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Euphonia: Reflecting on the Design of an AI-Powered Voice-Controlled Narrative Game

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ABSTRACT

This paper reflects on the design process for a work-in-progress AI-powered voice-controlled narrative game created by Innovation for Games and Media Enterprise (InGAME). This paper describes the steps which led to the final design decisions, and how the background research, research questions and initial prototyping may be traced through to the work-in-progress game. The design process is then reviewed for its suitability as a practice-based research and development workflow, before finally suggesting next steps the project will take.

CCS CONCEPTS

- **Applied Computing~Arts and Humanities** • Human-centered computing~Interactive systems and tools
- Interaction Paradigms~Natural Language Interfaces

KEYWORDS

Interactive Narrative; AI-Powered Storytelling; Videogames; Authoring Tools

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1 Introduction

There seem to be some common assumptions within the field of conversational design for AI in general and AI-powered storytelling in particular. Namely, that when designing AI-powered conversational toys, stories and games, two qualities are universally desirable: general intelligence (the ability to respond to a wide variety of inputs) [11, 24] and natural language (the ability to return human-like responses to input) [12]. However, many ‘natural’ human-like conversational mechanics such as interruption, digression and hesitation are considered aberrant when found in AI conversational systems or other conventional narratives [8, 24]. Therefore, much of the current literature around conversational UX design is geared towards completing commercial transactions with minimal friction [12] rather than crafting an interesting narrative experience.

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We sought to explore alternative paradigms outside of ‘natural’ conversation through the creation of our work-in-progress AI-powered voice-controlled narrative game, *Euphonia*. This paper is intended as a reflective exercise considering the design choices made during the early stages of *Euphonia*’s development and situates these choices within a context of ‘unnatural’ conversation. It is not intended to be a full evaluation of the research and its goals.

2 Conceptual Framework

If we take the position that ‘natural’ conversations with AI systems are not the desirable outcome, what are the alternatives? One possibility is to move away from anthropocentric design. This could mean allowing AIs to interact with one another, to have their own goals, interests and behaviors that do not necessarily involve serving the human participant. [1, 5, 7] And/or a move away from ‘natural’ conversational design might mean accepting that AI behaviors may be strange and alien and this should be embraced rather than mitigated against [2, 7]. It is also worth noting that existing ‘unnatural’ narratives and storytelling techniques [15] may have elements which are relevant to ‘unnatural’ AI-powered stories. The final perspective considered is that the entanglement of humanity and AI is inevitable, and therefore separating ideas of ‘human’ and ‘AI’ is an impossibility. The two are co-dependent and the development and advancement of one affects the development and advancement of the other. Therefore the only option is to accept AI as an extension of humanity and vice versa. [14, 21]

Since our research focusses on extending humanity’s capabilities via emerging technologies, we may take this final position as a given, and therefore are left with decentering the human player and concepts of ‘unnaturalness’ as design starting points.

3 Design Reflection

3.1 Exemplar Review

The first phase of the project involved a review of exemplar games and artefacts split into three categories – historic examples, AI-powered stories, and voice-controlled games. In the interests of brevity, only the most relevant examples are discussed below. Key takeaways that were later incorporated into the design are italicized for emphasis.

The two most significant historic examples were ELIZA [23] and the original *Euphonia* [3]. ELIZA was a text-based natural

language system, created in the 190s at Massachusetts Institute of Technology by Joseph Weizenbaum. Framed as a computerized psychiatrist, participants typed in their queries and the system responded in the same manner [23]. Euphonia was far older, an early example of text-to-speech (TTS) technology created by Joseph Faber in the mid-nineteenth century. Faber typed phrases into a piano keyboard, and the machine spoke them aloud via an automaton [3]. Despite being very different systems with very different end goals, one phenomenon occurred in relation to both. *Participants assumed the two systems not only engaged in conversation, but also understood the content of said conversations, despite the fact that their creators never claimed such a high level of technical capability, and even attempted to dissuade participants of these notions* [3, 23]. In the case of Euphonia, this was in spite of misgivings about the uncanniness of the automaton and its voice [3].

The AI-powered narratives were selected on the basis of the AI tool used to create them in order to explore as many different potential platforms as possible. *Restless* [17,18] and *Sherlock Holmes Mysteries* [13] were both created with tools which were taken forward for further experimentation.

Restless is a Unity game powered by Spirit AI's Character Engine (CE). The player takes on the role of a ghost haunting a young woman's apartment. The play experience is free-form and non-linear. CE's Dynamic Menu system means that the menu of player dialogue options is generated on the fly by CE and can be altered by changing the player-character's mood. Multiple moods can be selected at once, generating different menu options. Keywords can also be discovered and pursued as topics of conversation. *The game makes use of 'unnaturalness' through casting the AI-powered player character as a playful, disembodied ghost. Therefore, when it generates disjointed or strange menu text, the player is more likely to interpret this as intentional characterization rather than a failure of the system.*

Sherlock Holmes Mysteries takes an entirely different approach. Separating Google's Assistant from the narrative, the assistant instead acts as the narrator for a 'Choose Your Own Adventure'-style story, asking players what decisions they would like to make. While this simplifies the conversational options in the manner described by Moore [12] it also means that any frustrations encountered are more likely to be directed at the system, rather than explained away as character quirks as in *Restless*. *Sherlock Holmes Mysteries* is reliant on a keyword system similar to *Restless*, but here *the lack of a robust set of synonyms sometimes led to dead ends*, or attempting to guess the exact phrase required.

Finally, *The 3% Challenge* [6] based on the Netflix television show of the same name is a puzzle-based voice-controlled game. Players face various challenges including memory tests and hearing tests. *Characters frequently ask players to repeat words and phrases after them* under the guise of trying to fit in with the society presented in-game. This trains players in key word usage while also being in keeping with the narrative frame.

Having analyzed these (and other) exemplars the next steps arising from this phase of the design research were determined as follows: 1) to further study the different affordances offered by Google Assistant and Spirit AI's CE; 2) to explore the challenges

and opportunities associated with single versus multi character AI-powered games; 3) to consider how 'unnaturalness' might be incorporated as a design feature; 4) to further investigate the use of keywords in AI-powered narratives.

3.2 Initial Experiments

Next, short demo pieces were made with Google Assistant and CE, using both the Dynamic Menu and Natural Language input formats, and these were then presented to the wider team for feedback. Initially, each used the same basic narrative scenario to save on development time. This situated the player as a travel agent tasked with assisting a time-travelling tourist from the future. This narrative was selected because it inverted the typical player/AI Agent relationship, positioning the AI as the customer and the player in a subservient role. The character was developed using Google's guidelines for the conversation design process [9]. However, it was found this method prioritizes a single, idealized conversational flow, rather than the more branching, non-linear narrative that was required. Therefore, once the character personality was developed, the dialogue itself was written in Excel to record all possible utterances for each story state, with different tabs representing the different possible conversational topics.

It was at this stage that Google Assistant was rejected for further study, as its use of three discrete systems to handle different elements of the authoring process proved too time-consuming for what was intended to be a short experimental project. Google Assistant also seemed geared primarily towards commercial usage and was not particularly well suited as a narrative tool.

CE's Authoring Tool, however, proved to be self-contained and intuitive. Its Fragments system allows writers to stitch together sentences with a fine degree of control – individual words and phrases can be assigned specific conditions so that they only occur according to player knowledge or character mood. Yet, despite this complexity, a simple branching story can be created purely using the Plot and Scene functionality to divide scenes and lines of dialogue into conditional narrative branches. Built-in language classifiers means the system has default answers to certain types of questions (e.g. What? Where? When? Who?) which can easily be edited and/or expanded. Therefore Spirit CE was determined to be a suitable narrative tool, particularly for a project with a short time frame. However, this experiment also highlighted an unexpected issue with CE and/or writing a time travel narrative with an AI-powered tool – many of the built in language classifiers carried with them (understandable) assumptions about the nature of time, which meant that *asking questions about time-related concepts often caused conversational mismatches* such as the system assuming questions about time referred only to specific events, rather than more general queries, even when responses to these queries had been authored. This could have been addressed via the creation of a more in-depth knowledge model (the database the AI draws on for its conversations) but for the purposes of the test, time-related language classifiers were temporarily disabled.

The next round of experiments involved the creation of a multi-character AI game where characters argued amongst themselves if the player did not intervene (and sometimes even if the player did).

It was found that CE was unable to offer this functionality satisfactorily – while it is possible to create multiple AI agents in CE, control over multiple characters is limited. Characters can hold knowledge about one another as well as the player, but only one character can be present in a scene at a time, and the player must speak each time a character has spoken – a line of character dialogue cannot be followed by another line of character dialogue. This meant that it was not possible to implement the kind of interrupting behavior required for an automated argument using CE in this instance. Therefore, another tool was sought to test this particular scenario.

Charisma AI allowed for unlimited multiple characters present and allowed characters to speak after one another. A more developed (although still experimental) piece, *Elevenes With Eddie Murphy and Two Feuding Robots* [4] was made to explore this functionality. The user interface of Charisma is very similar to that of the interactive authoring tool Twine [10]. As in Twine, it is possible to zoom in and out of the Charisma interface which helps achieve a clear visualization of how each dialogue response is connected to each potential player input, offering a far more advanced version of Google’s conversational flow diagrams [9]. This led to reflection on the narrative design method to date. In CE it proved difficult to keep track of the overarching narrative once a larger number of conversational options had been authored, even if these were logged in Excel prior to entry into the authoring tool. Perhaps *Twine could be utilized as a design, rather than authoring, tool.*

At the end of this testing phase, both Charisma and Spirit’s CE were straightforward enough to permit a focus on general writing process rather than the minutiae of technical requirements. Multiple character versus single character pieces were found to be equally engaging, although *inexperienced players seemed to find the ‘misbehavior’ of a single character less frustrating than multiple characters.* However, this may also have been because the tourist character in the single player tests created more of an expectation of atypical AI behavior than the robot characters of the multiplayer tests. These findings were used to inform the outline planning of three potential projects for the team to choose between as the main game project. It was also decided that regardless of the selected game, Twine would be used for prototyping and planning of the narrative.

3.3 Project Selection

InGAME is a multi-disciplinary team, and therefore any project undertaken needed to foster collaboration between a variety of disciplines. The three potential projects outlined following the previous phases were:

- A voice-controlled VR game made with Spirit AI CE building on the findings of the initial single character test and using Euphonia as the central character
- A multi-character conversational game made with Charisma AI in which the player manages a love triangle between 3 AI characters (this would have built on the findings from *Elevenes* [4] but was also inspired by Seering et al’s idea for chatbots in love [16])

- A word puzzle game in which the tutorial AI gradually becomes a character in its own right – a wildcard idea which could be made with either CE or a bespoke solution and would build on ideas of ‘unnatural’ AI behavior and the inversion of subservient behaviors developed in the time tourist test

After discussing the benefits and drawbacks of the various options, it was decided that a voice-controlled VR game would allow the most opportunity for exploration of emerging technologies, one of InGAME’s core goals. Spatial sound, text-to-speech (TTS) and speech-to-text (STT) could all be explored as well as further developing ‘unnatural’ characterization and conversational design in an AI-powered narrative.

4 Game Design

Once these basic principles were in place, various others emerged either to ensure particular features identified in the earlier phases were included, or due to the constraints of the technology and timescale. Narrative decisions were then made based on these requirements and constraints. These were recorded in the design document which was edited collaboratively throughout the process. The requirements and constraints and their resulting design decisions were as follows:

Research Requirements:

- Exploration of concepts of ‘unnaturalness’ – Euphonia was selected because not only does it have a fascinating background story (a machine passed down through a family and eventually lost, along with the techniques used to make it work), it also inherently possesses the unnaturalness shown to make players more forgiving of technological failings, and a context likely to make players assume a greater level of cunning on the part of the AI [3, 23]
- Experimentation with CE mood settings – Euphonia has two moods which are on sliding scales, Trust & Anger. If Trust, hits a low level, Euphonia becomes Suspicious. Suspicion can increase Anger, but some actions and comments such as being insulting or refusing to help automatically increase Anger without affecting Suspicion. Reaching the highest Anger level ends the game
- Ambient sound as mood feedback - An ‘Anger’ parameter in FMOD Studio is linked to CE’s Anger parameter in Unity to change the ambient sound depending on Euphonia’s mood. This helps the player understand mood changes despite the lack of vocal inflection. e.g. The weather worsens the angrier Euphonia becomes
- Experimentation with TTS – voice-control is the primary mode of interaction
- Twine as a workflow component – draft conversations were created in Twine and feedback taken on the playable Twine prototype before implementation into CE. The visual nature of the interface meant that any gaps in conversational pathways were immediately obvious. This also aided implementation and testing as the idealized flow of any conversation could be mapped out, along with points for the AI to offer narrative

nudges to return to the main plotline. The fact a playable version could be shared to give an approximation of the final narrative also helped give the team insight into how the final game might look and provided further opportunity for feedback and refinement of plotlines and dialogue options

- Experimentation with keyword usage – keywords are often used to allow Euphonia to switch between conversational topics. Drawing on *The 3% Challenge* [6], some phrases may be repeated to elicit special responses. However, in *Euphonia* rather than being a repeated mechanic, uncovering this phrase is part of the central mystery of the narrative, so players may reach the narrative end without discovering it
- Further development of knowledge model – Euphonia’s experiences prior to the player meeting her were mapped to a timeline to account for questions relating to past and present

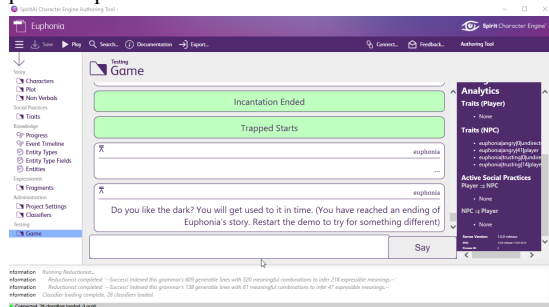


Figure 1: Euphonia test dialogue & mood data in Spirit AI’s Character Engine Authoring System

Constraints:

- Limited timescale – the game occurs in a single location (Euphonia’s attic), will have a first-person viewpoint, a single Non-Player Character (Euphonia), and uses a default TTS voice to limit asset creation.
- Limited time for animation may lead to uncanny character appearance – Euphonia was selected as primary character due to her embodiment of unnaturalness
- Default TTS voice lacks emotion – sound and narrative design convey character mood instead. Character mood settings affect the narrative tone of Euphonia’s responses and sound effects. (see Figure 1 & Research Requirements bullet point 3 above)
- VR movement can cause motion sickness for some players – the in-game camera is static, centered on Euphonia and requires no movement to play. Conversation is the game’s primary focus and occurs only in short bursts. Menus and controls are kept to a minimum

Considering constraints as opportunities to determine some of the required components is by no means a new approach [19] but it helped us balance exploring the features and technologies we were most interested in both collectively and individually alongside the difficulties we would inevitably face. When COVID happened, we were forced to make a further amendment and temporarily remove the VR component, as we felt this would add too much unnecessary complexity to both testing and sharing the work.

5 Conclusion

Ultimately, the design process ran as follows:

- Exemplar Review – current playable examples and historically documented precursors were examined. They were selected in order to cover a wide range of platforms, mechanics and technologies while remaining within scope of the central research interests – AI-powered and voice-controlled narrative.
- Theoretical Background Reading – occurred in advance of and alongside the entire project whenever new concepts arose.
- Experimentation – each made over a matter of days, and intended to get a feel for particular tools and mechanics, with a couple worked up further (although still taking no more than a week) to further analyze key elements. This included experimentation with authoring processes as well as with the tools themselves. These experiments were played and discussed by the team.
- Project Selection – several project possibilities were outlined based on the previous research, and one was selected which best matched the needs of the team.
- Design Creation – a design document was created building out from the fundamental restrictions and needs suggested by the technologies in use and team research goals.
- Prototyping – Twine was used to plot the narrative and gameplay flow, and this prototype was then played and discussed by the team.
- Game Creation – The narrative was implemented into the game engine (CE) and the relevant technologies were integrated (Unity and Microsoft Azure TTS).

This practice-centered workflow provides time to explore the affordances of the relevant technologies, but also allows freedom to discard those which were taking too long to learn or were found to be unsuitable for the desired end product. However, this process would be equally applicable for a wide number of projects and specialisms.

6 Next Steps

Euphonia currently only has bare bones implementation which showcases the TTS functionality and AI-powered storytelling. Further dialogue options will be fleshed out to limit repetition of central storyline phrases. An art pass will add a 3D model of Euphonia to the scene, further increasing the uncanny nature of the experience. Additional ambient sound will be added to create atmosphere. Euphonia’s sounds will be tied to her speech and moods so that it is more apparent to the player when her mood shifts. Accessibility has proved a challenge for one team member who has a vocal disorder, so options such as typing rather than speaking commands may also be added, particularly now that the VR component of the game has temporarily been put on hold. User testing will then be undertaken to further assess and refine the narrative content. A key challenge will be balancing playful ‘misbehavior’ with a rewarding player experience.

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REFERENCES

- [1] Birgitte Aga and Coral Manton. 2018-2019. *Women Reclaiming AI*. <https://womenreclaimingai.com>.
- [2] Ian Bogost. 2012. Alien Phenomenology, or What It's Like to Be a Thing. University of Minnesota Press, Minnesota.
- [3] William Chambers and Robert Chambers (eds). 1846. The Speaking Automaton. In Chambers's Edinburgh Journal. (141): 168–171.
- [4] Lynda Clark. 2019. Eleveses With Eddie Murphy and Two Feuding Robots. [Web] Charisma AI. <https://charisma.ai/play/806>
- [5] Kate Compton. 2017. Opulent Artificial Intelligence: A Manifesto. 19 May. Internet Archive Wayback Machine. <https://web.archive.org/web/20180827134459/http://www.galaxykate.com/pdfs/galaxykate-zine-opulentai.pdf>
- [6] Doppio Games. 2019. The 3% Challenge. [Mobile] Netflix, California, USA.
- [7] Sonia Fizek. 2018. Automated State of Play: Rethinking Anthropocentric Rules of the Game. In Journal of Digital Culture and Society. 4, 1: 201–14. DOI: <https://doi.org/10.14361/dcs-2018-0112>
- [8] Monika Fludernik. 1996. Towards a 'Natural' Narratology. Routledge, London.
- [9] Google Codelabs. Model conversational flows for your Action. In Add advanced features to Actions for Google Assistant. Google. <https://codelabs.developers.google.com/codelabs/actions-3/index.html#index=.%2F..index#3>
- [10] Chris Klimas. 2009. Twine. [Web] <https://twinery.org/>
- [11] Lara J. Martin, Brent Harrison and Mark O. Riedl. 2016. Improvisational Computational Storytelling in Open Worlds. In Interactive Storytelling. Frank Nack and Andrew S. Gordon (eds). 10045 (2016). Springer International Publishing, Cham, Switzerland. 73–84. DOI: https://doi.org/10.1007/978-3-319-48279-8_7.
- [12] Robert J. Moore and Raphael Arar. 2018. Conversational UX Design: An Introduction. In Studies in Conversational UX Design. Robert J. Moore and Raphael Arar (Eds.). Springer International Publishing, Cham, Switzerland, 1–16. DOI: [10.1007/978-3-319-95579-7_1](https://doi.org/10.1007/978-3-319-95579-7_1).
- [13] Ilya Platonov. 2018. Sherlock Holmes Mysteries. [Mobile] Google Assistant, California, USA.
- [14] Holger Pötzsch and N. Katherine Hayles. 2014. FCJ-172 Posthumanism, Technogenesis, and Digital Technologies: A Conversation with N. Katherine Hayles. In Fibreculture Journal. 23, Dec 2014. <http://twentythree.fibreculturejournal.org/fcj-172-posthumanism-technogenesis-and-digital-technologies-a-conversation-with-katherine-n-hayles/>
- [15] Brian Richardson. 2011. What is Unnatural Narrative Theory? In Unnatural Narratives, Unnatural Narratology. Jan Alber and Rüdiger Heinze (eds). de Gruyter, Berlin. 23–40.
- [16] Joseph Seering, Michal Luria, Geoff Kaufman and Jessica Hammer. Beyond Dyadic Interactions: Considering Chatbots as Community Members. In CHI '19, Proceedings of the CHI Conference on Human Factors in Computing Systems. Carnegie Mellon University, May 2019. Paper 450. 1–13 DOI: <https://dl.acm.org/citation.cfm?doid=3290605.3300680>
- [17] Emily Short. 2018. Restless. In Emily Short's Interactive Storytelling: Narrative in Games and New Media. <https://emshort.blog/2018/11/01/restless>.
- [18] Emily Short and Tea-Powered Games. 2018. Restless. [PC] Tea-Powered Games, London & Oxford, UK.
- [19] Patricia Stokes. 2006. Creativity from Constraint: The Psychology of Breakthrough. Springer, New York, USA.
- [20] David Streitfeld. 2018. Computer Stories: A.I. is Beginning to Assist Novelists. New York Times. 18 October. New York.
- [21] Vernor Vinge. 1993. The Coming Technological Singularity: How to Survive in the Post-Human Era in Vision-21. NASA, Westlake, Ohio. 11–23.
- [22] Martin Warren. 2006. Features of Naturalness in Conversation. John Benjamins Publishing Co, Amsterdam.
- [23] Joseph Weizenbaum. 1966. ELIZA - A Computer Program for the Study of Natural Language Communication Between Man and Machine. Communications for the Association of Computing Machinery. 9, (1): 36–45.
- [24] Sven Wilke and Leonid Berov. 2018. Functional Unit Analysis: Framing and Aesthetics for Computational Storytelling. In 7th International Workshop on Computational Creativity, Concept Invention and General Intelligence. C3GI, 1–11.