Future-Mine VR as Narrative Decision Making Tool

Tomasz Bednarz
CSIRO Data61 / UNSW Art & Design
Sydney, NSW, Australia
tomasz.bednarz@siggraph.org

Daniel Filonik
UNSW Art & Design
Sydney, NSW, Australia
d.filonik@unsw.edu.au

Amy Buchan
UNSW EPICentre
Sydney, NSW, Australia
amybuc6@hotmail.com

Lucy Ogden-Doyle
UNSW EPICentre
Sydney, NSW, Australia
lucyod10@gmail.com

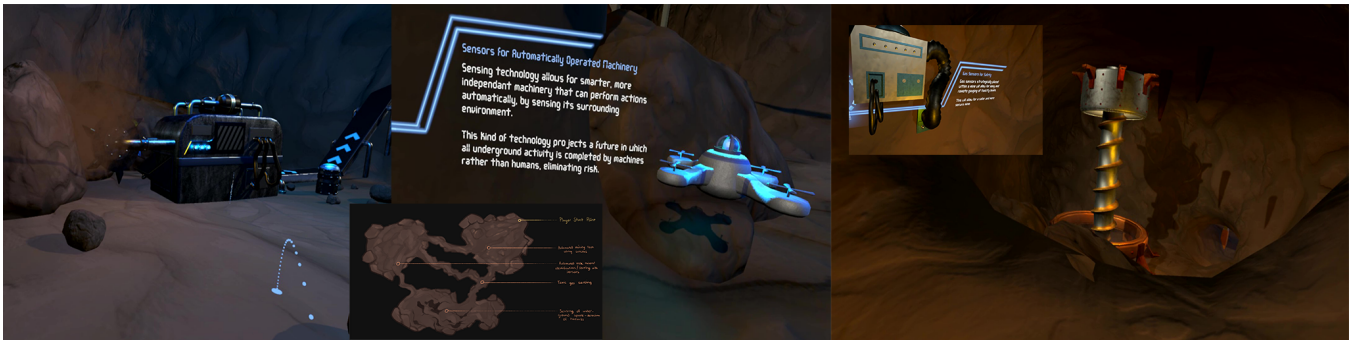

Figure 1: Future Mine Virtual Reality Scenario and Concept Design

ABSTRACT

This work presents a narrative story of a Future Mine scenario that uses Virtual Reality as a medium to replace traditional spreadsheet-based policy making framework currently widely used in government agencies for decision making process. The scenario presented envisions user exploring underground mine, where extraction processes had been almost fully automated, and environment is constantly monitored by a variety of modern and futuristic sensors. The use of story-telling using VR is explored to present novel application scenarios for sensing technologies and to facilitate better understanding of the context in which they will be used. Further the experience is translated into informed decision making.

CCS CONCEPTS

• **Human-centered computing** → **Virtual reality**;

KEYWORDS

virtual reality, informed decision making, storytelling, interactive design

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1 CONCEPT

Government decision makers are faced with the challenge of having to devise policies for increasingly complex and sophisticated technologies, such as sensor systems and autonomous systems [3]. To make informed decision about what type of sensors to invest in, it can be necessary to study the details of each proposal, which often requires in-depth specialist knowledge that they not necessarily have. Those decisions can enable the development of new products and services to create jobs. Therefore, it is essential to experience the proposed technological developments, and understand the effects that they might have in a specific technology-application context. This project explores the use of Virtual Reality (VR) to visualize future mine scenario for sensor systems through an immersive environment driven by visualizations carried out using HTC Vive or Microsoft Mixed Reality. The immersive quality of the presentation is intended to better illustrate and conceptualize the expected benefits from investing in sensing technologies in the application scenario. In particular, one key challenge are complex dynamics that arise from closely interrelated real-world systems. Immersive environments enable users to explore these relationships through interaction and simulation. Rather than merely reading a textual description, decision makers get a chance to experience them first

hand [5].
The scenario in this study is based on a proposed real-world policy making framework for prioritizing choose of sensor systems for R&D investments. The original framework comprises a total of 10 potential application areas, along with an orthogonal set of evaluation criteria focused around innovation and economic growth when sensors are applied measuring their benefit for society and business. This demonstration paper focuses on the application of sensors in the context of *Smart Mining*.

2 IMPLEMENTATION

The project included design and art led approaches: art concepts and sketches were produced in iterative brainstorming sessions after extensive references gathering. The development procedures included rapid prototyping, modeling, and expert review sessions to converge to a final visual and interactive setting.
For the environment, we chose a stylised, artistic interpretation over photorealistic rendering. The artistic freedom allowed for more creative interpretation, and stimulating the imagination. We aimed to explore VR as a storytelling medium, and as a medium for conveying information - individuals looking for an engaging narrative experience will find a more stylized visual aesthetic more easily digestible. We also wanted to explore the potential of a more stylized environment to be engaged with in this medium which makes the environment feel so real.

2.1 Implementation

Future-Mine VR was designed for use in a room scale HTC Vive, but also works with Microsoft Mixed Reality devices. The following software packages were used in design and development process: game design (Unity3D), VR (Steam VR and VRTK, Text Mesh Pro), modeling (Autodesk Maya), texturing (Substance Painter), image editing (Adobe Photoshop) and audio editing (Audacity). The VR scenes have the Open Sound Control (OSC) integration implemented, allowing translating real-world sensor data from physical environment to virtual environment, grounding the application scenario in reality (if needed) [1, 2, 4].

2.2 Design Process

The initial designs for the Future-Mine environment envisioned users exploring an underground mine, where extraction processes had already been almost fully automated, and were constantly monitored by a variety of modern and futuristic sensors. The terrain of the cave was modeled first. The model was based on previously developed concept art, and implemented into Unity3D so that we could begin preliminary testing of scale and atmosphere in VR. When this was acceptable we refined the model and UV unwrapped it. For texturing a base rock texture was created in Adobe Photoshop, making it seamless so that we could apply it in Substance Painter. Using it as a base material we added details and painted over the seams. Once this was completed we exported for Unity3D, creating three material maps: albedo, metallic and normal. In Unity3D, these maps were applied to a material attached to the mesh, completing base of the main scene.

The future mining machines were the next step in modeling. Initially, reference images of existing mining machinery and equipment were investigated. Subsequently, based on these images, we created our own artistic interpretations of various objects in the form of sketches. Finally, they were modeled in 3D modeling software. This process ensured that the objects looked familiar, while at the same time providing a more modern and futuristic vision. This was important to underscore the narrative of future sensing technologies in a mining environment, and ensured a consistent and engaging visual style.

These were some of the most complex models that were tackled in this project, as it was important that they had detail and interest in order to draw attention from the audience. We scripted the information overlays to appear upon approach, so that users could learn in what way the sensors related to these machines or objects were working. It was primarily through these overlays that we communicated this information.

3 DISCUSSION

The project highlighted several interesting tensions that arise when designing VR environments to inform policy making. For one, the choice between aesthetics and accuracy can be challenging. Open questions remain regarding the extent to which a stylised representation might misrepresent a potential application scenario. Most play-testers found the stylised representation to be visually appealing and associated it with a positive user experience, suggesting that it successfully captured their interest and affected their engagement with the proposed Future Mine scenario. However, some critical comments were also raised about potential to mislead, by presenting unrealistic or idealized images. At the same time, questioning the validity of the artistic representation suggests that users actively engaged with the subject matter of the application. Future work should also include extensive Human Computer-Interaction experiments to measure the potential of storytelling in VR to influence policy makers, as well as facilitate consensus from storytelling in VR to unify understanding of the context among decision makers with different knowledge backgrounds. The experience gained during the VR exposure can lead to better understanding of the context of presentation, and ultimately provide effective tool for more informed decision making.

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