Authoring Interactive VR Narratives on Baba Yaga and Bonfire

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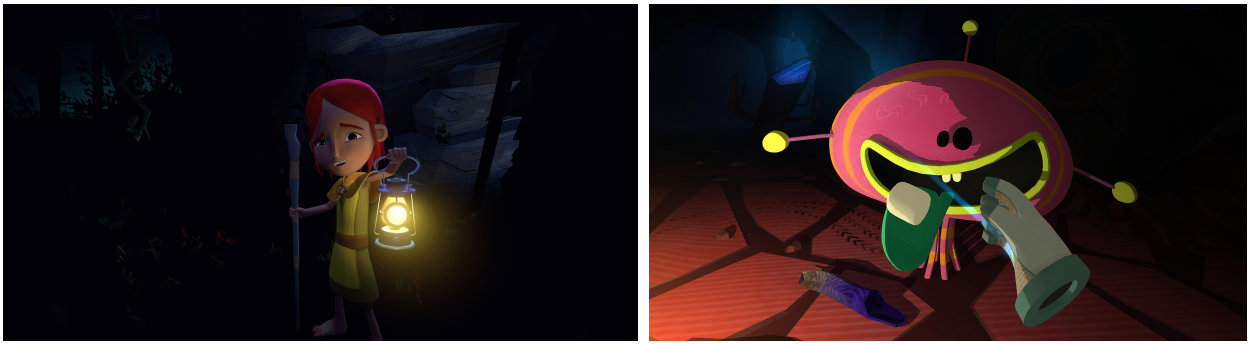

Figure 1: Images captured directly from a VR headset for the interactive VR narratives Baba Yaga (left) and Bonfire (right). Images ©Baobab Studios, Inc.

ABSTRACT

Virtual Reality (VR) is a transformative medium for storytelling where we can place you, the audience, directly inside the story and make you matter. We do this by giving you a role to play and empowering you to interact and build relationships with characters in the story. We present our experiments and learning in authoring interactive VR narratives across our two most recent projects: *Baba Yaga* and *Bonfire*. We showcase our Storyteller toolset for creating non-linear stories where interactivity is immersive. We then provide insights into creating emotive characters with the same quality character performances as in our hand-crafted linear animations.

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1 MAKING YOU MATTER IN VR

Virtual Reality (VR) has the potential to immerse you, the audience, directly into the story in a way that makes you matter. We achieve this by giving you a role to play and then empowering you to interact with the characters and to participate in the story. If the characters in VR are alive with thoughts and emotions, it creates the opportunity for you to develop a meaningful relationship with them. The arc of your relationship can even vary depending upon the choices that you make as the story is revealed.

We present our experiments in making you matter across our two latest VR stories *Baba Yaga* (2020) and *Bonfire* (2019). We highlight our Storyteller toolset for authoring non-linear, interactive narratives and techniques for creating emotive character AI.

Baba Yaga reinvents the ancient Eastern European folktale with themes of self-sacrifice and environmental conservation. You play the protagonist, Sasha, who along with your sister Magda will stop at nothing to cure your sick mother, even if that means venturing alone into the enchanted forest to face Baba Yaga.

In *Bonfire*, you play the hero character, Space Force Scout 817, who must make a difficult choice about the future of the human race. At its core, this piece is about you building a meaningful connection with a virtual character, specifically an alien life-form named Porkbun. You engage with Porkbun as he progresses through distinct stages of emotional engagement with you, ranging from suspicious, to curious, to hungry, to playful.

2 INTERACTIVITY IS IMMERSIVE

Interactivity plays a central role in creating immersion in *Baba Yaga* and *Bonfire*. You are able to interact throughout the experience with the characters and the environment. For example, in *Bonfire* you can interact with a small set of objects, such as compact nourishment cylinders, logs, scanner, and sticks, but they are always active throughout the story. In contrast many VR experiences are prescriptive and turn off or limit functionality during narrative sections of the story where interactivity is not important. This breaks immersion.

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Our interactive VR projects have a non-linear story structure that can vary widely depending upon the range of possible actions you take. Adopting the above methodology allows for flexible, rich interactions, where the characters and the environmental elements can always be "alive" and reacting to your decisions and participation. We handle all the edge cases and permutations so that interactivity adds to the immersion and feels seamless throughout the experience.

To author this type of interactivity, we draw inspiration from stand-up comedy sets which are flexible based on audience participation. Stand-up comedy routines are structured into **sets**, a standalone section of the performance, **chunks**, a single topic within the set, and **bits**, individual jokes within the chunk. Comedians can skip, reorder, and modify chunks and bits within a set based on audience participation.

This chunks and bits structure permeates all aspects of our projects, from the script and interactivity design, to animation, to our game engine toolset. Our director has adapted his script writing process and now works with our interactivity team to organize each scene into chunks and bits. The "interactive" script is then turned into an interactive design which translates the story into low-level specifications for the interactivity. Figure 2 shows a snippet of the interactive script and design diagram on *Baba Yaga*.

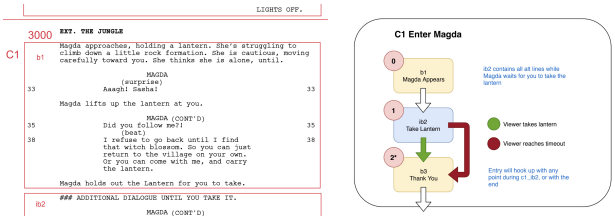

Figure 2: The chunks and bits structure is incorporated into the VR script and is then translated into an interactive design.

We have built a system Storyteller to author non-linear VR animated content so that artists and engineers can easily encode the interactive designs in the game engine. Storyteller was initially developed for *Bonfire* and then augmented significantly for *Baba Yaga*. Storyteller is bullt on top of NodeCanvas and allows our team to translate the chunks and bits into hierarchical behavior trees. A behavior tree is a directed tree where nodes are typically classified as root, control flow nodes, or execution nodes (i.e. tasks).

In our interactive stories, behaviour trees act as brains of the experiences - they monitor game states, evaluate triggering conditions and orchestrate story chunks and bits to happen at the right moment. Behavior trees are well suited for our problem space as multiple branches of the tree can be running at the same time. Storyteller supports nested behavior trees, which makes it possible to reuse repeatable bits and hides complexity from artists until needed. Figure 3 shows a set of high-level chunks and container bits for a sequence within *Bonfire*.

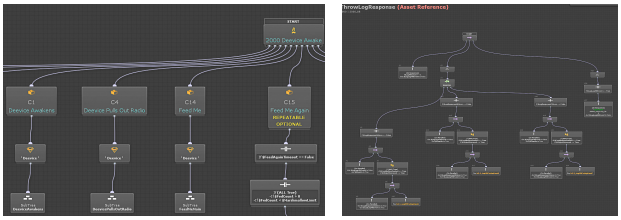

Figure 3: A Behavior Tree encoding a sequence of Bonfire with the set of chunks that comprise the sequence (left) and a subtree for the bits within a single chunk (right).

3 EMOTIVE CHARACTER AI

In *Baba Yaga* and *Bonfire* the characters have AI brains that generate autonomous behavior based on your actions. A key innovation with our character AI is that it generates procedural animation that has the same quality character performances as our hand-crafted, straight-ahead animation.

For *Bonfire* Porkbun's AI brain has a set of high-level needs and emotions, such as hunger and trust. Porkbun reacts dynamically to whatever the user does. We encoded Porkbun's personality in our AI systems. For example to emote suspicion, Porkbun uses eye contact to always lock on the viewer. He never turns his head or eyes away from you even when backing up. The AI brain learns and remembers over time based on your decisions. Porkbun will duck and become more suspicious if you throw a burning log at him but will become more trusting when you feed him a compact nourishment cylinder. Porkbun's AI is always active throughout the entire experience and generates emergent behaviors so that everyone's experience is unique.

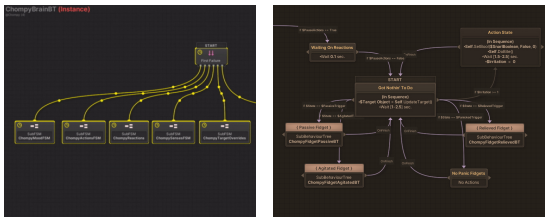

Figure 4: A character AI system for Baba Yaga. (left) A Behavior Tree that is running a set of nested Finite State Machines in parallel. (right) One of the nested Finite State Machines.

On *Baba Yaga*, you and Magda deepen your relationship over the course of the experience as you venture into the forest and confront Baba Yaga. To support this, we augmented Storyteller to provide full support for Finite State Machines (FSMs) and to nest FSMs inside of Behavior Trees and vice versa. FSMs are an important tool for easily creating character AI systems. This combination enabled us to build our character AI systems for Magda and other characters directly as part of Storyteller as opposed to in a separate bespoke system. Figure 4 shows the character AI system for an AI forest plant implemented as a Behavior Tree that runs a set of nested FSMs in parallel.