerges gradually alongside the player's broader understanding of the ecological situation.

There are 3 non-playable characters, representing different perspectives on the Lagoon ecosystem. The first is the Blue Crab, an invasive species whose rapid spread is altering ecological balances within the lagoon. The human characters include a fisherman, who shares the economic and cultural consequences of environmental change, and a lagoon inhabitant, who introduces the player to the context and acts as a guide throughout the experience.

Within this structure, the player takes the role of a mediator between the conflicted Fisherman and the Crab. At the beginning of the game the Guide will inform the player of their conflict ask for help in its resolution. The player then need to interact with each character and gather relevant information, so that they can make the Crab and the Fisherman understand each others' viewpoints and become friends. The game has 3 possible endings : if we side with the Crab, the guide will be disappointed and the Fisherman will give an angry monologue. If we side with the Fisherman, the Crab will express his sadness and leave the lagoon forever. If we support both of them, the game will end with the Crab and the Fisherman sharing a friendly moment.

3.2 System Overview

The game was implemented using TypeScript, with the SpeechState [10] package to manage the transitions from one stage of the game to another. SpeechState is a TypeScript package for browser-based

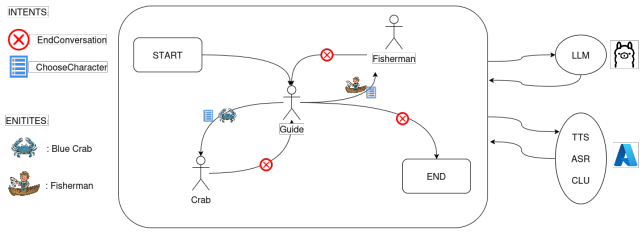


Figure 2: System Design

Dialogue Systems developement, which is based on XState, a state machine package for TypeScript.

The flow of the game is controlled by states defined within an XState state machine. The top-level states are : `Guide`, `Fisherman`, `Crab`, which represent the characters of the game. Additionally, there is an `Intro` and an `End` state, which include a prologue and an epilogue message. Moving through the different states controls both the User Interface (showing the appropriate character icons) and the NPCs' behavior.

To make the game controlled by voice we use Microsoft Azure's Text-to-Speech and Automatic Speech Recognition modules. To define transitions between, we use Azure's Conversational Language Understanding module. There, we define 2 Intents: `EndConversation` and `ChooseCharacter`. We also define the following entities: `Blue Crab`, `Fisherman`, `Guide` (for the characters) and `confirmation` (to detect whether the user says yes or no when a character proposes something to them). By detecting these intents and entities fromt he user's utterances, we are able to transition between different states of the Game.

To ensure a dynamic experience, the characters' turns are generated by a locally hosted Llama3.1-8B-Instruct [7] with 4bit quantization. The scenario and behavior of each character is defined with a system prompt, which details: the characters goals, their problems, and personality.

4 Discussions and Conclusion

The main contribution of the game Voices from the Lagoon lies in its attempts to support more comprehension about complex ecological environments. The interface is designed to be minimal, without textual information. During interactions, NPCs will also communicate their emotional states through simple visual and vocal cues. During development, some technical challenges also emerged, particularly related to the use of large language models for real-time dialogue. For example, occasional latency in response generation and issues related to the formulation of utterances can affect the fluidity of the conversations. Addressing these limitations will be important and open the possibility to investigate new forms of interaction, such as multi-party interactions, where multiple NPCs participate in the same conversation and interact not only with the player but also with each other. The project is currently in a prototyping phase, where the design is still evolving and several aspects will require further refinement through testing and user feedback with local communities. Additionally, we plan to measure the impact on climate awareness of the players with pre- and post-gameplay surveys.

References

[1] Deanne M. Adams, Richard E. Mayer, Andrew MacNamara, Alan Koenig, and Richard Wainess. 2012. Narrative games for learning: Testing the discovery and narrative hypotheses. *Journal of Educational Psychology* 104, 1 (2012), 235–249. doi:10.1037/a0025595

[2] Elettra Della Ceca, Samanta Corsetti, Gianni Sagratini, Sauro Vittori, and Germana Borsetta. 2026. From Invasive to Innovative: A Review of Socio-Economic and Ecological Pathways for the Sustainable Management of the Blue Crab (Callinectes sapidus) and Its Recorded Sightings in the Mediterranean. *Sci* 8, 2 (Feb. 2026). doi:10.3390/sci8020048

[3] Teun Dubbelman. 2016. Narrative Game Mechanics. In *Interactive Storytelling*, Frank Nack and Andrew S. Gordon (Eds.). Springer International Publishing, Cham, 39–50. doi:10.1007/978-3-319-48279-8_4

[4] LYNDA DUNLOP, Emma Nuttall, Zoyander Street, Toki Allison, Ben Carlin, John Ingle, and MARIA GERTRUDIS WILHELMINA TURKENBURG-VAN DIEPEN. 2025. Climate education through online narrative games:the importance of innovation, integration, interaction and intervention. *Environmental Education Research* (Aug. 2025). https://doi.org/10.1080/13504622.2025.2539476

[5] Stephen Flood, Nicholas A Cradock-Henry, Paula Blackett, and Peter Edwards. 2018. Adaptive and interactive climate futures: systematic review of 'serious games' for engagement and decision-making. 13, 6 (2018), 063005. doi:10.1088/1748-9326/aac1c6

[6] Anna Gavioli, Giorgio Mancinelli, David B. Eggleston, Robert R. Christian, Edoardo Turolla, Mattia Lanzoni, Elisa Soana, Emanuele Rossetti, Antonio Gottardo, Luigi Vidal, Aurelio Zentilin, and Giuseppe Castaldelli. 2026. A potential bottom-up cascade on the abundance of invasive Atlantic blue crab *Callinectes sapidus* in northwestern Adriatic lagoons. *Marine Environmental Research* 215 (March 2026), 107801. doi:10.1016/j.marenvres.2025.107801

[7] Aaron Grattafiori et al. 2024. The Llama 3 Herd of Models. arXiv:2407.21783 [cs.AI] https://arxiv.org/abs/2407.21783

[8] Philip Harms, Neelakshi Joshi, and Stefan Knauß. 2025. Designing multispecies role-playing games: From human-nature partnerships towards multispecies justice. *npj Urban Sustainability* 5, 1 (Aug. 2025), 68. doi:10.1038/s42949-025-00257-1

[9] Hartmut Koenitz. 2015. Towards a Specific Theory of Interactive Digital Narrative. In *Interactive Digital Narrative*. Routledge.

[10] Vladislav Maraev. 2025. *Speechstate*. https://github.com/vladmaraev/speechstate

[11] Iohanna Nicenboim, Joseph Lindley, Cristina Zaga, Arne Berger, Laura Forlano, and Elisa Giaccardi. 2024. More-Than-Human Design in Practice. *DRS Biennial Conference Series* (June 2024). https://dl.designresearchsociety.org/drs-conference-papers/drs2024/editorials/4

[12] Pat Pataranutaporn, Alexander Doudkin, and Pattie Maes. 2025. OceanChat: The Effect of Virtual Conversational AI Agents on Sustainable Attitude and Behavior Change. doi:10.48550/arXiv.2502.02863 arXiv:2502.02863 [cs].

[13] Li Song. 2025. LLM-Driven NPCs: Cross-Platform Dialogue System for Games and Social Platforms. doi:10.48550/arXiv.2504.13928 arXiv:2504.13928 [cs].

[14] Luigi Tosi, Cristina Da Lio, Marta Cosma, and Sandra Donnici. 2024. Vulnerability of tidal morphologies to relative sea-level rise in the Venice Lagoon. *Science of The Total Environment* 931 (June 2024), 173006. doi:10.1016/j.scitotenv.2024.173006

[15] Jason S. Wu and Joey J. Lee. 2015. Climate change games as tools for education and engagement. 5, 5 (2015), 413–418. doi:10.1038/nclimate2566

[16] Nima Zargham, Maximilian A. Friehs, Leandro Tonini, Dmitry Alexandrovsky, Emma Grace Ruthven, Lennart E. Nacke, and Rainer Malaka. 2024. Let's Talk Games: An Expert Exploration of Speech Interaction with NPCs. *International journal of human-computer interaction* 41, 5 (April 2024). doi:10.1080/10447318.2024.2338666