

Supporting Collective Inquiry in a Critical Action Game: A Role for Open AI Conversational Agents

Kathy H. Zhou, OISE, University of Toronto, kh.zhou@mail.utoronto.ca
Charlie Pullen, University of Toronto Schools, cpullen@utschools.ca
Jeff Holmes, Convai, jefftgh@gmail.com
James D. Slotta, OISE, University of Toronto, jim.slotta@utoronto.ca

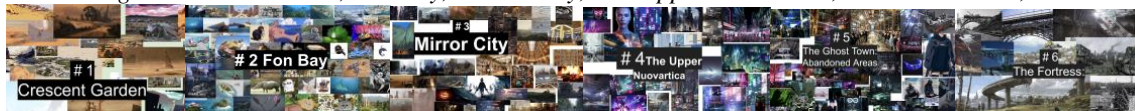
Abstract: This paper presents *Fall of Artica (FOA)*, a whole-class inquiry game set in a dystopian world that engages students to reflect critically and build media literacy through a collective inquiry about the dystopian context. This paper presents an application of cutting-edge AI technologies to create conversational agents using the OpenAI GPT3 large language model. These agents represent a new CSCL research affordance, allowing students to interact using natural language processing through spoken conversation with agents who are Non-Player Characters (NPC) that speak through a “portal into their dystopian world.” The agents allow students to uncover the game narrative and receive clues and quests through natural conversations and inquiry. Here, we describe our initial application of these agents in an 11th-grade visual arts curriculum where students construct a collective visual representation of the dystopian context guided by conversational interactions with the NPCs.

Introduction

How can we help students thrive in a world of disinformation, convoluted and messy social dynamics, and the fluid identities that characterize their lives and flavor their learning? Our approach is to develop an alternate reality game that transforms the classroom learning environment by embedding a dystopian universe as an object of collective inquiry and critical reflection. The game, titled *The Fall of Artica: A Way Back Home (FoA)*, aims to facilitate students’ critical thinking and collaboration with various elements of the *FoA* universe, intermediated by carefully designed intelligent agents that take the form of Non-Player Characters (NPCs). The agents appear through “portals” into the *FoA* universe, allowing students to pose questions, gain clues and draw inferences about the dystopian context. Agents are situated within various *FoA* settings, such as *Crescent Garden*, a refugee community where citizens struggle to build a sustainable outpost; *The Mirror City*, a remnant of the former civilization where students can find information about Old Artica; or *Nuovartica*, the modern city where a powerful Authority has established dominion over the surrounding lands (Figure 1). This paper summarizes our rationale and theoretical perspective, presents an overview of the *FoA* game context, and reports on technological innovation of building the NPCs using Convai Conversational Agents.

Figure 1

FoA settings: Crescent Garden, Fon Bay, Mirror City, The Upper Nuovartica, The Ghost Town, The Fortress.



Rationale: Serious games for contemporary issues

Twenty-first-century education demands that education move away from a position of producing the future workforce toward one of creating experiences and practices that can help students feel more confident when confronting uncertainty and ambiguity (Cremin, 2006; Merrotsy, 2013). Self-direction, self-organization, and self-regulation build resilience to uncertainty and complexity (Damşa et al., 2010; Papacharissi, 2011), which requires new forms of active learning that center 21st-century competencies (Freire, 2020). Moreover, students, even within the same classroom, are experiencing distinct realities. In the Twenty-first Century, fixed meaning no longer makes sense in a fluid world (Bauman, 2013).

Influenced by the Games for Learning (G4L) literature (Gee, 2005; Squire, 2006), this research investigates an approach to engage students in critical thinking, identity formation, and the interconnection of disciplinary content, practices, and epistemology in a mixed reality learning environment. Jenkins (2004) explained why narratives in-game environments serve as narrative artifacts contributing to the player’s experience. Djaouti (2011) and Wilkinson (2016) emphasize cultural and social perspectives in learning games. Antle et al. (2014) developed a game called *Youtopia* that supported elementary school students to change

their values and behavior toward a sustainable lifestyle. *Youtopia* was described as a “game for a change” because it aims to support learners in understanding, facilitating, and embracing social change.

In designing *FoA*, we also drew upon the notion of Alternative Reality Games (ARG) in which real-world environments are infused with additional layers of meaning and materiality (Williams-Pierce, 2016). One example of an ARG game is *Evoke*, which engages learners in responding to critical issues through the lens of a local community in Africa (McGonigal, 2011). *Evoke* addresses sustainability and environmental matters by guiding players to find clues through progressive levels and missions within the game.

One aspect of ARGs relevant to the present study is using the physical environment as a spatial index for the game world. Moher (2006) pioneered the digital augmentation of classrooms through Embedded Phenomena (EP), in which a scientific phenomenon like insect colonies (the *Wallcology* EP), Earthquakes (the *Roomquake* EP), or aquifers (the *AquaRoom* EP) are embedded as simulations within the physical classroom, accessible only through instrumentation or spatially situated inquiry. The *FoA* game employs spatial augmentation, distributing the dystopian world throughout the physical classroom.

Theoretical perspective

Our work is guided by the notions of *critical pedagogy* (Giroux, 2020) and *learning communities* (Brown & Campione, 1996; Collins & Bielaczyc, 2006; Hobri et al., 2018). Freire (2020) asserted that education must provide students with learning that empowers them against an uncertain or inequitable future. By engaging students in critical inquiry about a dystopian world, a game can empower them to develop perspectives about issues in their world, such as social justice, media disinformation, or economic disparities. In the learning community approach, the entire classroom is engaged collectively in activities that reinforce students’ sense of identity as a community and allow the wealth of talent and diversity of experience to become a resource for all learners (Brown & Campione, 1996). Knowledge Community and Inquiry (KCI) is a learning community model that blends student knowledge building with scaffolded inquiry scripts (Hobri et al., 2018; Amundrud et al., 2021). KCI was developed to guide the design of whole-semester curricula in which students work collectively to construct a community knowledge base which then serves as a resource for subsequent inquiry activities that foster a deep understanding of the designated topics. By understanding games as a mode of collective inquiry, we can leverage features like a community knowledge base and productive disciplinary engagement (Hobri et al., 2018).

Collective inquiry games can also cultivate a sense of belonging and engagement through playful, creative action that fosters positive emotions towards changes, such as confidence, curiosity, excitement, and hope. Students create new knowledge and game artifacts for themselves and others by engaging in collaboration and cooperation as a learning community. Teachers assume the role of a facilitator, leading different gameplay modes. Notably, the dystopian settings are not meant to forecast or prepare students for a dystopian future but to help them think beyond the limits of the current social issues and cultural norms to make space for critical conversation and critical inquiry regarding complex problems. Such a context can support meaningful narratives and interaction modes, enabling a culturally responsive form of critical action, building communities, and supporting students’ collaboration, communication, design, and critical making (Carvalho et al., 2022).

Technological innovation: Conversational agents using open AI platforms

This paper introduces a powerful new CSCL technology innovation in the form of artificial intelligence “conversational agents” that can now be created using the Convai.com platform, which connects to the Generative Pre-trained Transformer 3 (GPT-3) model. GPT-3 was developed in 2020 by OpenAI, a research company whose stated aim is “to ensure that artificial general intelligence (AGI) benefits all of humanity. GPT-3 has been described as “one of the most interesting and important AI systems ever produced” and “being able to write original prose with fluency equivalent to that of a human” (Chalmers, 2020). Because GPT-3 also allows the comprehension of natural language (i.e., in addition to language production), this has allowed the creation of natural language “conversational agents” (Meyer et al., 2020). With little or no programming, it is now possible to insert a fully responsive conversational agent into a Website who will communicate with visitors or as a teaching assistant who can support student inquiries (Dale, 2021). In short, conversational AI agents have emerged as a powerful new affordance that can support customer service, online learning, personal assistance, and myriad applications in virtual reality and the game industry. While there are still fundamental limitations to these agents, they open up a wide new space of CSCL investigations into how such agents could be used to support students, challenge or provoke their ideas, connect them with peers, or otherwise respond to their questions. The conversation from these agents is good enough that they can already play important roles within our learning environments. This work explores one such application: using conversational agents to implement the NPCs in our *FoA* game.

Method

This paper reports on a mixed-reality collective, collaborative game experience developed in a co-design partnership with a high school art teacher. While FoA will ultimately be able to engage students in multidisciplinary STEAM inquiry, we begin with a single discipline and relatively simple design aimed at supporting students in an 11th-grade visual art class. The learning goals are simple: to develop a collective, critical, visual representation of *Artica*, a dystopian world mapped onto the sizeable art-space classroom. Separate stations are set up around the room, each corresponding to a different region of *Artica*. For each station, a conversational agent was created using the ConvAI javascript SDK (Convai.com), which served as an NPC representing that region (see Figure 2).

Convai has produced a platform that enables such agents to be created with a “backstory” and other “assets,” including graphics for avatars, body actions, and shareable resources (Figure 2). The backstory equips the agent with an authoritative reference that must be checked and reconciled with any dialogue produced. This ensures that the agent faithfully represents the targeted domain. Our FoA agent backstories include (1) declarative knowledge, e.g., “we came to this place 18 years ago”; (2) historical context, “The cities all fell when there was drought, and the authority began a population control plan.” “Lineus took his family and fled when they saw families forced to break apart”; (3) affective context, e.g., “people are afraid that we will not last too many more years because the water is going to run out completely.” “We are worried that the Authority may be looking for us, and not sure if we are considered outlaws”; (4) visual assets, e.g., artwork representing housing, landscape, maps, artifacts. This paper reports on six NPCs (Figure 2) implemented using the Convai platform (i.e., including resources such as avatar graphics and body motions, as well as a “Backstory”), as well as a whole-class FoA game that was co-designed with a high school visual arts teacher. We articulated the learning goals, curricular elements (quests, cards, NPCs, etc.), and gameplay models, implemented new media technologies, and developed a coherent narrative that connects learning in the arts to FoA game elements.

Figure 2

NPCs: Lineus (Crescent Garden), Eren (Fon Bay), Otto (Mirror City), Ymir (The Upper Nuovartica), L (The Ghost Town), and Bdeir (The Fortress).



Game and NPC pilot design

The Convai agents are installed on six iPads, each located at one of the stations corresponding to a region of FoA. Through autonomous and parallel interactions with the NPCs, students learn about the environmental, social, economic, and political issues faced by citizens of Artisans. Based on those interactions, they collectively design and produce mixed-media artifacts: digital drawings, paintings, hand-crafted sculptures, 3D printed objects, etc. They work in small groups (n=4 to 6) to take stewardship of and co-curate an art installation representing their assigned region of *Artica*. Students will be given creative flexibility, including choice of media and subjects. They may want to represent themes of their region, characters, or settings - or a mix of those elements. NPCs, if queried, can provide rich media representations (i.e., sending links to other images or even agents). In this way, students will be called to visit other stations within the classroom beyond their own and may even build bridging artifacts or representations. After approximately one week, students will have constructed a deep collective visual story about FoA, which will no longer be hidden, but represented in material and spatial form through their critical lens.

Because this is a work in progress, we are preparing for the first classroom trial in December 2022. The teacher, “Chas” (second author of this paper), has been a high school art teacher for two decades and is interested in developing additional activities to build on this first one. By the time of the conference, we will have completed the first visual arts unit and a more substantial “game design” unit currently in the design stages. We will update the NPCs based on the first unit, where we expect to learn much about these agents.

Conclusion and next steps

Engagement in a serious learning game can create a need to find information, allocate resources, collaborate with others, compare evidence, communicate, make critical decisions, and more. In our first trials, student-created artifacts will be shared within the learning community. We will gain insight into how conversational agents can interact through natural language to help guide student inquiry. In the second activity, we will engage Chas' students in a game design workshop, where groups of students create game quests in FoA, drawing upon the visual representations created previously. Although the project is early, it has opened many conversations about designing learning experiences in specific contexts. This work moves us toward an accessible and inclusive game-based learning environment, which will open further research opportunities relating to learner engagements, tangible and embodied interactions, critical making, and more.

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