Rulemaking as Play:

A Transdisciplinary Inquiry about Virtual Worldmaking

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Abstract

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In the age of computing, we rely on software to manage our days, from the moment we wake up until we go to sleep. Software predicts the future based on actualized data from the past. It produces procedures instead of experiences and solutions instead of care. Software systems tend to perpetuate a normalized state of equilibrium. Their application in social media, predictive policing, and social profiling is increasingly erasing diversity in culture and identity. Our immediate reality is narrowing towards cultural conventions shared among the powerful few, whose voices directly influence contemporary digital culture. On the other hand, computational collective intelligence can sometimes generate emergent forces to counter this tendency and force software systems to open up. Historically, artists from different artistic moments have adopted collaborative making to redefine the boundary of creative expression. Video Gaming, especially open-world simulation games, is rapidly being adopted as an emerging form of communication, expression, and self-organization. How can gaming conventions such as Narrative Emergence, Hacking, and Modding help us understand collective play as countering forces against the systematic tendency of normalization? How can people from diverse backgrounds come together to contemplate, make, and simulate rules and conditions for an alternative virtual world? What does it mean to design and virtually inhabit a world where rules are rewritten continuously by everyone, and no one is in control?

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Chapter 1

INTRODUCTION

Introduction to the Problem

Background to the Problem

Homogenizing Culture

The 21st century has witnessed unprecedented growth in artificial intelligence (AI) research, particularly in machine learning (ML), a subfield that has garnered increasing interest from both the technology and cultural industries. The global market demand for ML will grow from $21.17 billion in 2022 to $209.91 billion by 2029. Rapid progress in computer vision and natural language processing enables us to enjoy the convenience of automation. However, in past decades, research in critical computing culture has questioned the increasingly predatory behavior of ML—more specifically, how it influences cultural shifts through an increasingly ubiquitous yet withdrawn presence within everyday communication. For example, Ananny and Crawford (2016) questioned the limitations of the transparency ideal and its impact on the limitation of external governance of algorithmic platforms. Mackenzie (2008) questioned how contemporary economic theories, based on mathematical models of markets, are not simply external analyses but also intrinsic forces shaping economic processes. Eslami et al. (2015) described how algorithmically filtered social media feeds, recommendations, and personalized search results shape users' experiences without awareness. Browne (2015) examined contemporary surveillance technologies concerning the history of racial formation, and technological approaches for policing Black life under slavery, such as branding, runaway slave notices, and lantern laws.

Within the visual culture industry, an example of predictive computing that emerged recently is the phenomenon of *Crapstraction*. Jerry Saltz, the winner of the 2018 Pulitzer Prize for

criticism, highlighted a disheartening trend in the online art auction market (see Figure 1). According to Saltz, artists increasingly turn against authenticity, mimicking a high-reward, low-risk, decorative art style that speculative art collectors and their friends trade online. Best-selling artworks look disarmingly similar, all conveniently tailored for online auctions—"frictionless, made for trade. Art as bitcoin" (Saltz, 2014, p. 1).

The commodification of artistic creativity alone is not a new problem. In every period of art history, the market value of a particular type of visual style tends to be overmined at the expense of the others, such as Impressionism in the 1800s, Expressionism in the 1900s, Pop Art in the 1950s, and Minimalism in the 1960s, among others.

Figure 1. Selected Bestselling Works Through Online Auction
Top row, from left: “All You Hear Is Beads Rattling” (2012), by Leo Gabin;
“Untitled #0904” (2009), by John Bauer; “Untitled (JS06198)” (2006), by Josh Smith.
Bottom row: “ST-AA (Transfer Series)” (2013), by Angel Otero;
“Big Squid Ink” (2014), by Jamie Sneider; “I” (2011), by Rosy Keyser.
https://www.vulture.com/2014/06/why-new-abstract-paintings-look-the-same.html

However, according to artist and philosopher Hito Stereyl (2020), what is new about Crapstraction is the emergence of online auction platforms and an invisible force of steering hidden behind the graphical user interface, in the form of reductive logic transcoded into software code running on modern-day personal computers.

Reductive Logic

Understanding a dataset often begins with grouping unlabeled raw data points, also known as clustering. Figure 2 demonstrates clustering analysis using the Gaussian algorithm.

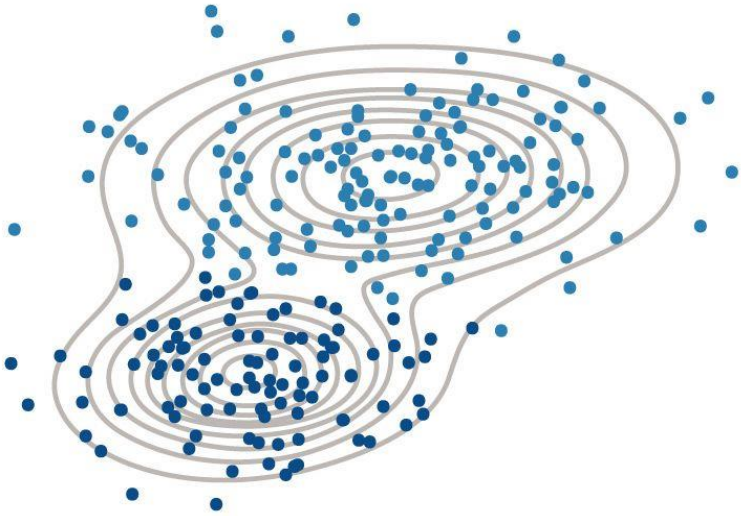

Figure 2. Contours of a Standard Gaussian Cluster Density Estimate
Author Unknown
https://www.mathworks.com/dis,covery/cluster-analysis.html

The raw data may have been gathered from user interactions with software or online sources like e-commerce websites. As part of the process, a few significant clusters are created, and data within proximity to each cluster are grouped. Then, a labeling algorithm is performed on each collection, selecting a singular point from each cluster. Finally, a complete data set is reduced to a few key points, as the rest are disregarded.

Clustering analysis has a vast technical application, one of which is image compression. A digital image consists of three channels, RGB, each having values ranging from 0 to 255. Therefore, any digital image can have up to 255*255*255 different color fields. As an example, the image below contains 16,777,216 color fields. We aim to reduce its file size by representing

only 16 color fields. With the smaller number of color clusters, the image compression algorithm offers a higher compression ratio at the cost of image quality (neptune.ai, 2021).

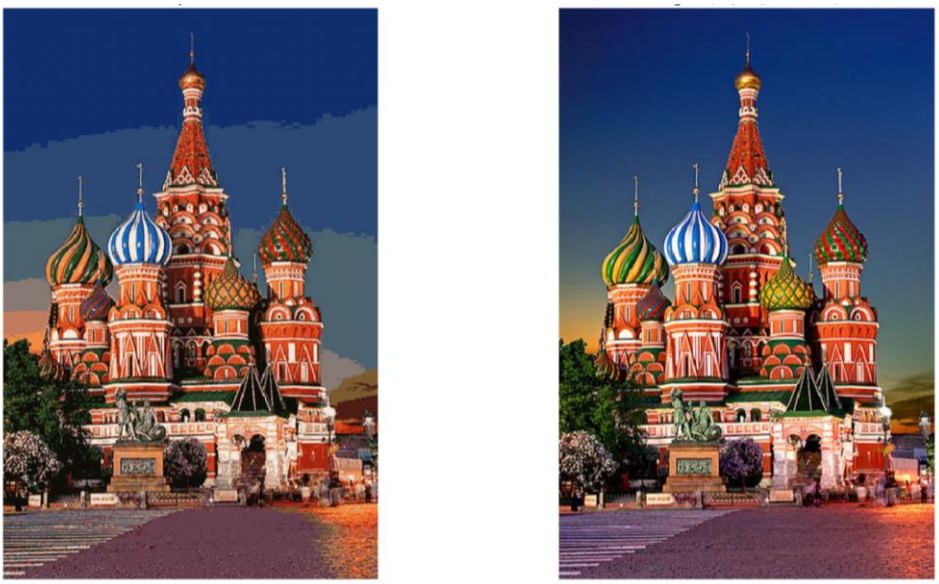

Figure 3. Compressed Image using K-means-clustering Algorithm,
with K set as 16 colors (Sakshi, 2020). Original Image containing 16,777,216 colors.
https://github.com/sakshi13-m/Image-Compression/blob/master/completed_notebook.ipynb

As personal computing becomes ubiquitous, the volume of personal data grows exponentially. As a result, more sophisticated clustering algorithms are required to process complex datasets. Data clustering is just the first step in a more complex ML process, allowing similar data to be processed more efficiently in the subsequent steps.

On the other hand, an autoencoder is an artificial neural network that could be considered one of the more advanced clustering methods used in algorithms, like facial recognition and machine translation. Deep autoencoder networks are used in unsupervised learning mode for dimensionality reduction. In Figure 4, when interacting with software, the users' faces are captured as a digital image and delimited with a bounding box (see input layer). Then, the input

layer is compressed via a three-layered Convolutional Neural Network (CNN). It performs hierarchical facial feature extraction with the help of an autoencoder (see hidden layers 1 and 2), and then recomposes the faces together using an autoencoder (see hidden layer 3). By shrinking image input into simpler, more abstract vector forms, the algorithm minimizes the time needed for pattern matching. However, more granular levels of details are also filtered out.

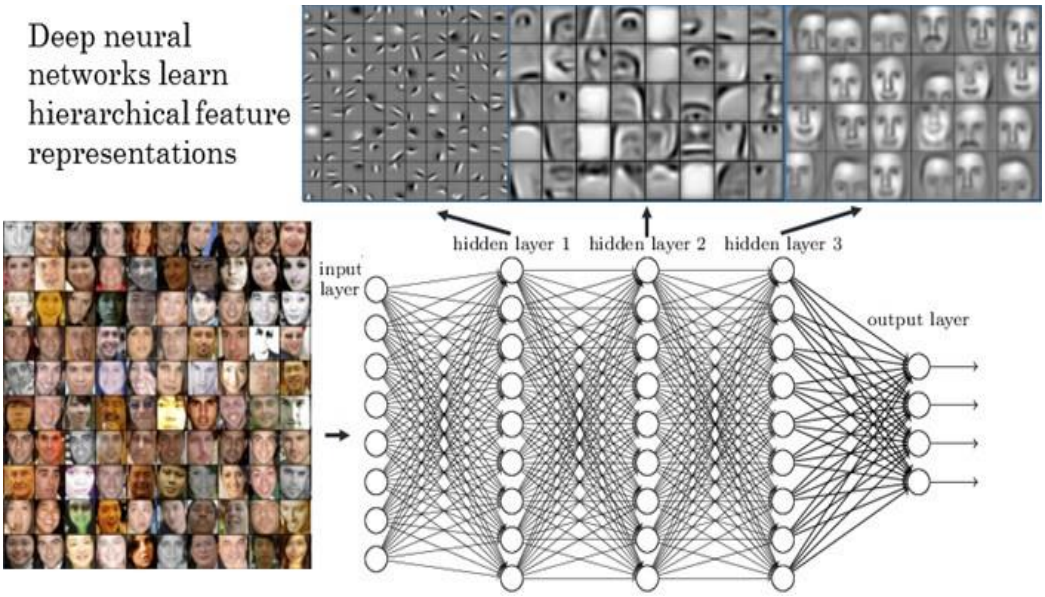

Figure 4. An Illustration of How a Three-layered Convolutional Neural Network (CNN) Performs Hierarchical Facial Features (Fenjiro, 2019) https://medium.com/@fenjiro/face-id-deep-learning-for-face-recognition-324b50d916d1

Culture Filtering

The cluster, label, and compression process has a wide application. Because of its exceptional data-processing ability, clustering is widely used for pattern recognition, feature extraction, vector quantization, image segmentation, function approximation, and data mining, among others (Du, 2009). In addition, the algorithm which makes content recommendations, namely the Recommender system, plays an essential role in social media platforms such as YouTube and Netflix (Ricci et al., 2015). Clustering is often the preliminary step used by various

Recommender systems to increase the accuracy of the prediction (Beregovskaya & Koroteev, 2021).

In the case of image compression, it helps reduce the size of the images without visibly degrading the compositional quality of the picture, which is crucial in industries like healthcare, where enormous numbers of medical images need to be archived daily. However, when reductionist algorithms are integrated into the core logic of communication platforms that hold the power to steer cultural trends and influence ideologies, problems emerge. ML techniques arise primarily from statistical methods invented based on information theory. Data points that do not offer significant explanatory power to historical patterns, but might significantly influence the potentiality of the system, are deemed unessential and deleted. Therefore, we rely on a mode of forecasting that determines the future based on the past, trapping us inside the perpetual loop of reduction and abstraction. As internet activist and author Eli Pariser (2011) put it, what is troubling about this shift toward personalization is that it is largely invisible to users and, as a result, out of our control. We are unaware that we see increasingly divergent images on the Internet. The Internet may know who we are, but we do not know who it thinks we are or how it uses that information. Technology that gives us more control over our lives is taking control away.

Overall, technology has greatly improved the efficiency and productivity of various aspects of our lives. The desire for control is often linked to the pursuit of optimization in work, communication, and everyday tasks. Automation, data analytics, and digital tools enable individuals and organizations to manage resources, time, and processes more effectively. However, this efficiency is achieved at the cost of reductionism. Technologies often simplify complex natural and social processes or systems into isolated components, which lead to a

reductionist understanding of nature and culture. This approach may overlook the intricate interconnections and dependencies, resulting in an incomplete or distorted understanding of the world. Globalization, facilitated by technology, can contribute to the homogenization of cultures by encouraging the spread of dominant cultural practices, values, and products.

Emergence in the Physical World

Against the backdrop of the prevailing practice of technological control, there has been an increasing interest in studying emergent systems in recent years. Emergence is a phenomenon where complex systems and patterns arise from the interactions of simpler components within a system without the need for external control or direction. It refers to the appearance of new properties or behaviors at a higher level of organization that is not present in the lower-level components themselves. Emergence can be observed in various fields, including physics, biology, social sciences, and computer science, and has been studied extensively in the context of complex systems and artificial intelligence. Many challenges society faces today, such as climate change and economic inequality, involve complex, interconnected systems. Understanding emergent behavior can provide valuable insights into these complex systems and help develop more effective solutions. The availability of large datasets and advances in computational power have made it possible to model and simulate emergent systems with greater accuracy and detail. This has led to increased interest in studying emergence to understand better the dynamics of complex systems.

Moreover, emergent systems are found across various disciplines, including art, technology, sociology, education, and computer science. The study of emergence fosters interdisciplinary collaboration and can lead to new insights and breakthroughs by bridging gaps between different fields of study. Emergent systems often involve decentralized, self-organizing

processes that can have advantages over centrally controlled systems. Studying emergence can help us better understand decentralized systems' potential benefits and challenges, such as in developing distributed computing, blockchain technology, or self-organized social structures. Emergent systems are often more adaptive and resilient to change, as they can self-organize and evolve in response to new conditions or disruptions.

Some scholars have drawn from research on emergent systems and gained insights into designing systems better equipped to handle uncertainty and change. For example, Christopher Alexander (1987), architect and design theorist, has advocated the practice of urban design as a "pattern language" of smaller, interconnected patterns, emphasizing the creation of organic, human-centered environments that foster a sense of community. Stuart Kauffman (1993), biologist and complexity researcher, has significantly contributed to understanding emergent properties in genetic regulatory networks. He proposed the adjacent possible theory, suggesting that innovations or possibilities can arise only from what is already in place or "adjacent" to the current state. In other words, the future state of a system or network is simultaneously constrained by, as inspired by, potentialities of a system that were not possible before. John H. Holland (1992) argued that emergent phenomena arise when complex systems, such as artificial intelligence systems, interact with their environment and other systems in ways that cannot be predicted solely by analyzing the individual components. He also noted that emergent properties often result in behaviors or patterns that are not present in the individual components or the environment alone, and these emergent properties can significantly affect the overall behavior and performance of the system. Economist Eric Beinhocker (2006) also argued that the economy and economic systems are complex adaptive systems that can be studied using concepts from evolutionary biology, complexity theory, and behavioral economics. Beinhocker asserted that these systems are not

solely determined by rational decision-making but are shaped by the interactions between individuals and their environment. He proposed a new economic paradigm that embraces complexity and emergence instead of the traditional economic models that assume rational behavior and equilibrium. Historically, emergence has also served as a powerful form of creation in art making. Flux artists such as John Cage, Yoko Ono, and conceptual artist Sol Lewitt have pioneered various forms of rule-based making. Artists design an initial set of abstract procedures, later carried through by partly serendipitous audience actions. Because of the idiosyncrasy introduced by impromptu audience input, collaborative making has generated creative and artistic outcomes beyond the creativity of individual artists alone.

The Complexity of Virtual Worlds

With the popularization of the internet, complex social activities are increasingly facilitated by technological platforms. For example, Instagram, one of the most popular social media platform among teens, now features user-contributed filter effects, which millions of other users use to generate augmented personal selfie effects. Several scholars have contributed to studying social complexities in the virtual world. For example, Jane McGonigal (2011) argued that games are a source of positive emotion, motivation, and social connection and can be used to solve real-world problems. Sherry Turkle (1995) explored how people use virtual worlds to experiment with different aspects of their identities and relationships and how this can impact real-world interactions. Henry Jenkins (2006) examined how virtual worlds and other forms of media can be used to create participatory cultures that foster creativity, collaboration, and social change. These scholars emphasized the importance of understanding virtual worlds as distinct social and cultural phenomena that offer unique insights into human behavior, society, and

culture. They also highlighted the potential of virtual worlds to serve as platforms for experimentation, innovation, and social change.

However, despite being given seemingly new modes to interact with digital narratives on a mechanical level, players are increasingly under technological control. Unlike social interaction in the physical world, which is largely face-to-face, interactions in the virtual world are heavily mediated by digital interfaces designed to reinforce certain power relations and social hierarchies. The design of interfaces shapes player interaction with technology and can have significant political and social implications. For example, in the popular sandbox game Minecraft, players can gather natural resources, such as wood and stone, and use them to craft tools, weapons, and other items. These items can then be used to build structures, dig tunnels, and fend off competitors. The game design internalizes a capitalistic extraction and competition value. This value affects players' understanding of the virtual world and offers them little room to challenge it. Lastly, unlike in a physical society, where most rules and social contracts are published, the rules of software platforms, including video games, are not visible to most players. In a virtual world, the rules facilitating interactions of agents are transcoded into algorithmic languages, or codes, and stored in hard disk drives. Once published, it is hard for most players to contribute to closed-source video game platforms on a rulemaking level. Therefore, participatory culture in the virtual world remains largely in the form of an audience clicking buttons to inactivate complex procedural narratives made by a small group of designers and developers. Despite the abovementioned challenges, virtual worlds change due to player activities. In multiplayer online games, spontaneous, unexpected behaviors, interactions, and phenomena arising from the complex interactions among players, the game world, and the game mechanics take place in several forms, such as narrative emergence, hacking, and modification, among others.

Problem Statement

Technological platforms are not neutral. They tend to perpetuate normalized states. Collective actions from within can sometimes generate emergent forces to counter this tendency and force it to open up. As software infrastructure becomes increasingly pervasive in effect and withdrawn in presence, how might a group of individuals from diverse backgrounds come together to activate conditions for a different kind of creative collaboration in the virtual world—one that is enabled instead of controlled by networked software? What might it mean to inhabit a virtually simulated world where everyone constantly rewrites the rules and no one is in control?

Research Questions

As software culture increasingly limits human input, personal experiences are becoming more constrained. This trend prompts questions about how alternative modes of play, such as rule making, affect virtual worldmaking. To investigate this issue, six participants with backgrounds in art, science, and technology were recruited for a study involving an open-world simulation game specifically designed for this research. The aim was to examine how participants' past experiences with computer games influenced their sense of control and agency in a networked narrative environment and their understanding of computational worldmaking more broadly. The resulting data will inform the design and implementation of a multidisciplinary worldmaking course for higher education hosted by an art school and jointly attended by art, architecture, and engineering students in a university setting.

Research Methods

As the researcher, I conducted a qualitative, action-based research study that was comprised of a series of participatory-based artistic interventions in making, playing, and discussing virtual worldmaking. Drawing from my professional experience designing,

developing, and teaching simulation art and interaction design for almost 10 years, I designed a research instrument inspired by open-world simulation games.

An open-world simulation game is a video game with a multiplayer, immersive, and explorable world where players can choose their objectives, missions, and paths. These games often provide a nonlinear gameplay experience, allowing players to explore the environment at their own pace and make decisions that can impact the game world, characters, and storylines.

In conventional open-world simulation games, players rely on digital interfaces to participate in a virtual world by using various input devices, visual representations, and auditory cues to interact with and navigate the game environment. These interfaces act as a bridge between the player and the virtual world, enabling them to communicate their intentions and receive feedback from the game. More specifically, players use input devices such as keyboards, mice, game controllers, touchscreens, and motion-sensing devices to send commands and control their in-game characters or objects. These devices translate the players' physical actions into digital signals that the game can understand and respond to. In addition, graphical user interfaces (GUIs) and heads-up displays (HUDs) present essential information to the players, such as health bars, maps, inventory, and quest logs. These visual elements help players understand the game world, their progress, and their objectives, making it easier for them to interact with and navigate the virtual environment. Moreover, sound effects, music, and voiceovers contribute to the overall immersion and provide essential feedback to the players. Audio cues can inform players about their actions, the presence of nearby characters or objects, and changes in the game world, helping them make decisions and adapt their strategies. The design of a game's interface, including its layout, color scheme, typography, and visual elements, plays a crucial role in enabling players to understand and engage with the virtual world. They, directly and indirectly, shape players'

understanding of the fundamental notion of the virtual world, as well as the players' sense of agency within it.

Instead of a conventional digital interface design, I designed the research instrument with an alternative approach. Drawing from digital text editors and APIs (Application Programming Interfaces), the research instrument creates a flat, transparent environment of play. It allows players to create new content, modify existing assets, or alter the rules of the game completely. This interface design enables simple asset editing as well as generating more complex behaviors or system outcomes. The objective is to allow players to participate in worldmaking by directly accessing and defining the rules of play instead of relying on conventional approaches of digital interactivity mediated by digital interfaces.

Once the research instrument was developed, I invited participants to conduct playtests and interview sessions. They compared their experience of worldmaking using the research instrument to other forms of digital play they have experienced in the past. Finally, I analyzed the data collected thematically and reflected on the research instrument's value for contributing to critical computing culture and media art education.

Limitations

There are several potential limitations of the study.

Field of Study

First, the research focused on a relatively new and unexamined area of study, which may lead to a lack of existing research and resources from which to draw. Although digital interactivity has deeply informed information control, communication, and entertainment, its practice as an academic discipline is relatively new. In 1999, the publication of *The Language of New Media* marked the first widely discussed definition of new media in the media studies field.

The usage of “New Media,” arguably the acronym of interactive media, reflects the fragmented and decentralized nature of the field’s current state of development. Today, digital interactivity continually draws theoretical foundations and modes of practice from adjacent areas such as visual and performing arts, computer sciences, psychology, system design, media studies, and philosophy. The rapidly shifting landscape and the multidisciplinary nature of digital interactivity make it a challenging research topic.

Researcher’s Role and Involvement

In addition, I designed and developed the custom simulation platform as the research instrument for the study. I drew from my personal and professional experience designing, playing, and teaching interactive media for almost 10 years. I may have an inherent bias towards certain aspects of the game, which may have skewed the results.

Participants’ Role and Involvement

The study participants self-identified as simulation video game players, which may have resulted in a lack of diversity and limited the generalizability of the findings. This may have led to a less diverse group of participants and potentially biased results. The study used a small sample size of six participants, which may also have limited the generalizability of the findings.

Research Methodology

The subjective nature of qualitative research may have limited the objectivity of the results. Furthermore, the study relied on a case study method with inherent limitations, such as the lack of control over events or problems.

In addition, studying interactive media requires hands-on making knowledge. As much as I utilized clear and descriptive language to describe specific interactive and simulation

experiences used as references in this dissertation, there was a limitation to describing the experience of playing a video game in words alone.

Educational Implications

Despite a growing shift towards multidisciplinary and interdisciplinary approaches in recent years, today's educational environment is predominantly designed around single-discipline subject areas. As human knowledge has expanded, fields of study have become increasingly specialized. Organizing education into separate subject areas allows for a more focused approach to teaching and learning, enabling students and teachers to develop expertise within a specific domain. Dividing education into single-discipline subjects simplifies curriculum design, assessment, and resource allocation. It can be more manageable for educational institutions to administer courses and resources when issues are separated into distinct areas.

However, many of today's challenges, such as climate change, public health crises, and social inequalities, are interconnected and cannot be fully understood or addressed through a single disciplinary lens. Multidisciplinary studies enable a comprehensive understanding of complex issues, recognizing the interplay of social, economic, political, environmental, and technological factors. This broad perspective is essential for developing sustainable solutions that consider the diverse aspects of a problem and its potential consequences. Complex issues often demand innovative solutions that draw on knowledge from multiple disciplines. Multidisciplinary studies foster creative and critical thinking by encouraging students to make connections between seemingly disparate fields, resulting in novel ideas and approaches that can drive progress and address real-world challenges.

Moreover, today's students increasingly seek holistic, experiential, and complex learning modes of study. For example, art students seek knowledge beyond how to create a single art

object. Instead, they are learning to design for systems and communities. On the other hand, technology students are actively looking for cultural engagement beyond making tools. As technology such as ML and AI rapidly develop, they want to understand the ethical and cultural implications of the tools they create.

Virtual worldmaking can serve as a multidisciplinary space for research and education by offering a virtual environment that facilitates collaboration, exploration, and learning across various fields. Virtual worldmaking encourages players to work together, communicate, and solve problems as a team. This fosters the development of essential skills such as collaboration, negotiation, and decision-making. Virtual world simulation games often incorporate realistic logic, such as physics, economics, and social interactions, that can be used to explore complex social dynamics, such as control and agency, in a controlled, virtual environment. Open-world simulation enables players to rapidly create and manipulate their settings at low cost, encouraging them to think creatively. This aspect of virtual making is crucial in disciplines such as art, design, architecture, and engineering. Multiplayer games often bring together players from diverse cultural backgrounds, promoting cross-cultural communication and understanding. This aspect can be valuable in multidisciplinary education, where collaboration between individuals with different perspectives and experiences is essential for generating innovative ideas and solutions. Virtual worldmaking is centered around player-generated content and rules, allowing players to create custom content, modify game mechanics, or even develop educational modules. This feature provides opportunities for learning and research in fields like computer science, game design, and digital media. In a virtual world environment, it is also easier to collect data on player behavior, interactions, and decisions, which can be analyzed to gain insights into various aspects of human behavior and social dynamics (see Figure 5).

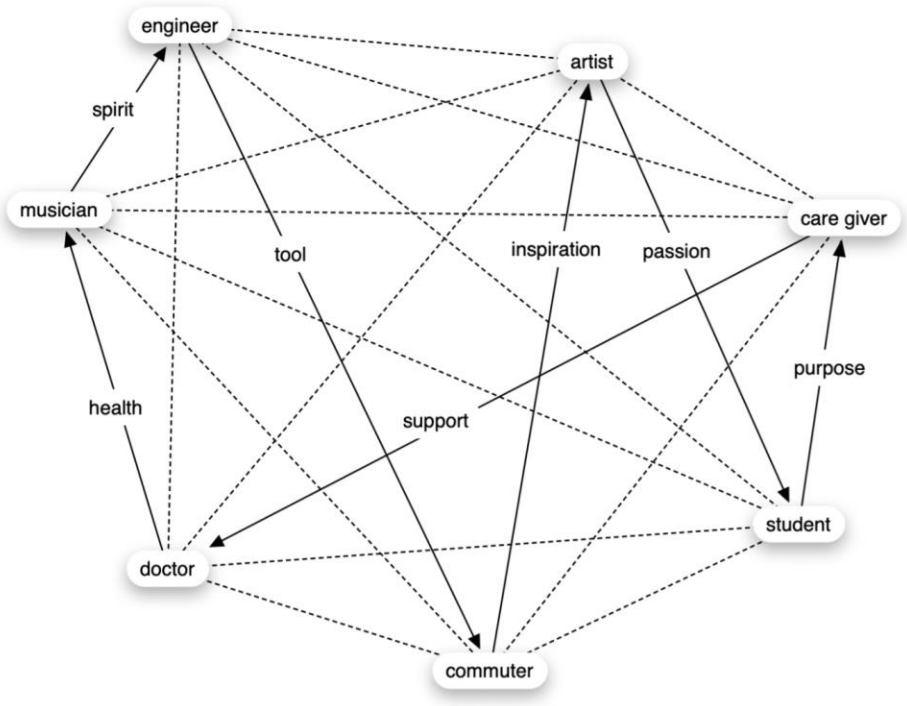

Figure 5. A Conceptual Model of Collaborative Worlding (Qi & Wang, 2021) https://rhizome.org/static-media/uploads/2_XB7DZZx.png.

Assumptions Not to Be Debated

Contemporary life experiences are increasingly prescribed, recursive, and normalizing. Stories depicted by mainstream media are increasingly divided.

Human communication is increasingly subjected to the effect of computation, either consciously or unconsciously.

There is a vast gap between participation, which has low barriers to artistic expression and technical skills, and creative expression, which is the opposite.

Online audiences are familiar with the concept of digital representation. They still need to learn how digital representation is being mediated and simulated by increasingly automated computer algorithms that are adaptive to user data and behavior.

Computational systems have become ubiquitous in our everyday lives. We now use devices like cell phones, video gaming consoles, and personal computers to interact with ourselves, others, and the environment through various computational interfaces.

Aside from using computational devices as practical tools, we increasingly use them to generate experiences, expressions, and relationships.

Assumptions to Be Debated

Our interactions with ourselves and others are inherently interactive. However, there are various types of interactivity, including physical, mechanical, digital, psychological, emotional, and aesthetic interactivity, each with unique connections and differences.

However, just because we interact with something physically or sensorially does not mean we are necessarily interacting with it on a deeper, more experiential level.

Material interactivity is sometimes prioritized at the expense of nonmaterial interactivity, resulting in a lack of personal expression and aesthetic engagement.

Our perception and understanding of the world are essential for our sense of agency and ability to take action.

When mechanical and sensory interactivity is prioritized over emotional, spiritual, and conscious interactivity, it can limit our ability to engage with things on a deeper, more meaningful level and reduce opportunities for personal expression and aesthetic engagement.

Interactive narratives may be exciting or realistic but not necessarily meaningful to audiences.

According to existing literature, cybernetic systems maintain their normalized states through negative feedback and noise cancellation.

Designing games based on emergence theory can encourage non-experts to participate in collaborative practices that create emergent narratives.

This study's findings will contribute to the growing literature on algorithms and how they can be modified to make creative practices more accessible to a broader audience.

Personal Suitability

As a little kid, I was a ferocious collector of rubber erasers. I spent a ridiculous amount of time in stationery shops after school and on weekends. Over several years, I had mounted a formidable collection. Among them, my most prideful spoils included a tube-shaped eraser that pushes out from a plastic lipstick container, a group of sushi-shaped erasers that snuggle perfectly into a tiny sushi box, and a few limbs that fit into a rubber robot's torso. As a kid, I never used any of these collectible-grade erasers. Once in a while, I would take them out of my closet, play with them, smell their perfumes, and carefully put them back. Almost 3 decades later, I visited my grandmother and the house I lived in as a kid. My grandmother brought out my entire collection of erasers, wrapped in a few layers of greasy plastic shopping bags. Most of them have lost their ability to erase. After I became a computational artist, I made most of my work electronically. I have not used a pencil or an eraser for many years. When I reached my hand inside the greasy plastic bags, touching these stiff erasers, my eyes became wet with tears. After I wrote about my eraser moment in a Chinese art journal, some readers also contacted me. They told me about the particular experiences of losing an old sweater or hat and their immense sadness afterward. Their experiences were far more profound than the simple reactive feelings towards objects meant to shield us from the cold or be functional to us.

My encounter with these old erasers made me reflect on my experience creating, teaching, and playing experimental video games. I rarely encounter the intimate "eraser moment" in my virtual worlds. As a computational artist and technologist, I am sometimes approached to make interactive digital experiences that simulate human emotions. In 2014, after graduate school, I worked on a video game development team developing an interactive installation. I was tasked to program a particle simulation effect controlled by an infrared sensor that senses human skeleton body gestures. When audiences walk in front of the projection screen, their hand gestures allow the simulated starry sky to gravitate slowly toward their palms. This specific part of the exhibition was called Regret. The visual elements of the installation design looked very similar to a natural night sky with falling stars. I observed the audience feeling excited before the screen, devising various gestures to experiment with particle movement. However, I doubted if the audience felt a sense of regret or something else or had time to reflect on what they were feeling. As an artist, a technologist, and an educator, it is my interest and responsibility to seek a set of languages to define clearly the value of a digital interactive experience on the mechanical, psychological, emotional, and reflective levels.

In philosophy and economics, the worth of an object, product, or service is accessed by two distinctive sets of measurements called intrinsic value and exchange value. Intrinsic value refers to an object, product, or service's inherent, essential, or natural value. This value is derived from the qualities or attributes of the item, independent of its relationship to other objects or its market price. For example, the intrinsic value of a book may come from the knowledge it imparts, the emotional impact it has on the reader, or the aesthetic qualities of its prose. Intrinsic value is often subjective and may vary from person to person, depending on individual preferences, needs, or beliefs. Instrumental value, also known as extrinsic value, refers to the value of an object,

product, or service as a means to achieving a specific end or goal. This value is not inherent in the item itself but comes from its usefulness or utility in helping achieve something else. Instrumental value is often context-dependent, as it relies on the relationship between the item and the goal it serves. Examples of instrumental value include a hammer's utility for driving nails, the educational value of a textbook, or the strategic importance of an alliance between two nations.

Digital interaction and network communication technologies have revolutionized communication and access to information. However, these technologies have been primarily designed to optimize certain measurable, instrumental values rather than intrinsic values. Digital platforms often prioritize easily quantifiable metrics like clicks, views, likes, shares, and comments. These metrics can be used to gauge user engagement, but they might not necessarily reflect the depth or quality of interactions. Digital technologies are designed to maximize user engagement by providing instant gratification through likes, retweets, or other forms of social validation. These features create a feedback loop that encourages users to seek more of these short-term rewards, leading to a focus on superficial interactions rather than deep connections and meaningful experiences. Algorithms that curate content based on user preferences, past behaviors, and engagement metrics often prioritize content likely to generate the most interaction. This approach can lead to echo chambers and filter bubbles, where users are exposed mainly to content that reinforces their beliefs and interests instead of being exposed to diverse perspectives and fostering critical thinking. The primary revenue model for many digital platforms is advertising. As a result, platforms are incentivized to optimize for metrics valuable to advertisers, such as user engagement and time spent on the platform. This focus on monetization can lead to a prioritization of content that generates the most engagement, rather than intellectually stimulating or emotionally enriching content.

Taken together, the current design of digital interactive experiences foregrounds instrumental and exchange value. To shift the focus of digital interaction and network communication towards intrinsic values, players, designers, developers, and educators should work together to promote platforms and features that prioritize meaning and transparency.

Summary

Overall, this chapter offered an overview of the background of the research. The idea of perpetual newness in digital and computational media often fascinates today's digital media world. Interactive narratives are judged based on their ability to offer clearly defined qualities such as virtual and augmented reality, sensory responses, and high-quality graphics that set them apart from earlier media. However, art provides a non-objective space to explore the concept of the self, which is in constant flux and ever-evolving and never concludes. Computational media play an increasingly important role in the ongoing search for authenticity and bring new perspectives to this exploration. It is important to ask questions such as the following: Is there space for non-computability, indeterminacy, and poetics in the near future when the boundary between physical and virtual completely dissolves? In the next chapter, we explore historical trends that have shaped computational media and the effects of these forces.

Overview of Chapters

Chapter 1 introduced the problem of the study, research questions and methods, as well as educational implications and assumptions.

In Chapter 2, the literature review discusses several historical events that have played a significant role in shaping the computational medium. This chapter examines these events thematically, forming an understanding of how computational media function in today's networked society and their influence on contemporary culture.

In Chapter 3, I discuss the design of the study, drawing from design philosophies reviewed in the previous section, and establish the criteria for designing the research methodology. Additional research design considerations concerning the research objectives are also reviewed in this chapter.

In Chapter 4, I present the data collected from six participants interviewed over 3 months. Collected data were validated with each individual and then compiled into three data profiles: the Artist, the Scientist, and the Technologist (two participants for each profile). In the context of the research, the six participants are designated as A1 (Artist One), A2 (Artist Two), S1 (Scientist One), S2 (Scientist Two), T1 (Technologist One), and T2 (Technologist Two). The research instrument game is referred to as RI.

In Chapter 5, I use the findings of Chapter 4 as a basis for analyzing and considering new ways of understanding the practices and implications of virtual worldmaking. I organized the findings into five themes: Visual Narrative, Operationality, Networked Agent, Forces of Steering, and States.

In Chapter 6, I discuss the development of a course titled "Computational Studio: Simulation," designed for undergraduate students with a fine art and architectural background. The chapter includes the design structure and the educational implications of the course.

In the final Chapter 7, I present a conclusion that recaps the investigation of rulemaking as play in virtual worldmaking. It highlights the potential of gaming conventions like narrative emergence, architectural emergence, metagaming, hacking, and modding to empower individuals and communities against software homogenization. I also make suggestions for further research on collective intelligence.

Chapter 2

LITERATURE REVIEW

Introduction

Several historical events have played a significant role in shaping computational media and continue to influence the development of new media technologies and applications today. This chapter examines these events thematically, forming an understanding of how computational media function in today's networked society and their influence on contemporary culture.

The Promise

Simulation art, as a genre, explores the relationship between the virtual and the physical world through the use of computer-generated simulations. Its history can be traced back to the 1960s and 1970s, when early computer artists began experimenting with digital technology to create artworks that incorporated virtual spaces and simulated environments. The roots of simulation art can be found in the experimental works of artists who started using computers to create images and animations in the 1960s. Pioneers like Frieder Nake, Georg Nees, and Michael Noll were among the first to explore the potential of algorithms and digital processes to create art. During the 1960s, artists began to explore more complex simulations in their work. The development of computer graphics and the advent of personal computers enabled artists to create immersive virtual environments, such as Myron Krueger's "Videoplace" (1974) and Jeffrey Shaw's "Legible City" (1989). These early works laid the foundation for exploring virtual reality in the art world. As digital technology advanced in the 1990s, simulation art continued to evolve. The emergence of the internet and virtual worlds like Second Life provided new platforms for artists to experiment with simulated environments. Artists like Char Davies and Maurice Benayoun created immersive virtual reality installations that aimed to engage and provoke the

senses, blurring the line between the physical and digital realms. Simulation art has continued to grow and diversify in the contemporary art world. Advances in virtual reality, augmented reality, and artificial intelligence have inspired artists to explore new ways of simulating reality and creating interactive experiences. The history of simulation art reflects the ongoing dialogue between art and technology. For artists, the simulation medium offers powerful tools through its worldbuilding, rulemaking, and interactive features.

Meanwhile, game designers and developers also drew from the boundless possibilities of artistic practices. They experimented with games that are more expressive, poetic, or even unplayable in some cases. Experimental games are a subset of video games that push the boundaries of conventional game design and mechanics. These games often explore conceptual ideas, unconventional themes, or unique gameplay mechanics, making them distinct from mainstream games. The primary focus of experimental games is not on engagement or challenge but on exploring new forms of interaction, narrative, or expression enabled by computational simulation. In 2013, Lucas Pope released “Papers, Please,” a game exploring morality and decision-making themes. Davey Wreden is the creator of “The Stanley Parable” (2013) and “The Beginner’s Guide” (2015), both known for their unique narrative structures and exploration of player choice. Dan Pinchbeck is the creative director and writer of “Dear Esther,” a 2012 narrative-driven game focusing on exploration and storytelling. Thatgamecompany, an indie game studio that released “flOw” (2006), “Flower” (2009), and “Journey” (2012), titles that emphasize human emotional bonds formed through virtual encounters. These creators, among many others, have contributed to the growth and diversity of the gaming medium by pushing the boundaries of game design and exploring conceptually meaningful engagements.

The Conflict

As simulation media advance dramatically, they not only reshape the connection between arts and technology but also bring forth important questions to consider.

Interactive storytelling has been a topic of passionate discussion since the inception of early home computer games like Pac-Man and Donkey Kong. Interactive telecommunication, a technology that converts user input into digital electronic signal feedback, was first developed during World War II in the 1940s for information control and communication. In the postwar era, as technology integrated into the social environment, human-computer interaction was primarily understood mechanically: How effectively could human input be translated into audio and visual feedback on a computer screen? In short, interactivity emphasizes immediacy, allowing audiences to influence a story's progression through intuitive interfaces like a mouse, keyboard, and graphical user interface while receiving instant feedback.

However, literary and artistic theories assess narratives based on different criteria. When examining visual and text-based storytelling, interactivity is seen as a cultural, a psychological, and an experiential exchange. Are the dialogue and graphic design coherent? Does the plot progress smoothly? Consistency in character behaviors is expected based on their prior actions. Tension, conflicts, and surprises are introduced to create temporary suspense but ultimately contribute to the characters' integrity and the plot's development. Effective stories employ visual and textual elements to establish boundaries, encouraging the audience to speculate thoughtfully beyond these limits. Stories should be continuous and unpredictable, leaving the audience with complexity rather than confusion.

Take, for example, the 2018 interactive science fiction film *Black Mirror: Bandersnatch*, written by Charlie Brooker and directed by David Slade. Audiences are given choice points with 10 seconds to decide before the default plot continues. This interactive design creates over one trillion potential paths, resulting in unique narratives for each viewer. Though the average viewing time is 90 minutes, some versions can be completed in under 40 minutes. Viewers will reach one of five predefined endings, depending on the chosen path. Even those who arrive at the same outcome may have made various combinations of choices. In some cases, hardcoded rules in the interaction software necessitate certain vital scenes to be viewed by all audiences, regardless of their personal preferences. Interactive narratives like *Black Mirror: Bandersnatch* raise questions about the central conflict within the author-audience dynamic of interactive media:

1. When the author-designer and audience-player jointly shape an interactive narrative's progression, whose story does it become?
2. When computer algorithms govern parts of the narrative, how can the human audience discern the impact of human input versus interaction technologies, which quickly surpass human understanding in scale, speed, and logic?
3. How can the integrity and continuity of a linear story be maintained in an interactive narrative while respecting audience agency?

In many ways, interactivity opposes narrative. A narrative unfolds under the author's direction, while interactivity focuses on respecting the audience's agency. When an interactive narrative continuously prompts audiences to rearrange the original story through clicks and gestures, the narrative can appear fragmented and disjointed. As artists, technologists, and educators incorporate interactive media into their work, a fundamental understanding of the

experiences enabled through digital interactivity still needs to be discovered. Which aspects of human experiences can be programmatically altered, and which cannot?

Interaction designers and media theorists have debated the inherent author-player conflicts in interactive media. Some believe interactivity is about audience freedom, allowing players to act independently (Adams, 2013). Simulation allows players to engage in spontaneous, fun activities that deviate from the primary quest, such as performing unexpected actions. However, others have argued that while interactivity is nonlinear, the overall structure of the world is entirely predetermined, offering audiences the illusion of free will.

Computation as Automated Control

The struggle to establish computation as an expressive medium can be traced back to its historical development.

From Punishment to Control

According to writer and anthropologist Jared Diamond, wealth accumulation became possible as human societies transitioned from nomadic to agricultural. A need to institute order popularized the practice of corporal punishment (Diamond, 2012). In agricultural societies, maintaining social order and cohesion was crucial for survival. Corporal punishment reinforced the power structure and hierarchy, ensuring that individuals understood their roles and responsibilities within the community. Corporal punishment was a relatively simple, inexpensive, and immediate form of punishment that could be administered without the need for complex legal procedures or long-term incarceration. Early societies like Mesopotamia, Ancient Egypt, and Ancient China enforced laws and administered punishments to maintain order. The earliest known legal code, the Code of Ur-Nammu (circa 2100-2050 BCE), detailed specific crimes and their

corresponding punishments. It addressed issues such as theft, murder, assault, marriage, divorce, inheritance, and disputes related to agriculture and irrigation.

Between the 17th and 18th centuries, thoughts inspired by the Enlightenment, such as liberty and reason, dominated Western society. Philosophers like Cesare Beccaria and Jeremy Bentham advocated for more rational and humane forms of punishment, arguing that they should serve as deterrents rather than retributions. As a result, some countries began to reform their penal systems, gradually moving away from brutal punishments like torture and execution. Physical violence was banned by the late 19th century, and disciplinary societies were established.

In 1977, French historian and philosopher Michael Foucault published *Discipline and Punishment*, a genealogical study on imprisonment—a gentler, more disciplinary way of correction than corporal punishment. While physical torture can only be applied to selected individuals, the imprisonment model can be used widely in society, with factories, hospitals, and schools employing specific methods established by the modern imprisonment model. According to Foucault, observation is an integral method of imprisonment. While corporal punishment responds to actions, observation responds to the lack of actions.

Observation as a control mechanism is demonstrated by the Panopticon, a type of architecture for modern imprisonment designed by English philosopher and social theorist Jeremy Bentham in the 18th century. Derived from the Greek word for “all-seeing,” Panopticon is a multilayered, cylindrical-shaped building. Individual cells occupy the outermost layer of the building, separated by concrete walls. An inner layer of observation corridors allows the correctional officers to patrol each cell and ascend or descend to different floors. Blinds separate the outer and inner layers, allowing them to be concealed from the observed.

The Panopticon design is conceptually significant. It enabled a kind of invisible gaze from nowhere—an artificially constructed, godlike omnipresence. Under the effect of an invisible gaze, inmates do not know precisely when they are being observed. As a result, they act as if they are being watched even when they are not. The result is forced behaviors that are seemingly self-motivated and self-regulated—the illusion of agency. The metaphorical gaze has been extended to various social institutions like schools, hospitals, and factories, creating a "panoptic" society. Individuals pass on from one enclosure to the next, subject to the same methodology of disciplinary control. According to Foucault, with the invention of the modern imprisonment model, societies of sovereignty are replaced with societies of control and normalization. Penalty, which focuses on action, is replaced by observation, targeting the acting individuals, their bodies, behaviors, and thoughts. Disciplinary societies control individuals through normalization by defining acceptable behavior and encouraging conformity. This concept highlights the role of institutions in shaping individuals to be compliant and obedient members of society.

Decentralized Control

In his 1992 essay "Postscript on the Societies of Control" ("Post-scriptum sur les sociétés de contrôle"), Deleuze built on Foucault's notion of the society of discipline to argue that society is undergoing a shift in structure. Where disciplined societies were characterized by discrete physical enclosures (such as schools, factories, prisons, and office buildings, among others), institutions and technologies introduced since World War II have dissolved the boundaries between these enclosures. As a result, individuals have become "dividuals"(p.5), entities that are continuously subdivided and used for various purposes, such as data profiling and targeting. While disciplinary societies rely on intermittent surveillance, societies of control continuously monitor through data collection, algorithms, and digital technologies. In a society of control,

power is no longer centralized in specific institutions but is spread across multiple sites and actors, making it harder to identify and resist. Disciplinary societies impose rigid boundaries and routines, whereas societies of control are characterized by flexibility and mobility. Individuals must be adaptable and constantly in motion, pursuing various projects and identities. The society of control relies on individuals internalizing norms and expectations, making them responsible for self-regulation without being consciously aware. This can create a sense of constant, heightened competition. In a society of control, power operates through networks and connections, which can be rapidly reconfigured and reassembled. This makes resistance more challenging since there are no fixed points of confrontation.

Control Through Communication and Automation

Cybernetics is an interdisciplinary field that deals with systems' communication, control, and feedback principles. The term was coined by mathematician and philosopher Norbert Wiener in the mid-20th century, and it is derived from the Greek word *kybernetes*, which means "steersman" or "governor." Cybernetics seeks to understand how systems regulate themselves and adapt to their environment, intending to create more efficient and effective systems.

During World War II, Wiener was hired by the British military to invent an anti-aircraft system that could help improve the possibilities for ground soldiers to predict the flight path of enemy flying objects. Wiener adopted a mathematical modeling technique called Stochastic Processes, where the errors made in prior predictions automatically became an input parameter of the next round of calculation (Galison, 1994) (see Figure 6).

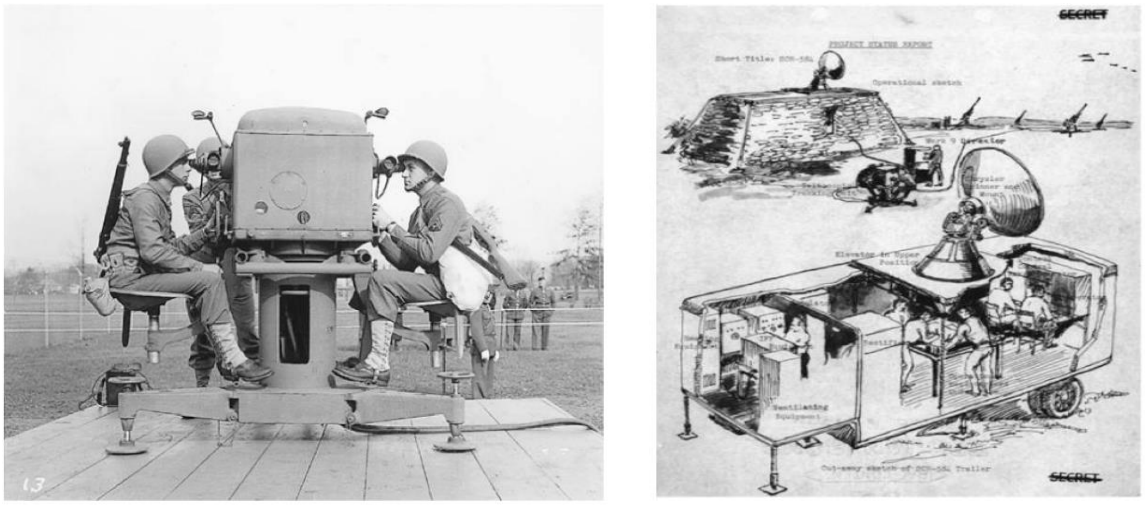

Figure 6. Human M (2004)
Left: Pursuit of a goal (one operator) and its localization (two operators) without radar.
Right: Pursuit of a goal with radar and localization, calculating the goal's flight line
for predictions and their transfers to cannons.
https://dreher.netzliteratur.net/4_Medienkunst_Kybernetik4.png

This self-referential circuit becomes crucial for the control of information. Inaccurate target tracking is eliminated through continuous, automated data-smoothing processes, which will not stop until the overall systematic objective of shooting down enemy aircraft is reached. Actions initiated by a human are recursively measured, analyzed, and corrected via the mediation of a machine as long as the goal can be precisely defined and measured from a machine's perspective.

> When I communicate with another person, I impart a message to him, and when he communicates back with me, he returns a related message which contains information primarily accessible to him and not to me…. When I give an order to a machine, the situation is not essentially different from when I give an order to a person. In other words, as far as my consciousness goes, I am aware of the order that has gone out and the signal of compliance that has returned. To me personally, the fact that the signal in its intermediate stages has gone through a machine rather than through a person is irrelevant and does not, in any case, greatly change my relation to the signal. Thus the theory of control in engineering, whether human or animal or mechanical, is a chapter in the theory of messages. (Wiener, 1988, p.16)

Wiener's (1988) cybernetic theory is simultaneously considered a communication and control theory. It emphasizes the importance of information exchange within and between a system and its environment. This includes the transmission, processing, and interpretation of signals or messages. In this framework, control refers to how systems regulate behavior to achieve specific goals or maintain a desired state. Control mechanisms often involve feedback loops and information communication to guide system behavior. Cybernetics is closely related to systems theory, which seeks to understand the properties and behavior of complex systems. Both fields emphasize the importance of understanding systems holistically, considering the relationships and interactions between their components.

Higher-order Cybernetics

From the perspective of system complexity, Weiner's (1988) theory is considered a relatively simple system of control, or first-order cybernetics. In the case of his ballistic shooter invention, the purpose of the inner agent—the soldier operating the machine—is aligned with the system-level goal of tracking enemy targets. The system's design is relatively transparent to its inner workings. The obscurity of cybernetics deepens as contemporary systems' complexity grows.

Gordon Pask (1968), an English psychologist and also a collaborator of Weiner, is historically credited with expanding cybernetics from first- to second order by further introducing the role of an observer. In 1968, he demonstrated this logic via an interactive installation called "Colloquy of Mobiles"" in the Cybernetic Serendipity exhibition in London. "Colloquy of Mobiles" featured a triangular panel with obtuse-angled corners and three rotating fiberglass bodies with organic forms. Inside, inorganic mobiles were attached to a rotating oblong element under the triangle. Pask called these "Males"" and the fiberglass bodies "Females." The "Males,"

photocells, and light-sending parts were installed to illuminate “Female” mirrors. “Male” photocells detected light reflected by “Female” mirrors. Rotating elements memorized and learned from each other. In addition, visitors could also influence the stimulus-response system by using pocket torches to direct light to the “Female”" mirrors, acting as artificial “Males.” Pask’s experimentation added a new layer of the observer, expanding Wiener’s cybernetics model from first to second order.

Pask’s installation differs from Wiener’s (1988) wartime machinery as it involves an observing party with hidden intentions rather than explicitly defined goals. In this system, the observed can only attempt to understand and describe what the observer is doing, knowing that the model created is provisional and could be as much about the observer as the observed. Identifying a border in this system means being open to the speculative creations of the self and the other (see Figure 7).

Figure 7. Left: Gordon Pask, “The Colloquy of Mobiles” (1969/2018), installation view of the exhibition “Neurones,” P. Pangaro for Center Pompidou (2020) https://zkm.de/sites/default/files/styles/r17_720_dynamic/public/bild/ZKM000176075.jpg?itok=26SPyTwO
Right: Gordon Pask, “The Colloquy of Mobiles” (1969/2018), installation view of the exhibition “BioMedia,” Felix G. for ZKM Center for Art and Media (2021) https://zkm.de/sites/default/files/styles/r17_720_dynamic/public/bild/ZKM000192830.jpg?itok=dWWYDGjP

The concept of second-order cybernetics is further extended into higher-order cybernetics, creating an onion-skin structure that leads to incomprehensible complexity beyond human understanding. When participating in digital communication, the observer of lower-degree cybernetics becomes the observer of higher-degree cybernetics, making it difficult for the observed party to comprehend the observer's intentions at the higher level. As shown in Figure 8, the observed party may feel a sense of freedom, but it is subject to the highest-order objective of profit maximization within the capitalist system.

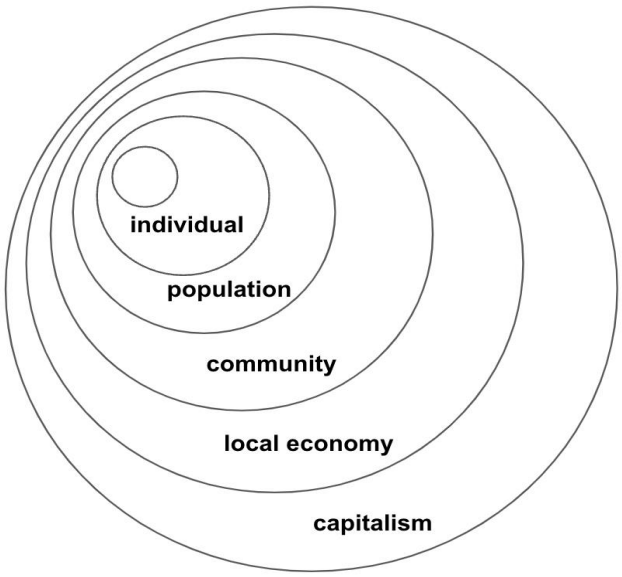

Figure 8. Diagram Illustrating Higher Order Cybernetics

Cancelling Culture

Cybernetics has applications in various disciplines, including engineering, biology, computer science, psychology, sociology, and management. It has influenced the development of fields such as artificial intelligence, robotics, control theory, and our understanding of the complexity of social society.

In his Beyond Cybernetics Hypothesis, cybernetics theorist Brian Holmes (n.d.) extended the implication of cybernetics for the social and cultural realm. According to Holmes, cybernetic feedback logic expanded from military operations to politics and economics during the post WWII era. It formed a continuous self-validation process reinforced by an invisible data Panopticon. He argued that the Nielsen rating system attached to early television sets in the 1940s was "the Cybernetic Hypothesis at work" (p. 2) on the scale of the societal level. The Nielsen rating system, developed by Arthur C. Nielsen, was a crucial innovation in the early days of television broadcasting. It provided a way to measure TV programs' audience size and composition, enabling advertisers and broadcasters to make informed decisions about advertising spending and programming choices. The system relied on devices called "Audimeters" attached to a sample of TV sets, which recorded the channels and programs being watched. The ratings reflected which TV programs the public wanted to see. Over time, producers could adjust their investments to meet only a narrow range of popular demands. This recursive loop eventually allowed for a perfect "machinic equilibrium—homeostasis" (Holmes, n.d.), enabled by machines and fulfilled by humans.

The early Nielsen rating system laid the groundwork for audience measurement, which enabled the growth of mass media, the centralization of power, and the emphasis on commercial interests over audience preferences or cultural values. This legacy was eventually inherited by the network culture that emerged in the late 20th century. Networked culture has made it easier for people to access information and media content. This has led to the rapid growth of mass media, as more people can now consume and share content across multiple platforms. The rise of networked culture has led to the centralization of power in a few major technology companies, which control the platforms and services that many people rely on for accessing information and

connecting with others, giving them significant influence over media distribution and public discourse. In contemporary networked culture, content is often curated and personalized through algorithms prioritizing user engagement. This inevitably results in a homogenization of content as platforms prioritize popular, easily digestible, and profitable material rather than promoting diverse perspectives or less commercially viable content. Like its earlier predecessor in the 1940s, networked culture has facilitated collecting and analyzing vast amounts of user data, allowing advertisers to target their messages effectively. While networked culture has allowed for greater access to information and media, it has also contributed to the fragmentation and polarization of public discourse. Social media platforms and personalized content feeds can create echo chambers reinforcing existing beliefs and preferences, limiting exposure to alternative viewpoints or cultural values. As major platforms and tech companies dominate content distribution, it becomes increasingly challenging for independent creators to sustain themselves financially.

Computation as Indeterminacy

Contemporary informatics software systems can be perceived as controlling due to their recursive logic, negative feedback loop, ubiquitous data collection mechanism, and effect of canceling culture and centralizing power. Contrary to a fundamental notion of a deterministic society assumed by its design, the world originated from a place of indeterminacy.

Origin of Indeterminancy

The concept of indeterminacy has various origins and interpretations. In philosophy, indeterminacy has been a subject of debate for centuries. The ancient Greek philosopher Epicurus (341-270 BCE) proposed that there was an element of randomness or chance in the motion of atoms, which he called “swerve” or “clinamen.” This idea implied that events are not entirely predetermined, allowing for agency, potentiality, and indeterminacy.

In the early Han Dynasty (206 BCE-220 CE) in ancient China, the concept of "kong" (空), or emptiness was presented by the foundational texts of Daoist philosophy, primarily the Dao De Jing. Related to the Greek concept of swerve, this notion is associated with the idea that ultimate reality is an empty, formless, and non-substantial essence from which everything arises and returns. Kong is intrinsically linked to the Dao (or Tao), the underlying principle that governs the natural world and the cosmos. The Dao is often described as an empty and indescribable force that precedes and encompasses all phenomena. It is the source of all things and the underlying unity of the universe. In Daoist philosophy, kong signifies the potential for transformation and change. Emptiness is seen as the natural state from which all things arise, exist, and eventually dissolve back into. This understanding of emptiness implies that all phenomena are interconnected and interdependent because they share the same fundamental nature. Daoist teachings emphasize that embracing the concept of kong leads to a deeper understanding of the world and the self. By recognizing the emptiness of all things, one can cultivate detachment, humility, and inner peace. This awareness allows harmony with the Dao, leading to a balanced and fulfilling life.

The concept of kong in Daoism is analogous to the Buddhist concept of Śūnyatā, which also refers to emptiness or voidness, although the two have distinct philosophical implications within their respective traditions. Both notions, however, emphasize the idea of the interdependence and impermanence of phenomena and the importance of recognizing the ultimate insubstantiality of existence.

Śūnyatā (Sanskrit), often translated as "voidness," is a central concept in Buddhist philosophy, particularly in Mahayana Buddhism. Indian philosopher Nagarjuna and his Madhyamaka school have contributed significantly to the understanding and articulating of

śūnyatā. It refers to the idea that all phenomena, including material objects and mental states, are devoid of inherent, independent existence or essence. This concept is closely related to the Buddhist teachings of dependent origination (pratītyasamutpāda), which emphasize that all things are interconnected and interdependent in nature. The idea of śūnyatā challenges the common belief in the intrinsic, unchanging nature of objects and the self. According to Buddhist teachings, phenomena arise and exist only through a complex web of causes and conditions. Nothing exists independently, and therefore nothing has a permanent, unchanging essence. Śūnyatā is not equivalent to nihilism or the belief that nothing exists. Instead, it is a way of understanding the true nature of reality, which goes beyond the dualistic concepts of existence and non-existence. Emptiness, in this context, describes the ultimate reality that transcends the conventional understanding of the world. Realizing the truth of śūnyatā is considered a crucial step toward enlightenment. However, in Buddhism, recognizing the emptiness of all phenomena can lead to the elimination of attachment, clinging, and ignorance, which are the root causes of suffering (dukkha), as described in the Four Noble Truths. By understanding and experiencing śūnyatā, one can cultivate wisdom (prajñā) and compassion (karuṇā), ultimately reaching a state of liberation (nirvāṇa) from the cycle of birth, death, and rebirth (saṃsāra).

Indeterminacy in mathematics can arise in various forms, such as undecidable problems, ill-posed problems, or problems with multiple valid solutions. One of the most famous examples of indeterminacy in mathematics is Kurt Gödel's incompleteness theorems. Published in 1931, these theorems demonstrate that within any consistent, formal system of mathematics, there will always be statements that cannot be proven or disproven within that system. In 1936, Alan Turing introduced the concept of the Turing machine, which is a theoretical model of computation that can simulate any algorithm. Turing proved that there are problems that cannot be solved by

Turing machines, thus proving the existence of uncomputability. The most famous example of an uncomputable problem is the Halting Problem, which asks whether a given Turing machine will stop or run forever on a given input. Turing's proof is a foundational result in the theory of computation and helped establish the concept of uncomputability. The Halting Problem has important implications for the limits of computation and our understanding of what can and cannot be computed. It demonstrates that problems exist that are fundamentally uncomputable, and no algorithm or computer, however poswerful they are, can solve them.

In science, the origin of indeterminacy in quantum mechanics can be traced back to the early 20th century with the development of the theory itself. In 1927, Werner Heisenberg formulated the Heisenberg Uncertainty Principle, which stated that certain pairs of physical properties (such as position and momentum) cannot be measured simultaneously with arbitrary precision. This principle introduced the concept of fundamental indeterminacy in the behavior of subatomic particles, eventually leading to a probabilistic interpretation of quantum mechanics.

In the early 1960s, Edward Lorenz, an American mathematician and meteorologist, discovered the Lorenz attractor. The Lorenz attractor is a set of chaotic solutions to a system of three nonlinear ordinary differential equations. Lorenz initially derived these equations as a simplified model for atmospheric convection, which he was studying to understand weather patterns better. The Lorenz attractor is popularly referred to as the Butterfly Effect. In his weather model, Lorenz found that tiny variations in the initial conditions led to dramatically different outcomes over time. This sensitive dependence on initial conditions is a hallmark of chaotic systems. The indeterminacy associated with the Lorenz attractor and other chaotic systems arises from the practical limitations of measuring initial conditions with infinite precision and the exponential growth of errors that occurs over time. Even though the underlying equations of the

Lorenz attractor are deterministic, the long-term behavior of the system is practically unpredictable due to its sensitivity to initial conditions. This unpredictability is a form of indeterminacy, highlighting the challenges of accurately predicting the behavior of complex, nonlinear systems.

Designing Error

Post World War II, parallel to the aggressive adaptation of cybernetics into mass culture is the emergence of a less known but conceptually significant movement of experiments in Art and Technology. Experiments in Art and Technology (E.A.T.) was founded in 1966 by engineers Billy Klüver and Fred Waldhauer and artists Robert Rauschenberg and Robert Whitman. E.A.T. aimed to facilitate collaborations between artists and engineers. The organization supported various projects, performances, and exhibitions that combined art and technology in innovative ways.

Culturally and artistically, E.A.T. was influenced by the Happening movement in the 1960s in New York. According to its main organizer Allen Kaprow (1961), Happenings are events that happen. Compared to the traditional notion of the object of art, Happenings are loosely organized theatrical gestures with no beginning, middle, or end. The experiences, structures, and building components are constantly in flux. In some ways, Happenings are aware of the cybernetic notion of challenging the boundary of a liberal humanist sense of subjectivity—each object not as a self-enclosed entity but as part of a system that involves every other object within the same system. However, Happenings also distance themselves from cybernetics by acknowledging the Self as a unique, primary entity that cannot be reduced or deconstructed. While perfection burdens traditional artists, Happenings artists openly embrace transience, chance, failure, and noise.

E.A.T. expanded the ethos of Happenings by integrating mechanical and electronic systems, which led to the creation of a new art form known as Kinetic Sculpture. In 1960, for instance, Billy Kluver, an engineer at Bell Labs, collaborated with Swiss sculptor Jean Tinguely to create "Homage to New York." This artwork featured a series of interconnected kinetic gears that functioned flawlessly for 30 minutes before setting the entire machine ablaze, bringing the performance to a close. In accordance with Tinguely's vision, Kluver constructed the structure using discarded objects found on the streets, enabling it to release energy and tension before reverting to its original state—junk. Although unfamiliar with Zen concepts of selflessness and complete anarchy, the machine's performance was critically perceived as nihilistic and self-destructive. Nevertheless, the poetry arising from the engineered systematicity encapsulated the essence of the Kluver-Tinguely collaboration—a system that is designed not to erase error but, rather, embrace it.

The E.A.T. movement played a crucial role in breaking down barriers between art and technology by the end of 1960s. While E.A.T. itself focused on various forms of art and technology collaborations, including kinetic sculpture, light art, and video art, the broader environment it helped create enabled the birth of computer art. As computers became more accessible in the 1960s and 1970s, artists began to explore their potential as a new medium for artistic expression. Pioneering artists such as Vera Molnar, Manfred Mohr, and Harold Cohen started experimenting with computer-generated graphics, animations, and algorithmic artworks.

Automating Aesthetics

One characteristic of the computer, uniquely different from other alternative media, is its ability to execute vast numbers of simple calculations within an unparalleled efficiency level to enable machines to mimic thoughts and behaviors that we usually associate with other human

beings. In *The Language of New Media*, Lev Manovich (2001), a media theorist and author, explored the ways in which computer algorithm has transformed visual culture and communication. In this book, Manovich identified five principles that characterize new media: numerical representation, modularity, automation, variability, and transcoding. These principles help to define the unique qualities of computational media and differentiate it from traditional media. It has become a foundational text in the field of new media studies and has significantly influenced the thinking of many media theorists and computational artists.

Specifically, Numerical Representation refers to the representation of a new media object as digital code, either created programmatically by defining each digital pixel's attribute or by converting analog art forms into the numeric codex. Modularity means a new media object is a systematic combination of elements that function independently. Combined with Numerical Representation, Modularity renders media "Programmable." New media objects are digital elements related to each other through rules governed by a software system, making them subject to dynamic algorithmic manipulation. Variability refers to the idea that artistic experiences made with computer code are not static but permeable. Each version of the generative code can potentially result in infinite versions of the final artwork. Consider a classical visual programming approach called Random Walk. We arbitrarily place a single digital pixel of any color on a digital canvas. When the computer executes, we ask the pixel to step "randomly" toward its Top, Right, Bottom, or Left direction. Over time, an organic pattern emerges on the canvas, reminiscent of a crawling beetle with ink on its feet. Each time we execute the computer algorithm from the beginning, the path of travel of the pixel will remain uniquely different from any previous iterations (see Figure 9).

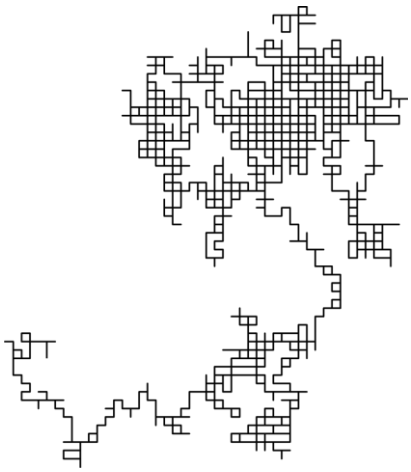

Figure 9. Random Walk in Two Dimensions, with 2500 Steps (Nemeth, 2013)
https://en.wikipedia.org/wiki/Random_walk#/media/File:Random_walk_2500.svg

Simulating Virtual Worlds

Manovich's (2001) writing established the theoretical foundation for a new field of practice, which is referred to as generative art and design. Artists and designers establish rules, systems, or algorithms to guide the creation of artwork, as opposed to manually producing the work. This automated, rule-based approach grants the computer a certain level of autonomy to "improvise" based on the artist's initial intent, resulting in outcomes that are jointly determined by the artist and the computer's execution. The output is frequently marked by elaborate patterns, detailed forms, and an impression of organic development or evolution. Directly contradicting cybernetic design philosophy championed by the prevailing computer science community, generative art and design instead deliberately embrace code-based indeterminacy as a novel form of expression.

In an essay drafted in 1996 titled "On Totalitarian Interactivity," Manovich expressed his fear of the internet turning the information society into a giant dumping ground with complete transparency and, therefore, control. His turn towards poetic computation is his effort to

depoliticize and refocus on positioning computational media as its predecessors—cinematic effects. However, media theorist Alex Galloway (2004) believed that Manovich's view responded to a humanistic desire for the world to be brought near to anonymous viewers, which the invention of cybernetics and digital interactivity in the 1940s has eroded. Galloway's criticisms primarily focused on Manovich's approach to understanding new media and the emphasis he placed on formal aspects. In Galloway's view, Manovich's focus on the formal qualities of new media could overlook the social, political, and cultural dimensions of digital technologies. Galloway argued that, by concentrating on the formal aspects, Manovich may have missed the larger implications of new media, especially in terms of power, control, and the way digital technologies shape our understanding of society.

Borrowing Plato's metaphor of the Ring of Gyges, Galloway (2012) claimed that cinema forces the viewer into becoming an invisible participant in the world. Instead, to be in an informatic relationship with the world, one must "erase the world, subjecting it to various forms of manipulations, preemption, modeling, and synthetic transformation" (2004. p. 13). Galloway spoke of new media as a language for Worldmaking. Instead of hiding behind screens to observe the world, we should instead create rules, make relations, and perfect the conditions for simulating one. The computer "instantiates a practice, not a presence, an effect, not an object" (2004, p. 22). It is not possible or necessary to cry at computers as one cries at the movies. When a player fails at a video game, she simply hits the restart button, simulates another world, and plays again.

Galloway (2012) introduced the concept of Coherence to distinguish computation as poetic verses ethic. With coherent aesthetics, visual elements are crafted to create an immersive aesthetic experience. Conversely, incoherent aesthetics are seen in artworks adopting generative

or glitch aesthetics, resulting in a meta, broken, manipulated, or unsettling visual experience. In coherent politics, viewers are aware of and completely accept the system's rules, such as when starting a massive MMOG like World of Warcraft, where players must select a profession, race, and gender and complete set quest lines to advance the game. This process acts as a binding contract for all players to perform within the in-game identity and is subject to the history of a kingdom, island, or territory. Galloway further claimed that ethics is produced when incoherent aesthetics are combined with coherent politics. A computer is ethical because it foregrounds data over experience, promoting network integrity and neoliberal markets. When switching the two conditions, poetics is produced when coherent aesthetics are combined with incoherent politics.

Galloway's Coherence theory provides the philosophical basis for the fundamental conflict embedded in digital interactive experiences. The digital interface revealed a primordial axiom: The more coherent a work is aesthetically, the more incoherent it tends to be politically, and vice versa. The first type of paradigm inspires computation as aesthetics and narrative, while the latter inspires hacking and rulemaking.

Architecting Emergence

The perspective on technology as ethic emphasizes designing cultural tendencies into specific systems, allowing concrete solutions to emerge. It generates new issues that finite methods can no longer contain. Storytellers and theorists use imaginary landscapes to project forward and outward, making visions and weaving stories that eventually evolve into new systems. Postmodernism calls for a new mode of thinking that embraces the concept of computation from a narrative perspective and poetics to a systematic, procedural perspective. While cybernetics' application to arts and culture is currently limiting, it has undoubtedly paved the foundation for a new mode of expression, inspiring a new wave of thinkers, researchers,

artists, and technologists to rethink the creative potential of a powerful systematic language, from a binary machine with only two states, zero and one.

Summary

In this chapter, two main streams of the theory were revisited. First, Cybernetics, a subset of system theory created by American mathematician Norbert Wiener, was reviewed to establish the foundation of current software theory and practice as a system of control. In addition, simulation, a theory originating from historical roots of indeterminancy and, more recently, adapted into the context of computational media by Lev Manovich and Alex Galloway, was reviewed. These two theories provide the overall framework for critically examining software culture as either a force of control or artistic intervention.

Chapter 3

DESIGN OF STUDY

Introduction

Drawing from design philosophies reviewed in the previous chapter, I now establish the criteria for designing the research methodology. Additional research design considerations concerning the research objectives are also reviewed in the following sections.

Type of Study

This research is a qualitative case study on agent-based, open-world computational simulation. This research was based on the belief that virtual reality players have historically established and reproduced an increasingly narrowing software culture. Through this study, I sought to expose contradictions in social systems mediated with computation and discover emerging forces of creative intervention. I assumed a relative instead of a "true" ontology constructed in a computationally simulated social context. The findings of this research heavily depended on the framing of the study and cultural norms shaped by social actors to which researchers are exposed. Therefore, qualitative rather than quantitative research was deemed more suitable.

In addition, the phenomenon and context of the research, virtual worldmaking, are relatively new and unexamined. Therefore, the case study method was considered generally suitable for probing deeply to gain insight into new phenomena. A qualitative case study enables researchers to explore complex phenomena explicitly within the specific context of simulation games. A case study allows a phenomenon to be studied in real-time within its naturally occurring context (Merriam, 1998), making it an appropriate methodology for examining simulation video games. Lastly, a case study is a relatively flexible methodology that allows researchers to

understand the how and why of specific contemporary events, which does not require control over those events or problems. They are designed to "illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result" (Schramm, 1971, cited in Yin, 2018, p. 13). Thus, a case-based research method was deemed appropriate for inquiring about new areas and discovering new phenomena.

Lastly, life simulation games (or artificial life games) are a subgenre of simulation video games in which the player lives or controls one or more artificial lifeforms. A life simulation game can revolve around individuals and their relationships, simulating a social system or the relationship between individual behavior and system norms. Social simulation games are one of its subgenres. It applies computational techniques to reproduce conditions for generating social issues and uses digital interactivity to allow players to manipulate such conditions to study changes in a system due to individual actions and behaviors. Such properties of life simulation make it a suitable research instrument for this study.

Due to the relative ontology, unexamined context, and simulative nature of the research, I will conduct a qualitative, algorithmically simulated case study.

The Participants

Functions of Participants

The primary research objective was to study dimensions of agency, collectivism, and emergence mediated through digital interactivity in virtual game worlds. By observing the participants, I collected primary data on how different modes of computational gameplay contribute to the players' sense of agency.

Participants were introduced to a game that tested different elements of traditional computing methods. They were prompted to immerse themselves in the gameplay by modifying

various aspects, including their virtual avatar's appearance, navigation techniques within the virtual environment, regulations that control character interactions, and any rules that may change the virtual world. Following this, players were encouraged to contemplate their experiences; draw comparisons with previous games; and identify similarities, discrepancies, or conflicts.

Criteria for Selection

Six general players were selected to play the game. The primary selection criteria were that the participants should self-identify as players of simulation video games. They should have prior knowledge of playing simulation video games alone or with friends, partners, or organized guild members. They should be familiar with basic gaming interfaces, modes of interactivity, and basic vocabulary. These criteria ensured that selected participants could describe their in-game experience and decision-making process clearly and conclusively. The game player identity also provided a basic level of homogeneity, allowing individual playtest and interview data to be compared across all participants. Besides the benefit to the study itself, selecting participants who self-identify as game players also generated helpful knowledge for the participants. The research could contribute to their reflections on their preference as players, such as what game they would be more inclined to play in the future and in what ways and with whom they would like to play. Overall, selecting experienced gamers promised to result in a collaborative and reciprocity relationship between the researcher and the actors.

In addition, arts, technology, and education are three industries intimately related to the design, development, and reception of simulation games. Therefore, six participants were recruited in total, two from each of the three industries above, allowing for a comparison of each participant's experiences and perspectives with the other.

In early 1950, computer scientists, who were becoming increasingly aware of the limitation of a linear perspective of recollecting human history, began using software to simulate human experiences. They conceived the nascent forms of digital interactive media, which hugely shaped contemporary culture. Technologists familiar with coded language can contribute insights into virtual reality simulated through recent software technology. However, many programmers have received limited training in visual art, literature, or human behavioral psychology. Human-computer interaction within computer science is primarily interpreted on a mechanical level—to what extent can human input be translated to audio and visual feedback accurately and reliably inside the computer screen? Interactivity is about immediacy—allowing the audience to disrupt the story's progression through intuitive interface design such as a mouse, a keyboard, and a graphical user interface and receive instant feedback.

Additional participants from arts backgrounds who were included in this study complemented the functional perspective of software culture. When considering visual and text-based storytelling, artists focus on interactivity as cultural, psychological, and experiential exchanges. Are the dialog and graphic design coherent? Does the plot flow smoothly? At any given point, we expect the characters to behave consistently based on characteristics built up from prior actions. Tension, conflicts, and surprises are introduced to create suspense temporarily but contribute to the characters' integrity and the plot. Good stories use visual and textual instruments to plot a boundary carefully and provoke the audience to speculate beyond this boundary in a thoughtful, reflective way. Stories should not be predictable but continuous. The artists participating in this study contributed to understanding emotional and psychological complexity.

Lastly, a growing number of academic curricula are being redesigned in networked narrative environments. Students are entertained while learning new knowledge and

simultaneously expressing themselves inside a simulated game world. Since simulation games make learning a matter of direct insight, they may soothe the dreariness related to more traditional guidance methods. They request discovering original interests instead of examining pre-existing ideas and thoughts. Hence, educators can likely provide insights into simulation games related to the larger education landscape, which is being rapidly affected by the emergence of open-world games.

Designing and Developing the Research Instrument

Commercial simulation games such as Fortnight and Minecraft are increasingly opening up the development environment to encourage player-contributed modification of the original games. However, there are several issues with this. First, players who want to contribute modifications are frequently required to download mod-making tools and various construction sets that could significantly raise the contribution barrier. In addition, player-contributed changes are primarily based on expanding the existing narrative of the game, which does not allow the original game to be modified. Lastly, player modifications are restricted to changing the visual look of the game world rather than challenging the rules of the play.

To address the above limitations of modding practices in conventional simulation gaming environments, I designed and developed a custom simulation platform for this research. This simulation game comes with a web-based code editor, allowing audiences to create rules determining how each creator relates to others. In addition to the game platform, online workshops are held to help players understand worldmaking. A digital artist or technologist guides the participants through making a rule-based entity during the workshops. At the end of each workshop, a new simulation with its unique narrative is generated and available online for viewing.

Summary of Procedure

Qualified individuals were contacted via an email invitation that outlined the research procedure, benefits, and risks. If the participants confirmed their initial interest, I sent them an Informed Consent Form which documented the research procedure in greater detail. After reviewing and signing the consent form, I asked the participants to schedule a time to participate in the official research, which contained a 30-minute, video-recorded playtest session and an open-ended interview immediately following the playtest session immediately.

Validity and Reliability

The same participation protocol was repeated for all six subjects. Informed by replication logic, each subject received as similar treatment as possible (Yin, 2009). In this way, the protocol was more than a script with questions but, rather, an instrument that improved the reliability and validity of conducting a case study, considering all relevant parts (Souza, 2005). Interview skills were deemed to be based on the following factors: asking appropriate questions and interpreting responses; being a good listener and not bringing any kind of prejudice; being well-grounded in the theory for the topic investigated; being receptive and sensitive to possible contradictory evidence; and being adaptable and flexible toward new or unforeseen situations, considering these as opportunities rather than threats (Yin, 2018). During data collection, I limited my effects and always kept in mind that I was a strange element in the analyzed context; regarding my effects as a researcher, I needed to eliminate my influence on the respondents (Souza, 2005).

In addition, given that the research process primarily concerned system design actions that encompassed multiple iterations, updates, and evolutions, I established a research journal documenting the details of these changes to serve as the primary data source.

Site of Study

In simulation games, it is common for players to download the game on their computing devices and play privately in their homes while being connected via voice. Since the primary setting of the study was simulation games, the site of the study was the natural environment where game players would feel the most natural conducting the playtest. Therefore, the following arrangements were made to constitute the site of the study.

1. The playtest happened individually in the player's site of choice. This site was a place where players are used to playtesting regular games. Therefore, it should feel familiar, natural, and intimate.
2. Discord, a popular game streaming and communication platform, streamed and recorded the playtesting session. However, only the playtest session itself was recorded. Identifiable information regarding the player, including the player's face, was not recorded.
3. After the playtesting session, the player was invited to participate in an audio-recorded interview via Discord.
4. All videos, audio recordings, and transcripts were stored in a password-protected Google Drive folder. Only I as the researcher will have access to it.

Data Types and Sources

Data Collection

The data collected from each of the six players included passive participant observations, which were video and audio recorded, written notes and sketches by the participants, interview transcripts, and a research journal written by me as the researcher.

Playtest and Interviews

Interview of Players. The protocol for the initial interview was generated based on insights from the pilot study, the literature review, and existing research in interactive media and video games. The interviews were held in a semi-structured form to allow for probing and guiding questions. The interview process incorporated open and closed questions led by the state of responses, the original interview guidelines, and the conversation flow. Open-ended questions were asked when a more general description of the concept or the field of practice was needed. For example, "What is the role of narrative in interactive storytelling?" Closed questions were asked when an opinion about a specific making or decision was needed, such as "Do you think the interface design will allow players to act intuitively?" Depending on each participant's response, I decided if probing or guiding questions were needed; for example, "Can you further elaborate?" "Where did you gather that information from?" "Why?" "How?" These questions were asked to guide participants to provide information that was well-aligned with the design of the research questions.

Preliminary Questions for Players. The following presents the questions for the protocol of the feedback interview:

1. If you can make any kind of world, what would be like?
2. What's your past experience with gaming?
3. How would you describe your interaction with the research instrument?
    a. Which part of the story is controlled by you, the author, or the computer software?
    b. Did your experience of the game change at any point, and in what way?
    c. How did the game's user interface and scene design inspire you to play differently?

d. Did you choose to act according to, against, or indifferent to the game's intention? Why?

4. How does this experience remind you of any past experiences related to video games?
5. How does this experience reshape your understanding of worldmaking in general?

Consent and Confidentiality

All participants signed a consent form declaring the following information. Each audio interview would be recorded. Quotes from the audio will be used in a doctoral dissertation at Teachers College, Columbia University. Participation in this project is voluntary; participants can choose to cease participation at any point in the interview, playtest, and feedback session without providing any reason or explanation. Quotations from the participants recorded during the research will not be used for publication beyond this dissertation without the participants' written consent. The consent form gave the audience a sense of expectation and a chance to communicate questions before deciding to participate, thus building trust between the participants and the researcher.

Data Treatment

Immediately after the interviews, the audio recordings were transcribed by the researcher. I then coded the data and gathered emerging categories so that I could detect significant patterns that were difficult to see otherwise. I cross-compared preliminary categories with other transcripts to ensure the themes were consistent and generalized at a project level. Then I examined the initial categories; combined, eliminated, or subdivided codes; and looked for repeating concepts and broader themes that connect codes. Two cases of the experiments' initial design and education implications were developed following coding. The feedback from professional media theorists and game designers also fed into designing and developing the game. Finally, the

general audience's feedback was incorporated into the dissertation's educational implications and conclusion sections.

Table 1

Data Collection and Anticipated Outcome

Data Type	Data Source	Data Collected	Relation to Research Questions	Anticipated Outcome
Transcript of Audio and Video Recording	Observation of Gameplay	How different level of modification contributed to overall player experience and agency in the case selected for study	Subquestion 1: confines and limitation of current software experienced by design	Players will raise questions about certain modes of modifying the game as more or less meaningful than the others.
Transcript of Player Interview	Player Interview	How different level of modification contributed to overall player experience and agency in the case selected for study	Subquestion 2: various video game design cases that contribute to agency, collectivism and emergence Subquestion 3: player modification as intervention	Players will compare their experience playing the rules of the game as experienced in the case study, against their experience playing more conventional games through spatial navigation, directing the camera, and selecting different in-game narrative progressions.
Text	Research Journal	Insight from player and expert interview. Insight from designing the video game	Subquestions 1, 2, 3, 4	Insight is gathered in context not directly defined by the limits of the study, which serves as a measure for objectification and generalization.

Summary

Below is a summary of the role of the researcher in carrying out various aspects of this study.

1. Design the Study

I designed the study's overall theoretical and experimental framework and procedure.

2. Design the Game

I was also responsible for designing a video game platform (system) so the participants from selected backgrounds can create their objects and program their behaviors. The behaviors are essential for an emergent system with a technical framework. A participant is not only supplying a static, cosmetic object. Nevertheless, packing a bag of rules into the system will help build the complexities of the system later on.

3. Design and Carry Out the Interviews

I recruited volunteers who met the selection criteria to playtest the game. During the playtest, I observed the gameplay as a facilitator. The players were encouraged to describe their play experiences verbally and ask questions. I was restricted to answering only questions directly related to the instructions for playing the game. Once the playtest and observation ended, I then asked a set of questions to probe the play experience more deeply, categorizing some aspects within the gameplay or contrasting them against other games the player has played in the past.

4. Collect and Analyze Data

After the workshop, all participant contributions were compiled to form a live simulation. The participants saw their computational objects in the world of the simulation, interacting and exhibiting behaviors programmed by them or triggered by other people's objects. In those simulation sessions, we often spotted surprising moments not programmed deliberately or systemic bugs or malfunctions triggered by a collective chain of behaviors. Those transient moments of emergence always drove us to further our research and development.

5. Archive Data

Once the entire research process concluded, I archived the data according to the following appropriate procedures: (a) I stored all data in my password-protected computer. (b) I erased or

changed all names in transcripts and other materials to protect the participants' identity. (c) I erased information pointing directly to an individual. (d) I ensured that no one would access the database unless for requests strictly related to the purpose of the research.

On Reflection

During the data collection stage of this research, I found that although certain individual actions of the participants showed emergent properties, the overall result of the virtual worldbuilding did not achieve system-level emergence. Participants largely contributed to a handful of pairwise interactivity such as copy-pasting, killing, and stealing. The overall collective behaviors of the virtual avatars were chaotic and lacked time-based variation or continuity.

Emergence is a concept in systems theory in which the whole is seen as being greater than the sum of its parts. In other words, emergence describes how new, unexpected traits can emerge from a complex system, even when those traits are not present in any of the system's individual parts. In the social sciences, a society is an emergent property of the interaction of individuals. The properties of the society—such as culture, norms, laws—are not properties of the individuals themselves but emerge from their interaction. Emergence theory fundamentally challenges the reductionist approach (where a system is understood entirely by understanding its parts) by asserting that certain properties and behaviors can only be fully understood at the level of the system as a whole.

Emergence is a complex process that is being actively developed in fields such as social science, evolutionary biology, and artificial intelligence. Determining the exact condition needed for the emergence of a given system is a challenging question. However, several key conditions or principles are generally believed to be necessary for a system to achieve emergence. The design of the research instrument for this study took into consideration several of such factors, such as:

- Interactions: Most of the components of the virtual world (namely, the individual avatars) are allowed to interact with each other at will. Without interaction, there would be no way for a new, emergent system to arise.
- Diversity and Redundancy: A diverse set of components with a level of redundancy can often lead to emergence. Diversity ensures a wide range of responses to stimuli, while redundancy can safeguard against failure and offer a multitude of interaction paths. During the data collection stage, this is achieved by inviting a reasonably large number of participants from diverse backgrounds to make avatars and rules that will naturally overlap as well as differ from each other.
- Self-organization: Emergent properties typically result from bottom-up dynamics, meaning they result from individual interactions and not from a top-down command or control. Emergent systems often exhibit self-organization, a process where some form of global order or coordination arises out of the local interactions between the parts of an initially disordered system. During the data collection phase, some worldmaking experiments composed mostly of large group of strangers meeting anonymously online achieved a self-organization of anarchism, while smaller offline groups of participants who already had prior relationships formed collective behaviors that were much more friendly and sustainable.
- Nonlinearity: A concept found in mathematics and the sciences, nonlinearity refers to any relationship or process that does not conform to a proportional or direct correlation, where a change in input does not result in a proportional change in output. In a linear system, any change in input will always cause a proportional change in output. For instance, if one doubles the input, the output will also double. This

relationship can be represented by a straight line when graphed. On the other hand, in a nonlinear system, the output does not change proportionally with changes in input. For example, doubling the input might more than double the output or much less than double the effect. These relationships can be represented by a curve or other shape that is not a straight line when graphed. The data collected indicated that the growth of populations in the virtual world can be nonlinear as changes in size can lead to greater or smaller growth rates.

However, limited by the scope, funding, privacy concern, and technical support, the design of the research instrument failed to account for several factors such as:

- Immersion: Immersion refers to the level of engagement and involvement a player feels within the game world. This includes how real or believable the world feels, as well as how well the player can identify with their character or role within that world. In highly immersive games, players often feel as though they are not just playing a game but actually living or participating in the world the game presents. Thus, immersion motivates players to think naturally of ways to participate or even transform the virtual world they inhibit. Typically, immersion is achieved through detailed graphics and sound design, character customization, complex storytelling, logical consistency, sensory feedback, and player agency. During the data collection process, many participants expressed that visual and narrative storytelling lacks the level of complexity needed for them to feel motivated.
- Adaptation and Learning: For some emergent systems, especially in biological and social contexts, an ability to adapt, learn, or evolve is crucial for emergence. However, since the research instrument does not have a database designed to retain in-game

participant behavior data over time, it is not possible for virtual avatars to learn and adapt from the past data.

- Complexity: Emergent behavior tends to arise in complex systems, where the number of components and the number of interactions between them are very high. Even though the study ensured a reasonable number of participants, the total number was not enough to achieve a high level of complexity in the final virtual world made at the end of each research session.
- Openness: Many systems demonstrating emergence are open systems that exchange matter or information with the outside environment. During the data collection stage, participants are encouraged to draw any resources they can imagine to support their worldbuilding process. However, due to the limited amount of time the participants committed to interact with the research instrument, they often did not end up bringing in much information beyond what was immediately presented to them from the interface design of the research instrument.
- Accessibility: During the data collection stage, the artists expressed difficulty inputting rules for their avatars through transcoded languages. This prevented them from participating actively in the rulemaking of the world. In the future studies, I hope to integrate natural language model based interfaces which will help translate rules written in human language into codified language. This will allow participants who have less fluency with computational literacy to be able to participate at the rulemaking level.

Chapter 4

PRESENTATION OF DATA

Introduction

Chapter 4 presents the data collected from six participants interviewed across 3 months. Collected data were validated with each individual and then compiled into three data profiles: the Artist, the Scientist, and the Technologist, with two participants for each profile. In the context of the research, the six participants are designated as A1 (Artist One), A2 (Artist Two), S1 (Scientist One), S2 (Scientist Two), T1 (Technologist One), and T2 (Technologist Two). The research instrument game is referred to as RI.

Initially, I as the researcher evaluated the participants' backgrounds and assigned the main profile for each participant, which ensured that two participants were interviewed for each professional profile. However, throughout the interview, all participants occasionally commented on their experiences across multiple profiles.

Edited Profiles

A total of six participants were interviewed across 3 months. To construct the profiles, I asked each participant four questions. Collected data were validated with each individual and then compiled into three data profiles: the Artist, the Scientist, and the Technologist. Initially, I evaluated the participants' backgrounds and assigned the main profile for each participant, which ensured that at least two participants were interviewed for each professional profile. However, throughout the interviews, all participants naturally commented on their experiences across multiple profiles.

Artist One

Personal Background

Artist One is a creative writer and poet and teaches creative writing at a university. When asked about her background related to the research, the artist recalled her experience participating in a national city arcade challenge when she was 7 years old. As a child, she was inspired by this experience to become a professional video game player. All her childhood pocket money was invested in topping up the video game coupons and getting the equipment and outfits for virtual characters. The artist lived in a world of gods and demons for a long time, in Fantasy Westward Journey, Audition Online, and Crazyracing Kartrider. She was secretly hoping to work for a major IT company that developed many popular video games, imagining that, in that way, she could have unlimited coupons. In the early 2000s, apart from its video game business, this company also owned a major internet literature site that first allowed literary works to be published and adapted very quickly. Therefore, in her earliest sense, literature and games were permanently bonded together for the artist.

Games Played in the Past

The first game Artist One played was the Legend of Sword and Fairy, which is translated from a classical fantasy novel. Every chapter of the game starts with a poem. At the time, she was too young to know what literature was, but she thought games and literature should be this way. The artist has many older brothers; she is the youngest child, a girl. They all played arcades together outside. Because there was no computer, they took her to internet cafes that were installed with a full suite of games. In those video games, the player is a character with a story to be inactivated.

Later on, Artist One played Age of Empires. In this game, the player starts with completely barren land. The artist liked the open-world game more because the dialogues in role-play games such as the Legend of Sword and Fairy can sometimes become boring. On the other hand, in the Age of Empires and the Command and Conquer series, she felt she had more room as a player to imagine and make. There was no dialogue but a backstory. The clothes worn and the tools used all came from the same background. Artist One also described her experience of playing Red Alert. According to her, the plot begins with a briefing at the White House. Yuri interrupts and tells U.S. President Michael Dugan that he has established a global network of mind controllers and plans to mind-control the entire planet. One of the mind controllers is on Alcatraz in San Francisco, and Yuri activates it at the end of the briefing. President Dugan immediately orders an air strike on the Psychic Controller. Nevertheless, all AV-8B attack aircraft are shot down, although one crashes into Alcatraz's nuclear reactor, causing the equipment to lose power and abort. Despite this, Yuri, hiding in the lunar command center, activates his other two mind controllers (divided between the Great Pyramid of Egypt and the South Pole). Most of the population on Earth is quickly mind-controlled by Yuri. The first episode has nuclear weapons. The sequel allows players to convert enemies into armies. The scarier the enemy, the more exciting it becomes. Players can spend in-game money to build a castle that hypnotizes the enemy. Compared to narrative games she played as a child, Artist One became excited playing strategy games like these later. The stories became secondary to the player operations.

In addition to online video games, Artist One has also played many standalone video games. The first was the Legend of Sword and Fairy, where the game develops its plot in interactive dialogues and each scenario even has a poem as an inscription. The artist also played Super Mario, Grand Theft Auto, and CS, as did everyone else. However, her favorites are still the

strategy and simulation kinds, such as Red Alert, Age of Empires, and The Sims Series. The artist thought these could be counted as the precursors of Animal Crossing. According to her, compared to previous generations, young people of her generation often lack the desire to express themselves and talk to people in the real world. By contrast, the video game world is a relatively clear and lovely place in which to reside.

Later, when Artist One was in high school, mobile phones got smarter, and she occasionally played games with beautiful interfaces, such as Monument Valley and Pokémon GO. The most recent time she felt addicted to games was at the peak of the COVID-19 pandemic when she could not do anything to help the rising terrible situation of hopelessness in the human world. Out of grief, Artist One lost herself in Animal Crossing—picking up perfect peaches to exchange for better furniture, listening to the sea waves at midnight, and blessing the virtual cherry blossoms. Here, at least, Artist One was able to construct order on this tiny island of hers which was healing. She was mostly drawn to these games because of their visuals. Playing internet games felt like a career to her—very labor-intensive, with much leveling up. These mobile games proved to be mostly just light-hearted and fun.

Then, as her life got busier, Artist One said she played fewer games. However, when the pandemic hit, everyone played Animal Crossing like crazy. On average, Artist One played more than 5 hours per day. As she grew up loving video games and visual arts and now had graduated with degrees in poetry, Artist One always feels all these elements can be combined in a wider context. Especially nowadays, with everything shifting to online, it is hard to disagree. Our virtual lives are, after all, the life of video games. Animal Crossing's time is in sync with real time. In real life, during the pandemic, players were trapped inside their homes and so could take phone calls, have meetings, and have birthdays only online. Like in real life, Artist One celebrated mid-

autumn festivals in Animal Crossing and went fishing with her friends. Back then, the artist always hung out at her friends' homes in Animal Crossing. While these festivals are from real life, Artist One was experiencing them virtually, and sometimes they were even better as virtual. For example, no Sakura is seen in New York, but Artist One could do that in Animal Crossing, which has a Sakura river and lots of fish. The artist caught the fish and bragged about it when meeting the fish shop owners.

Thoughts on Worldmaking

Artist One mentioned a project she worked on during the pandemic. Within a mysterious silk forest, a world within worlds, the labor of Chinese factory workers and silkworms is evoked through a satiric reimagining of the Chinese mythology of the Silk-Worm Horse. Both performers and audiences appear in cyborg embodiments in an online VR space, and the audience can explore the place as when playing a video game. Collaborating with lighting and sound artists, Artist One installed recordings of herself murmuring bilingual poems on tiny planets in a virtual desert. By accessing this piece (https://beyond.garden/), the audience can become immersed in an audio-visual lighting installation. When the audience gets close to a planet, players will hear a poem, and many planets are waiting for players to explore. The volume changes along with the distance as part of its highly interactive nature. Artist One noted that it feels like a video game space, but its point is similar to that of Animal Crossing: Players are not here to fight with monsters or win anything but to dive into a surreal environment and find a minute of peace.

As noted earlier, the most recent worldmaking game Artist One became addicted to was Animal Crossing. The world she assembled is spooky, surreal, and cozy. She built an outdoor hair salon on a forever-rainy site where players can sleep on a leaf. A bathtub and a tearoom were filled with books. A dessert shop is located in the graveyard. Cyber graveyard surveillance is run

by a police bear. Worldmaking is not creating a world that looks exactly like our real world; rather, it is a psychological space, more of what is built up in dreams. Artist One liked the virtual camera function in the game. She kept changing furniture, taking photos, and using them as memories. The visual continuously turns more and more surreal—something players cannot see in real life. Artist One felt that she made spaces she would have never created in real life. She also liked the aspect of seeing her friends' homes. For example, one of her friends put a big bowl of soup inside a shrine and asked lots of animals to come celebrate.

Interaction with Research Instrument

Artist One said she was scared by the code. As a creative writer, she has never worked with code first-hand. When playing games, Artist One wanted to maximize her freedom, but this was too scary. If another version were to give her some parameters to change, she thought it would be less scary. Artist One felt that it was not apparent what she could do. Things would change as time went on; some creatures would die, and others would be reborn. Some shapes were more real, like mushrooms, desks, and boots, but some were rather abstract ones and did not understand why. She suggested that maybe their vertex points had been stolen (similar to someone being robbed or beaten in the real world). Artist One felt a weird pleasure in the chaos of colors and loved the warmth of the background color. She also liked the contrast of color between the different creatures. In a future edition, she would like to see the players changing each other's colors during their encounters.

Summary

Artist One was currently grappling with the question: Does the worldmaking game become different when we enter the world of Metaverse? She is familiar with Unity, the video game engine with which the research instrument was developed. She saw the research instrument

from within the framework of contemporary art, which she likes. Artist One also likes how this game is experimenting, assuming that players also have their thoughts to offer. For example, the artist's favorite mythology game is very much a clickable book. She likes that as everyone reads the same book, each person can experience the research instrument differently.

Artist Two

Personal Background

Artist Two identified herself as practicing both new media and digital art, with some relevant experiences in simulation and building virtual environments. She has an almost lifelong experience watching much video media like films and animations, plus 2 years of experience playing video games of all kinds.

Games Played in the Past

Artist Two started as a regular gamer in 2020. Before that, on average, she played two to three games per year, mostly detective or puzzle games. As she does not own a lot of games on Steam, she also enjoys watching game walkthrough videos to get the information and experience she needs for playing certain games. Some of her favorite games are the Danganronpa Series, Papers Please, and the Doki Doki Literature Club.

More specifically, Artist Two enjoys the Danganronpa Series because of its rich plot, characters, and worldview. The game was originally conceived as a basic visual novel, but as visual novels grew less popular, new gameplay elements were added to make it stand out. Besides the unique visual narrative element, simulation has always been a hidden theme for the whole series. By the end of Danganronpa V3, the plot extended to a conversation with the players outside the screen, leading to a meta-game revelation ending and bringing the game's depth to another level. As for game-level design and mechanics, it is a successful fusion of multiple

categories, including text adventure, gal game, action game, and puzzle game, with no specific expectation of the players to be top experts in each category. The game's visual style is very stylistic and outstanding; even the fan art of this series is quite distinctive from other game fan art. It is a world combined with 2D and 3D components, and the two spaces pair up with the plot so well that they do not cause controversies. As a series created 10 years ago, it occupies a certain position in many gamers' rankings and continuously attracts new gamers. One reason for this might be the vitality of the fan population, with the fan base continuing to create imitations of classic scenes in the game. Artists value Danganronpa's techniques in combining shallowness with depth and cheesy content with serious content, creating a unique simulation environment.

Another game favored by Artist Two is Papers Please, a pixel simulation game with a simple plot and mechanism. It intertwines the history of the Soviet Union in with a fictional background, and the familiarity helps immerse the player in character. The player is a normal office worker at the immigration department on the border of a fictional nation. The successful use of historical elements and subtle choice of information uniquely build the world, strengthening the power difference between individuals and a nation. The pixel aesthetic, through which everyone is blurred, also fits the cold and ironic tone of the story.

Artist Two also mentioned the Doki Doki Literature Club, famous for its revolutionary game mechanism of building a connection between the player and the simulated world. The game begins as a typical gal game. In contrast, the plot and characters gradually deteriorate and twist, bringing a meta-revelation about the essence of gaming by the end. Artist Two liked it because of the strong contrast the game maker created for the whole process and how it effectively encapsulated many themes into the not-long process of the game. It is a work showing different

approaches to thinking games between cultures (western vs. Japanese) and critically examining our obsessions with game characters. It is a horror game that is also emotionally touching.

Thoughts on Worldmaking

Artist Two shared that if she could create a world, it would be a liminal place inside the darkness, composed of lines and pixels, and visually flat. It would have a retro aesthetic of the D&D games of the last century or old online games like Runescape. It could be horrific, like the game Sad Sata, but not necessarily. It would include a certain kind of eeriness and liminality, showing that this place differs from the real world or other realistic simulations. Ideally, the people or objects inside would be visually flat as if the world maker (a/k/a Artist Two) were out of budget, unsure if they are usable or have any personality. Perhaps some of them have, while some do not, as is true of reality. Architecture styles like Minecraft are not delicate in a common sense but are all silent and massive, with a maze-like inner structure. Many unnatural creatures hide within the walls and corners with unfathomable language. However, the world is not dangerous as the creatures will not eat players and the NPCs will not attack. Yet some people feel it is depressing because of low-rendered quality and silence everywhere. The world exists as if it has existed since the beginning of time. It might remind people of the inner world in the series Silent Hill, which requires transgression from the game's outer world to enter. If people change anything in the world, it will return to its original form in a few days. No one leaves traces in this world. If players live inside it long enough, they become homogenized into the creatures or NPCs and forget their original selves.

Interaction with Research Instrument

Artist Two described her initial reaction to the research instrument as many meshes gradually appearing in a world with several layers of color, all moving somehow towards the

center. Some of the shapes are highly irregular, while some are recognizable. As they collide, many start to extend themselves and change their colors. Black lines appear and spark as a demonstration of a collision between two objects. Artist Two put all action into the functions, so the movements of the world are dynamic. As time passes, most meshes lose their original shape, and the process seems to speed up. The artist could also change the camera angle and position during the process (the camera almost seems to move by itself as well), making the whole visual effect more chaotic. In Artist Two's observation, some meshes generate themselves without connecting to other meshes. The background color also changes from time to time. After watching the simulation for a while, more than half of the meshes turn white.

Artist Two did not feel much playing in the process, as most of her work is done when setting the parameters and function. More labor could be devoted from the side of the player. The process was more like "hmmm…interesting, let me wait and see how it transforms"—more like a watching process, though she understood this was part of her labor in the rules of the world.

The visual was enjoyable as the colors were bright and chaotic, which fit her aesthetic. However, actions like erase, clone, and seek were not so distinct from each other once many objects were happening simultaneously. Most of the time, she could see collisions, but the speed of regeneration prevented her from recognizing what exactly was happening, despite texts and numbers on the meshes. It also reminded her of some of the generative work she had made in the past through p5.js or max.msp, which resonated with this game in that she could also change the parameters of how meshes are generated and meet different visual effects. From her perspective, the lines of collisions disturb the harmony of the meshes, frustrating her eyes as she watches shapes and lines coming together without organization.

The part of setting parameters is like many traditional games, but in most games, the customization of a character does not lead to an essential change in its narrative. In contrast, the change in this game, Artist Two believes, could be described as essential or ontological. Also, there is no clear narrative of the whole process. However, she would like to view it as a highly abstracted version of a narrative in which events between characters are simplified into changes of shape and color. Thus, there is still a "story," but it is not built on a traditional human idea of a story.

The space for imagination is not much for Artist Two, but she might be viewing it from a human perspective, and she considered that something more specific would refresh her perception. However, Artist Two did like the part about moving the camera around because it put her in the position of an active observer. When looking at the collision between two meshes, she felt as if she was visiting a zoo, although the animals' behavior was not so predictable. Artist Two already mentioned some possible changes to the above part, like refining lines and shapes and separating different actions, among others. She also advised specifying multiple phases of the game. Some are still, while others are more dynamic to relax and refresh the player.

Summary

Artist Two finds that different people view simulation with individual preferences. For example, she prefers to compare the common and uncommon features of the simulated and real worlds. At the same time, some people might focus on the generating mechanism of the code or design level, among others. Different perspectives have no pros and cons, but they might lead to extremes in criticizing a simulation work. Even within the simulation world of games, there are drastic variations in the preference and purpose of making simulations. Artist Two considers the

word “simulation” to be so comprehensive that it could theoretically transmit ideas into the world infinitely.

Scientist One

Personal Background

Scientist One is trained as a cognitive scientist. She is also interested in sound art and art as systems, and she plays many video games. She is interested in systems (as a level of explanation, exploration/enactment), not so much in art. To her, art can be a speculative method for comprehending systems. Sound art is another thing, however. Sound implies organization in time, and the latter interests her. In 2019, Scientist One wrote an introduction for a book called *The Brain Is a Time Machine*, a scientific account of time. Time for her can be repeated reliably. Scientist One is interested in rhythm, the relationship between the previous and the next notes, and the difference between permutations. Many of her friends and colleagues who study neuroscience are also interested in sound; some of them compose and release electronic music. Similarly, sound is political, given the entire “radio wave thing.” Idiosyncratic actions, such as sending radio waves to North Korea, can transcend physical barriers. While it is primitive technology, it is more politically radical than the visual arts. Scientist One is more interested in activism that has the potential to revolutionize.

Games Played in the Past

Scientist One is a big fan of puzzle games Braid and Baba Is You. She recalled game theorist Ian Bogost’s statement that games are a social system, a film, software, and hardware. On the level of software, both these games point out the rules. Nevertheless, they make players realize that a game is software, and players can learn about implicit games, but more about how these rules take advantage of the nature of programming. The creator of Baba Is You was initially

interested in negation, a logical operator, and he wanted to reinvent this logic into a play style. As for Braid, its time is not time in nature but time in a programming context. The creator was thinking about how to execute this programming time and realized he could retrieve previous states of the game. If a film is rewound, it is deterministic. Nevertheless, if a game is reminded, it can inspire a potentially unlimited number of outcomes, which no one can predict, including the game maker himself/herself. When Scientist One first encountered simulation, she thought it was a closed experiment with a beginning and an end. Even in Ian Cheng's work, the artist changes software but does not take any input. Thus, it is closed. Conway's Game of Life is also like that. However, a game always considers a game player's experience, which makes it an open system that considers player-introduced uncertainty from Day One. Therefore, Scientist One does not think simulation is the most accurate way to describe a game. She is also thinking about the Souls game. Some items in Eldren Ring are tough to find, even for seasoned players. The game maker has already considered that players will search on the internet for strategy. This made her question whether designers need to consider game strategy nowadays. Is it already a part of the gameplay experience itself? Do game designers need to ensure that even searching the internet still cannot exhaust some element of surprise? The game Hollow Knights also has items on high grounds that normal players can never achieve unless they intentionally do so. Also, in the Beginner's Guide, the narrator takes players to a few places. Afterward, the narrator unveils certain areas in the game that players are forever forbidden to access. Most of the games are player-facing. The designer will think of how he or she might want the player to feel. Nevertheless, in the Beginner's Guide, the game is made only for the maker. Scientist One has read novels like that, but encountering them in games she felt was weird. In novels, reading about someone's telling of a story is the story itself. However, players shape a world in a game like Beginner's Guide and

enter a larger world, part of which is not designed for them. As Scientist One suggested, one goes back and forth between two worlds, one broken purposefully for the player.

Thoughts On Worldmaking

On this topic, Scientist One is hugely influenced by one of her professors, Benjamin Bratton, and his urban theory, The Stack. A comprehensive political and design theory of planetary-scale computation proposes that The Stack—an accidental megastructure—is both a technological apparatus and a model for a new geopolitical architecture. What has planetary-scale computation done to our geopolitical realities? The background is that today's computing systems are best understood as a global megastructure (the titular Stack). The Stack is layered, and Bratton identified six tiers: Earth, Cloud, City, Address, Interface, and User. Earth entails the material and energy-harnessing geological demands of computing; Cloud names the weird sovereignty of corporatized, global technology services like Google; City addresses the lived experience of cloud-computerized daily life; Address deals with identification as a form of management and control; Interface connects with coupling users to computers; and User relates to the human and nonhuman agents that interact with computational machines. Previous notions of sovereignty separated by national boundaries are revealed to be not just obsolete but have always been wishful thinking. Now it is necessary to see how territories and models of governance take their form in virtual layers, although this is not yet familiar to see or compare with the model of government-citizen as it is known today.

Interaction with Research Instrument

Scientist One presented an exciting assumption that rulemaking is like multiple choices. However, she was stunned to see that the actual code block was presented to the player participant. Seeing this code block reminded her that in classical economic modeling, students are

constantly asked to edit ranges of numbers, and the number closest to the norm wins the game (e.g., guessing the norm value of what others might guess). The final converging number always differs when playing with people from different backgrounds. It is like a more complex version of Prisoner's Dilemma. Scientist One noted that when people communicate in everyday language, they have assumptions about what others might say in typical situations—a form of convergence. Maybe players can consider changing the teleological goal so that they somehow can prevent people from optimizing their state of the game at the expense of others, such as restrictions or tools. Scientist One is part of an artist community, an experimental economic system called "relationship currency." In this community, one must share its currency with others. Maybe someone provides labor of care and earns currency this way. Similarly, in Journey, designers can limit how players interact with each other—for example, by not being able to push someone off the hill.

Scientist One once had a conversation with design philosopher (and her professor) Benjamin Bratton, who asked her what her parents did. She replied that they had some boring jobs at large banks. Bratton noted that risk management in banks is a very undervalued virtual reality. He was very interested in preventing human existential risks like destroying the earth. The social responsibility index in the financial market was also fascinating as it has existed as a financial instrument for a long time, but nobody uses it. Along these lines, a behavioral economics concept called Paretto is possible from a system and statistical point of view but very hard to achieve in reality. Human rationality is a major obstacle. The measurement of efficiency, which is singularly defined, is also questionable. This experience reminded Scientist One of a heated debate in the game world a few years ago about whether a game is a system of rules or a kind of narrative.

Summary

Scientist One said this experiment made her recall a heated debate in the game world from a few years ago, which is whether a game is a system of rules or, rather, a kind of narrative. In video game studies, this debate is termed Ludology vs. Narratology. The term Narratology emerged as the need to study narratives or storytelling arose. The problem with this term is that scholars from different disciplines contribute perspectives from outside the purview of storytelling that this term cannot unify. Ludology, or a system of rules, was created to borrow from the Narratology tradition and do more. Aarseth (1997) described story as our primary mode of understanding of the world.

The research instrument also reminded Scientist One of what Jasper Jul (2005) wrote in his book *Half-Real: Video Games Between Real Rules and Fictional Worlds*:

> Video games are two rather different things at the same time: video games are real in that they are made of real rules that players interact with; that winning or losing a game is a real event. However, when winning a game by slaying a dragon, the dragon is not a real dragon but a fictional one. To play a video game is, therefore, to interact with real rules while imagining a fictional world; a video game is a set of rules and a fictional world. (p. 1)

Juul noted that games are both ludic and fictive, without the need to give up their systematic or fictional nature. Also, just ask for the research instrument; for every other game, there is part of it that more closely refers to our immediate reality than others. Game is powerful because it contemplates the potentiality of the future related to the present in an imaginative but not causal or suggestive way. It contemplates the future without holding it hostage to the past. In a game, the rules are real, governed, and executed by computers, but the overall experiences are stored in the act of play and the players' minds.

In the research instrument, virtual avatars of player participants had their own experiences of dying, giving birth, and escaping, among others, which are not direct reflections of the rules of

the games themselves, but rather their perceptions of the rules. In another word, there are parts of the game that are more fundamental, and others personal knowledge of the mind, the experience of the fundamental, epiphenomenal. Hunicke, LeBlanc, and Zubek also wrote in Mechanics Dynamics Aesthetics of game design that the player experience of a game is produced by the player's interaction with the game's dynamics, which are the emergent effects of mechanics or rules designed by the designers. The essence of a game lies in the player's perception. However, a game also operates more profoundly- the realm of mechanics or rules.

The participant also said that the research instrument reminded her of a term called operational logic. It refers to the idea that games exist on multiple levels. However, some are more real or material than others. This leads to the game/player problem. The game frames what players can do, but the player enacts a game from a nicely packaged piece of software. This relates to studies of multiplayer games as social, political, and economic ideologies. She referred to a diagram made by game theorist Ian Bogost, from whom she originally learned of this concept.

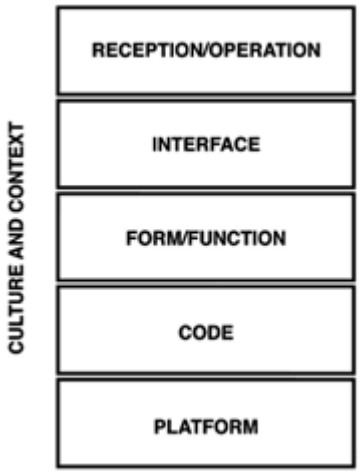

Figure 10. A model for computational creativity (Bogost, 2022)
http://www.bogost.com/images/content/writing/levels.gif

Scientist Two

Personal Background

The second scientist is professionally trained as a data scientist. He has some understanding of the complex system but not as much as a physicist. His professional job involves analyzing large quantities of online data to make strategies for improving user experience on a massive social media platform. He shared that he has been an avid video game player since he was young and has played many video games over the years. He especially likes simulation and worldbuilding games, such as Cities: Skylines. From a player's perspective, it is a simple game that accumulates. Minecraft is also similar, with a more fundamental building block—a 3D pixel. Scientist Two has participated in some server activities, but nothing compares to experienced players. Currently, he is playing Rim World, a narrative-building game about a free world with an accessible narrative. It is built with AI generation, which he finds to be even more fun. Rim World is one of the best-built games, in his opinion.

Games Played in the Past

Scientist Two shared his experience playing a few massive online multiplayer games. The game Cities: Skylines has a very active mod community, where players can use mods to have more aesthetic and design choices. Some Japanese modders recreated the entire landscape of Japan, with details of street architecture and traffic signs that replicate the original in Japan. As a player, Scientist Two downloads many mods but rarely contributes his own because he does not know how to make assets. He is mostly interested in game mechanics and liked large, commercial games as a teenager. When he started high school, he began to feel that AAA games were boring. After playing open-world RPG games like Elderscroll, Fallout, and Fallout New Vegas, he started to realize that the narrative was essential. A good narrative made him much more interested, and

he invested in narratives. These games made him realize that his choices would influence the narrative's long-term impact. Scientist Two also noticed that choices made early on would affect the player's relationship with certain factions, which would in turn influence the game's ending.

Scientist Two expressed that for him, the Co-op mode in Elden Ring provides an excellent opportunity for collaboration. He also mentioned Rimworld, a game that centers on surviving in a space colony. The game comes with an in-game editor that enables players to edit each character's characteristics, experience, region, and beliefs. The game has a low-fi visual that allows modders to contribute new objects and gear quickly. AAA developers often prioritize creating cinematic games, while games like Rimworld can allocate more resources to the rule of play and narratives. On Reddit, which the scientist considers a worlding experience in itself, several subreddits are dedicated to Rimworld. Moderators of each subreddit decide what content to feature. Popular subreddits include mods and scenario designs. Players also share their single-player experiences, such as realizing that a player controller they created in a previous round was rebranded as an NPC with additional generative behaviors.

Scientist Two expressed a fondness for the Software Series, which includes games such as Dark Souls III and Sekiro. He found the game's narrative mode interesting, describing it as almost like a meme. The game's backstory is hidden within the details embedded in environmental design, item design, and item description. Every single item, timing, and character's path strictly reflects part of the overall narrative. He also appreciated the game's level of difficulty. He compared it to skiing, explaining that falling at first is scary but gradually becomes less so. Similarly, the game allows him to create a boss dance moment, which is very satisfying. Unlike AAA games, which are often busy on the eye but simple on the brain, Souls games offer a challenging experience that he appreciates.

Thoughts On Worldmaking

Scientist Two has developed an interest in exploring the basic elements of biology and the motivations of different species. As part of this interest, he plans to conduct an experiment where sentient beings such as dwarfs, elves, and prehistoric simulations are placed in a controlled environment to observe how they evolve under different settings in parallel worlds. Scientist Two intends to make slight adjustments to parameters such as total resources, geography, distance, isolation, traffic, and individual motivation to see how these beings behave. The experiment will involve simple models where each being has a utility function based on self-interest, maximizing long-term gain, and altruism. He plans to observe the results without intervening or looking at the intermittent results. The cost of altruism will be a factor, making it difficult to accomplish.

Interaction with Research Instrument

Scientist Two noticed a similarity between the research instrument and the previous thought experiment on worlding. He expressed sadness that game companies are no longer producing massive multiplayer online (MMO) games and massive multiplayer online roleplaying games (MMORPGs) like World of Warcraft, Final Fantasy, and Elder Scrolls Online. Scientist Two wonders why this is the case and believes many people still enjoy the experience of building a community with others online. Minecraft, for example, allows players to sell access to their servers, while Fortnite allows players to sell scenarios, mini-games, and mechanisms. The metaverse is beginning to have landlords, which makes the original game developer a mega-landlord. Scientist Two questions how this is different from the iOS store and how the experience of play can be transformed into work for the original game developer. The creator of Wordle previously developed a Reddit pixel drawing experience that resulted in the creation of many community symbols and memes.

Summary

Scientist Two has a keen interest in exploring human motivation and its outcomes when beings with different motivations are brought together. He plans to conduct stylized experiments to examine this phenomenon. Additionally, he is intrigued by group scenarios, such as in the game Rimworld, where the player's world is joined by sims with varying personalities, including prisoners, refugees, and others. Failure to actively manage and convert people with marginalized or extreme beliefs can lead to a crisis, and Scientist Two wants to explore this aspect further.

Technologist One

Personal Background

The first participant in the study identified as a creative technologist who builds interactive installations with game-like elements in an experiential design studio. He felt that his technical background and expertise aligned well with the research topic. As both a technologist and a designer, Technologist One brings a unique perspective to the study. Additionally, he has been an avid video game player since he was 7 years old, considering it his default mode of play growing up.

Games Played in the Past

Even though Technologist One grew up playing video games, the number he played might not compare to most people. He spent much time playing games, but not very different kinds of video games. In terms of games he likes, he enjoyed RPGs while in high school, especially the experience of going through scripts and interacting with other characters. He felt really immersed in the stories as if he had known those characters for years. For a few weeks or months during and after playing the RPG game, he felt he was the protagonist. He felt their happiness and sadness. Many RPGs are inspired by ancient mythologies, so the game world is very beautiful and engaging. Just as it could take weeks to complete a fictional novel, so too could good RPG games. To Technologist One, storytelling and role-play games constitute his favorite genre because he likes seeing a person going through life with a complex bittersweet experience.

Technologist One also appreciates games that have great music that accompany the stories. For example, Bloodborne does not feature role-play, but is mostly about battle and mythology. However, the music elevates the game to new emotional and psychological levels through music—a universal abstract form of storytelling.

For example, in Dark Souls, instead of one monster in a room, there is a MOD generating three monsters in a room. When Cyberpunk 2077 was first released, some players were not satisfied with how blue the sky was in a game reflecting a dystopian post-capitalist worldview. Thus, one game player released a MOD that made the sky very dim.

Thoughts On Worldmaking

Technologist One first reacted to the question "What would a perfect world look like?" but soon realized that it was an unanswerable question. Instead, he reinterpreted this question as "How can we take advantage of the easiness of creating a computationally simulated world to help people make decisions in the real world?" Technologist One will create a world that looks exactly like the world we live in—a simulated version of our world—which can help us look into the future. He referred to everyday examples such as deciding what food one should eat: "I will create two worlds simulating two options and observe the outcome," Technologist One said. "Or, if my friend doesn't know whom to marry, I will also create two worlds for him or her to simulate some conditions computationally." He enjoys thinking about the process of creating this world—how to figure out a mathematical and procedural way to represent our current world. He feels that this question will help him make sense of the real world in a somewhat abstract and predictable way, which helps manage uncertainty.

Interaction with Research Instrument

When Technologist One interacted with the research instrument, he realized he could not tell the world simulation engine to make whatever kind of world he imagined in his mind. Demo scripts already had concepts like "jump," "speed." and "movement," which were predefined in a programmed way. Regarding this, Technologist One referred to Disco Diffusion, a popular AI-catalyzed text-generation engine as an example of what he expects of a "free" worldmaking

engine. “The input of the network is text. You tell the engine a few words and the engine with generating literally anything for you.” He shared an image generated with the algorithm: “A dog holding a cat calmly and looking at it in its eyes. Pink Color Theme.”

Figure 11. An image generated by AI engine Disco Diffusion with the promo “a dog holding a cat calmly and looking at it in its eyes. Pink Color Theme”

Technologist One felt this was an example of an open-ended tool, which allows him to be immersed in his own world while using it. In contrast, he felt that the world offered by the research instrument made him leave his own world to realize the potential of this world. Technologist One seemed to be commenting on the difference between an engine, a platform, or a tool that makes worlds, versus a world that allows inhabitants to make certain choices within. He thought that most video games belong to the latter category. For example, in Call of Duty, in order to participate in the game, players need to believe they are entering this virtual world as a WWII soldier. In a way, players are contributing something to a world that already exists, so (by way of entry into this world), players need to (know and) obey the rules that are already established in this world.

In addition, although Technologist One is familiar with the technical platform (Unity) and coding language (C Sharp) that were used to build the research instrument, he felt a strong desire to understand more about the creative boundary of this platform. What are examples of functions and APIs that previous players have already made in this world? What is the goal? Technologist One felt that knowing what has already been made will open up so many doors. He said that when he travels to a foreign country, it is important to know what cultural protocols are already in place and which languages are spoken. In this way, even if a foreigner does not speak any of the local languages, one can still think of alternative solutions such as doodling, body gesture, or more. Technologist One felt that he is a problem solver who relies heavily on borders and constraints. For him, freedom comes from solving problems and disrupting boundaries.

When faced with the research instrument, Technologist One had a clear realization of the mutually stimulating relationship between creativity and limitation. He wished that someone would tell him what he cannot do, which would help him get creative. It reminded him of the game World of Warcraft, which offers a finite number of emotes such as clap, poke, and dance. Players then get very creative with these tools and go on to host pool parties and role-plays. Technologist One thought that for every designer and player, there is a sweet spot between giving players some options but not too many. Developers also cannot accommodate all requests. This is tantamount to the 20/80 rule, often mentioned in the design industry. The makers can spend 20% of their effort to fulfill 80% of player scenarios. Then, the makers can decide if they want to spend 80% of their effort to achieve the remaining 20% of player needs. Technologist One thinks this art of balancing limitation versus openness is true for any game. Some games give fewer constraints, as with strategy games such as Minecraft. Other games, like the cinematic game Uncharted, give very limited options. Technologist One personally enjoys the games that are in

the middle, like the RPG games he mentioned earlier. One can choose to be a man holding a catana or using a magic wand. On the other hand, Uncharted is a very well made game in terms of visuals, but given so few choices players can make, the game feels more like watching a movie while clicking forward and back buttons on the controller rather than playing a game. Technologist One thinks there is no absolute rule when it comes to design freedom and constraints. In fact, he really likes the term "design constraints." He thinks freedom lies within constraints.

Technologist One made a few interesting connections between the physical and the virtual world. The first is a virtual pandemic that happened in the MMORPG World of Warcraft called The Corrupted Blood incident. It began on September 13, 2005. The plague was caused by the introduction of the new raid instance Zul'Gurub and its end boss, Hakkar the Soulflayer. Players who fought Hakkar were afflicted with a debuff called "Corrupted Blood," which damaged them over time and could spread to other players and non-player characters (NPCs) in the vicinity. The plague quickly spread throughout major cities in the game, killing many NPCs and players before it was contained. The incident was widely reported by mainstream media and has since been studied by medical, military, and academic professionals who have used it to better understand real-world epidemics.

In addition, Technologist One expressed a sense of boredom and fatigue towards the world of gaming in general; this mirrors a feeling of exhaustion that everyone is already familiar with in the real world. He felt that sometimes gaming seems like a very dead world, with many monsters and mobs behaving in ways that one might very well expect or anticipate. While they may look vibrant and beautiful, like animals in the wilderness, they nonetheless behave very predictably—sitting and waiting for the player to hit them before they do anything. Technologist

One considers this related to the fact that many games try to motivate players to achieve a one-dimensional goal that is competitive at its core. As a result, most of the efforts of making a game go into simulating computational creatures that are mobile enough to be killed instead of creating creatures who have real experiences or are really alive.

Summary

In addition to the specific feedback from interacting with the research instrument, Technologist One also mentioned a few more general, cultural-level associations. The collectivist aspect of the instrument reminded him of an example called Plague of Blood in Warcraft. One player's action will stir up the butterfly effect and directly or indirectly affect other players, even the world—landscape, climate, conventions, cultures, and so on. Conversely, he liked how, compared with World of Warcraft, this instrument can be changed by a player in almost any aspect one can think of.

Finally, the research instrument reminded Technologist One of the hacker movement in the 1990s. The term *hacker* used to be very popular but no longer. Instead, it encompasses a free spirit, an innovator mind, and someone capable of achievements that are bigger than individual interests. For example, the person who made Twitter and Facebook was able to make a much bigger influence than someone who made a car. Snowcrash, the novel that invented the word *metaverse*, depicted a fictional world in which hackers are the all-powerful group of people who have the ability to change how the world works. When Technologist One thinks about worldmaking in the digital world, it is heavily linked with the hacker spirit. For example, in the setting of this research, there is a blank canvas in the digital realm. Any hacker can chime in and change virtually any aspect of this world, not just in a cosmetic sense, but in the way it works—in its very roots. It sounds like the ultimate political thought experiment, and it is more about the

process rather than the result. Technologist One is not so much interested in whether the participants end up creating a perfect world; rather, do they exercise their power in the process itself? The end world might be a terrible place to live in, but for Technologist One, that is another different research topic and experiment.

Technologist One has a keen interest in observing players hack the boundaries of the Dark Soul series through regular video viewing. He finds this relationship between gameplay boundary, game limitations, and player agency fascinating. Although all games have predefined limits, players have an inherent desire to break these boundaries. Players employ various methods such as modding and game file changes to expand the game's limits. Through this process, players experience happiness, pleasure, and a sense of freedom that are extremely rewarding. Technologist One believes that for players to experience this happiness, they need rules to break. He likens this experience to a contemporary art piece he observed, where an artist put up fake street signs in a city and named the streets after his own name. The artist and his audience gained a sense of pleasure that is akin to the hackers attempting to break the structure of a game system.

Technologist Two

Personal Background

Technologist Two identified professionally as a creative technologist. Many of his professional projects revolve around creating collective spectacle using various software and hardware technologies. Personally, he has played video games since a very young age. His favorite story was that he and his brother played Golden Eye with their father when they were 5 and 7 years old, respectively. They beat their father so badly that he stopped playing with them.

Games Played in the Past

When Technologist Two was young, he played a very simply made shooter game called GunZ: The Duel. At some point, a few Korean players found a bug in the game, which is that one can fly around at any point of the game anywhere by swinging a sword in a particular butterfly motion. From that point on, the game became far more popular than the original, non-hacked version. This story made Technologist Two aware of a unique way players can empower themselves by breaking the original game rules.

Similarly, Technologist Two recalled playing Apex Legend, a battle royale-hero shooter game. At some point, he discovered a technique called bunny hopping, another example of hacking the play style of the game. If a player chooses healer as a profession, he or she can perform this rapid high jump while healing players nearby, making the overall team much harder to defeat. As a result, the game maker eventually rolled out a software batch to disable this operation after hearing from less skilled players about the difficulty of performing it, which implied an unfair advantage to more seasoned players.

Besides playing games, Technologist Two follows video game streamers and Reddit discussion forums. For example, he watches Criticalroach, a popular Twitch streaming on roleplay tabletop game Dungeons and Dragons. In this channel, viewers created a term called "rule lawyer," referring to rules that arise in D&D play sessions that generate fun play experiences that are not included in the official D&D rule book. Similarly, when playing regular chess, one always wants the game to be the same. However, a Reddit discussion forum called Anarchy Chess features a meta-chess game in which players can make up any rules as they progress to each additional round of the game. For example, NoseHeavy123 posted a recorded anarchy chess session featuring two middle schoolers cheered on by their classmates in a

classroom. At some point, one player countered chessboard H7 with a G8, which is a microwave he found in the classroom. In the comment thread below, jml011 continued the make-believe rules by commenting that "he could have played Convection Oven from d6." Not far below, Dedoorath said, "if you come up with a good enough reason or it fits your past choices, you can essentially make any move. It's so fun."

Besides social rules, the rules that shape one's identity can also be challenged in a virtual game setting. Technologist Two watches a number of VR chat videos for professional research at work on metaverse design. According to him, some people do not want to reveal traits of their physical identities and do not speak. They borrow VR technologies and full-body trackers to become very expressive at using emotes. One will not necessarily know their voices or see their faces, but through their virtual bodily gestures, other VR chat participants quickly understand who they are. In VR chat, people learn how to interact with their friends who do not speak verbally by subverting the original bodily gestures into the use of expression beyond the original intention of the platform.

Thoughts On Worldmaking

Technologist Two plays Dungeons and Dragons with his friends on a regular basis. For him, playing this game is making a world among the players. It is about using roleplaying and storytelling about adventure worlds of swords and sorcery with other players. The progression of the game is jointly driven by the imagination of the players, game statistics, and roleplaying hooks reinforced by the dungeon master.

Players tell the dungeon master a race (such as human or halfling) and a class (such as fighter or wizard) that they want to have. They also invent the personality, appearance, and backstory of their characters. It is open-minded, depending on the adventure the players want.

Similarly, Technologist Two wants his world to afford whatever people want, which is not the same as being able to do just anything. One is still bound to a physical map, which dictates where to navigate one's avatar. In combat, one can move x feet per round of strike. However, once off combat, like the make-believe games children play, the game is mostly driven by creative problem-solving. For example, in Legend of Zelda, Breath of the Wild, hacks and exploits have been explored by the community for years; they do not hack the game via code but by combining special mechanics and in-game physics to create whole new ways of solving problems, beating enemies, and exploring the fictional land of Hyru from heights that are not possible by regular gameplay.

According to Technologist Two, many people's in-game D&D characters end up becoming different facets of their real-life personalities. One carries oneself into a game but expands beyond the physical realm to the imaginative realm—the theater of the mind or collective imagination. When one becomes a more experienced player, one can converse with other players' characters and say such things as, "I don't trust this guy. I will do a wisdom check on this guy." The more one learns about other players' real-world personalities, the more one can shape one's way of approaching in-game encounters. Real-world personas inspire different in-game tactics that one can operate at any given time.

Interestingly, Technologist Two also played another tabletop RPG game called Fate with the same friends with whom he plays D&D. Fate has fewer rules; anyone can change the environment at any point, but this makes the game less interesting. Technologist Two thinks that many times, well-designed rules that give entrance are freer than complete freedom. He has many friends who make their own video games. As a result, he is frequently asked to playtest their games. This makes him think about how to find bugs or break people's games—and that is when

the game turns fun! He asks questions like “What if I turn off the light?” and “What if I put my hand here versus there?” Oddly, for a player, the fun comes from thinking of ways to break what already works in a world. By contrast, too many rules can also be hard. For example, when Technologist Two played Valheim with his friend, he built an escape room on an isolated island. Players must jump in a very particular way through a platform with many holes in order to progress. Technologist Two described it as “so painful and suffering” to play. He felt that when the game reaches this level of difficulty, it no longer has a point. Feeling something is too difficult can be very discouraging for a player. In a way, this difficulty is a result of having too many rules the players have to follow all at once.

Interaction with Research Instrument

Regarding the research instrument, Technologist Two was surprised that players were given access to change all parameters in-game. It is interesting to see how players can do anything, even erase the entire game. He mentioned that the only other game he knows that allows players this level of access is Screeps (https://screeps.com/), an open-source game wherein the core mechanic programs the unit’s AI. Players control their colonies by writing code.

Technologist Two mentioned that he loves the customer characterization of the game and would like to see more of it. He thinks people either enjoy creating something that represents them or make something completely hideous. He would also like to see visual representation when he is changing the stats of the world. He wants to see more rough-like procedurally generated maps that can introduce complexity via the uncertainty of the world map.

The research instrument also reminded Technologist Two of a common video game playstyle called min-maxing. Min-maxing is the character-building strategy of maximizing a specific desirable ability, skill, or other power of a character and minimizing everything else that

is considered undesirable. The result is a character who is excessively powerful in one particular way but exceedingly weak in others. Min-maxing has a history of controversy among players and game designers. Game designers may dislike min-maxing because it discourages variety in play through extreme specialization. It can also 'break' the difficulty balance of a game—making parts of a game too easy or too hard—since games are usually tuned with the goal of providing a reasonable (and thus enjoyable) level of challenge for all normal character builds. Over time, video games have grown more accepting of min-maxing in general, and game design has improved to better account for min-maxing by players. Games such as Diablo III embrace min-maxing as a core part of its gameplay loop. Other games with more story and roleplaying, like Mass Effect, have separate character-building systems for in-combat (skill points) and out-of-combat (paragon/renegade points) so that a min-maxed character does not have to sacrifice one for the other.

Summary

Overall, this research reminded Technologist Two of AI training processes in the 1990s. Virtual creatures evolved to perform specific tasks in simulated physical environments. Swimming speed was used to determine survival. Most creatures were the result of independent evolutions. Some developed strategies similar to those in real life. Once they evolved multiple copies, these creatures could be made and simulated together in the same environment. The next group of creatures evolved for their ability to move in a simulated land environment with gravity and friction. Some seemed as if they could use some assistance, while others were fairly efficient with a rowing-type behavior. Separate groups then evolved for different goals—some for their jumping ability, others for their ability to follow a red light source adaptively. In later stages, the resulting creatures from the previous stage interacted with a user, who moved the light source

around. Those with propeller-like fins tilt them according to the direction of the light and can adaptively swim up or down very well. However, when Technologist Two plays games with his friends, there is a very different key behavior. He used to play a game called Need for Speed_ Undergrounds II. When they first began playing online, there was no way to drive around with his friends. Later, they discovered a tiny crack on the highway, beyond which point players can enter this free roam mode instead of speeding against each other as in a normal X formula race. Technologist Two and his friends lined up on the highway and passed through the crack individually, effectively transforming the game into an entirely different one. In similar games like GunZ: The Duel, whole systems of behaviors are designed specifically for transgressing the original game. What Technologist Two alluded to is that, in a simulation game, even though AIs can be trained to optimize towards specific goals, they will not have the ability to challenge the goals themselves. To the contrary, when real humans play a game, they sometimes question the original goal of the game in its entirety and devise playstyles that were not intended by the original premise of the game.

Findings Through Research Questions

The main focus of the field observation was the following two research questions. Firstly, to what extent do field observations suggest that current software systems, specifically, videogame may function as forces of control, i.e., influencing the player's behavior and normalization, i.e., limiting alternative modes of play over time? Secondly, in what ways can software game environments be designed to inspire players to challenge the premise of the game and initiate behaviors that go beyond the limitations imposed by the designers? In other words, how might an individual player assume agency?

Method of Investigation

The above questions were investigated through three steps. First, six participants were invited to speak about worldmaking as a thought experiment. That is, participants were encouraged to describe the kind of world they could imagine building as a game without being constrained by technological issues.

Second, the researcher invited the participants to interact with a research instrument inspired by an open-world simulation video game. With the research instrument, they could design and make an imaginary virtual world using visual and procedural tools.

Finally, a follow-up interview was conducted with each participant. The six participants were invited to reflect on their experience of virtual worldmaking with the research instrument. They could either describe it directly or compare it with their past experiences playing video games; interacting with digital platforms; or drawing additional references from articles, books, movies, and audio or visual materials.

The following presents general responses from the participants' interaction with the research instrument.

The six individuals who were invited to be participants in this research consisted of two artists, two scientists, and two technologists. This spread of background experiences was intended to discover whether and how different interests shaped responses to the design of video games.

The findings suggested that the two artists focused on designing the visual style of their avatars as well as the overall look of the virtual world. In addition, they focused on designing the audio and visual effects of the avatar's behavior in the world, such as bumping into obstacles and meeting other virtual creatures. In addition, one of the artists expressed difficulty interacting with the research instrument at the rulemaking level. She found that writing procedural rules that are

interpreted and executed by a computer was scary. The other artist commented on the lack of a variety of behaviors in the virtual world. Both artists found the virtual world simulated by the research instrument as too abstract, lacking personal details, feelings, and expressions. They suggested a few games, such as Animal Crossing and Doki Doki Literature Club, that allowed more nuanced expressions to unfold. Like novels and movies, these games feature characters that look and behave like real humans.

Compared to the artists, the two scientists commented on how the overall virtual world changed due to individual agent actions, such as how virtual avatars made by players inhabited and enacted the virtual world. In the design of their game, both scientists changed the parameters of their avatars' actions and observed if the world became more stagnant, chaotic, or emergent. In this way, the scientists contrasted with the artists, whose parameter design for their avatars focused largely on visual attributes such as shape, color, and sound. The scientists indicated they wanted to spend more time with the research instrument to observe the long-term effect of collective behavior. On the other hand, the artists were less interested in change over time but more focused on immediate, visual-oriented changes in the game. The scientists also appreciated the abstractness of the virtual world simulated by the research instruments, while the artists were more concerned with preserving elements of the physical reality. Moreover, the scientists thought abstract environments called attention to complex systematic changes over time. They referred to classical behavioral research experiments such as Prisoner's Dilemma and Conway's Game of Life that showed a relationship between individual actions and systematic design over time. Lastly, both scientists referred to research papers on worldbuilding in software environments that offered ways to redesign the world as it might evolve.

Like the artists, the two technologists commented extensively on the importance of storytelling as rulemaking. However, unlike the artists who thought of storytelling as an expressive means, the technologists thought that having a convincing backstory of the world and individual players helps the players find meaning and motivation to immerse themselves in the world. In addition, they thought stories help establish the world's limitations and boundaries, motivating the players to take action. In addition, the two technologists commented on a unique aspect of the videogame that neither the artists nor the scientists mentioned—hacking and modding the game. Unlike the artists who saw themselves as individual inhibitors, or the scientists who saw themselves as observers of the world, the technologists saw themselves as hackers of the world. When they interacted with the research instrument, they were motivated to find ways to break the game, play it in unconventional ways, and write software rules to change the game's original premise completely. Both technologists made recommendations of games they played in the past that used storytelling as a way to construct order and encourage individual players to break them simultaneously. Thus, the technologists held a uniquely different view from the artists and scientists—playing as making, breaking, and remaking rules. Lastly, similar to the artists and scientists, both technologists also talked about the integration of AI. They believed that the emergence of sentient, nonhuman creatures was the future of gaming.

Expected Findings from Participant Interviews

In addition to interacting with the research instrument directly, the six participants were also invited to reflect on their actions. They were prompted to comment on it as a conceptual framework for virtual worldmaking, compare it against their past personal experience playing games, or note its impact on the general videogame culture. All six participants offered their views of videogame conceptually, practically, and analytically. However, influenced by their

professional lenses, the research data collected identified and supported three key themes. Statistically, Game as System was mentioned 22 times, Game as Storytelling 15 times, and Game as Action 13 times. Below is a more detailed qualitative description of the themes.

Theme One: Game as Storytelling

Visual and Literary Storytelling. Overall, the two artists mainly viewed the videogame as a medium of storytelling. Both artists frequently mentioned that they were drawn to games because of their visuals. As seen from their profiles, the artists frequently mentioned visual elements like color and shape to describe their favorite gaming experiences. For example, when describing her interaction with the research instrument, Artist One said, "There are shapes that are more real, like mushrooms, desks, and boots, but some rather abstract ones." It is clear from this statement that non-representational images were not so compelling. She also mentioned having "a weird pleasure in the chaos of colors," especially the contrast of color between the different creatures. When given an open-ended opportunity to inquire what they would change in the game, Artist One said she would like to see the players "changing each other's color when encountering." Due to her professional background as a creative writer, poet, and someone who teaches creative writing at a university, Artist One often mentioned the connection between games and poetics. Indeed, in her interview, she explained that she started playing role-play games based on classical fantasy novels when she was very young. Stimulated by these gameplaying activities, she stated that she "was living in a world of gods and demons" as a reflection of her childhood interests. Based on her earliest experiences of playing games translated from fantasy novels, she felt that "literature and games have always been bonded together." Moreover, both artists mentioned in their responses the importance of literary elements like the richness of character and plot development as critical to game design. They thought that

engaging visual details such as color, shape, and backstories help a game stand out by building complexity and inviting the player to be deeply immersed in the activity. For example, Artist Two mentioned one of her favorite visual-novel games, Danganronpa. This refers to a Japanese game franchise created 10 years ago by videogame designer Kazutaka Kodaka, which "occupies a certain position in a lot of gamers' rankings and could continuously attract new gamers." The theme of this particular game is based on a series of high school detective activities, in which the vivid visual, sophisticated character profile continued to motivate a vibrant online fan population. Overall, visual and literary detail motivates players to immerse themselves sensorily and emotionally in the game world and commit to player engagement. Player engagement is, of course, a critical condition for any kind of action that takes place in a game world.

Personal Expression. Storytelling also plays an important role in expressing one's needs, feelings, and aspirations in a semi-fictionalized environment. Technologist Two is a long-time player of the roleplaying game Dungeons and Dragons(D&D). In each session, all players construct narratives about their race (such as human or halfling) and class (such as fighter or wizard). They also invent their characters' personalities, physical appearances, and backstories. Technologist Two thought that this process was one of the most open-minded gameplay experiences he has ever encountered, which could afford almost any adventure the players want. According to Technologist Two, many people's in-game D&D characters become a combination of personal and creative expressions, fusing facets of their real-life personalities and their imaginations about the future. One carries one's past into a game but also "expands beyond the physical realm to the imaginative realm—the theater of the mind." Players' backstories allude to their fictional missions in life. The characters' aim serves as their primary driving force, and everything their character says and does should revolve around this ultimate objective. It also

hints at how far the characters are prepared to go to obtain what they desire. For example, if a player's character lost one's family in a mercenary's rampage and wants to seek revenge on those responsible, the desire for revenge compels him or her into adventures. Perhaps he or she is willing to do anything for revenge—even sacrifice oneself or one's friends. As players become more experienced, one can have a conversation with other players' characters. One can say such statements as "I don't trust this guy. I will do a wisdom check on this guy." The more one learns about other players' real-world personalities, the more that learning shapes one's way of approaching in-game encounters. Real-world personas inspire different in-game tactics that one can operate at any given time.

Creative Constraint. However, according to Technologist Two, expressing oneself is not the same as being able to say or do anything. Storytelling naturally introduces multitudes of implicit creative constraints to the game. First, each story is bound by its internal integrity. For example, if a player designs a character narrative of a human, other players are expected to derive associated details from this race. Humans reach adulthood in their late teens and live less than a century; their base speed is 30 feet per minute; they are normally between 5 to 6 feet tall. For any backstory to be compelling, all details must contribute coherently to the overall characters' goals and motivations.

In addition, character backstories should also reasonably extend into how virtual characters interact with each other in-game. For example, if a player chooses Human as one's virtual character's race, the character should behave in ways aligned with the legacy and culture of this race. For example, it is reasonable to expect the character to pick up the languages of other people gradually as they have regular interactions. Alternatively, if a player's character is a half-

orc who grew up among humans, perhaps he or she will naturally step forward to protect the village. Orcs have a reputation for strength, honor, and fighting off enemies. They should expect to attract the attention of other in-game players who might recruit them for adventures. As with the make-believe games children play, the game world of D&D is also driven by creative problem-solving, drawing heavily from personal and imaginative narratives.

Space of Feelings. Among all participants, both Artists and Technologist One described their in-game experience by describing how the game made them feel. For example, when asked what kind of world one would create, Artist One defined her world as "spooky, surreal, and cozy." Similarly, when describing her encounter with the research instrument, Artist Two said the world does not feel dangerous because "creatures won't eat players and the NPCs won't attack them," but the low-rendered quality and lack of sound effect "feel depressive to some people." When describing his favorite games, Technologist Two said the roleplay game is his favorite genre because it allows him to see another person "going through his or her life with a complex, bittersweet experience." He also mentioned that he grew to like many soundtracks of the fantasy RPG games he played in the past. The whole experience is very immersive, which provides the same sense of personal intimacy as "reading a good novel." He also compared this personal intimacy with the intimacy provided by media technology like VR and AR goggles. He said it is not the same sense of intimacy; the latter is more like technological immediacy.

In addition to being a space to notice one's feelings, the game world is also a space to process and reorient these feelings. When asked about one's thoughts on worldmaking, Artist One spoke extensively about constructing virtual healing spaces. During the COVID-19 pandemic, Artist One built a small island with an outdoor hair salon on a forever rainy site where players can

sleep on a leaf, have a bathtub, visit a tearoom buried under books, and enjoy a dessert shop in the graveyard. She considered worldmaking not as recreating a world that looks like the real world in which we already live, but as a psychological space—a dream. She has frequently hosted virtual tea parties and invited her friends to join her virtually during COVID. She found it a very healing experience because she was able to construct "a sense of order and warmth." She also liked seeing her friends' homes, many of which were also made to be meditative. For example, one of her friends "put a big bowl of soup inside a shrine and asked many animals to come to host ceremonies."

Theme Two: Game as System

Both scientists focused on games as interactive networks of systems. Contrary to the artists, Scientist One thought defining a game solely from the storytelling perspective is problematic. She described her own gameplay experience and referred to scholars from different disciplines who contributed perspectives that the term *storytelling* cannot unify. Such scholars largely described gaming experiences systematically with clearly defined, verifiable rules, free from the inference of human irrationality. Scientist Two thought that abstracted systems reveal constant rules and variables within a system, which motivates individual actors to take action. However, it was interesting that all artists and technologists responded to the same theme from different perspectives. Instead of viewing individual experience as irrational, the artists and the technologists thought that human idiosyncrasy introduces necessary complexity and creative constraints to any system.

Game as Programmed Rules. In addition to inviting responses to the content, participants were invited to compare the task game they played and the games they enjoyed

playing on their own. Looking carefully at these responses gives insight into their interaction with the research instrument. For example, while interacting, Scientist One spent most of her time programming pseudo-rules attached to virtual creatures and observing their effect in the simulated world. In her own words, she was interested in "a scientific account about time." Time for her can be repeated reliably; it implies a rhythm, "the relationship between the previous note and the next note, the difference between permutation," which interests her. As a result, Scientist One enjoys playing puzzle games, such as Braid and Baba Is You, because both of these games reveal the effect of software rules—which enable repeated actions "that have the potential to revolutionize." After being played for a while, these games make players realize that the game is software, and players can learn about implicit rules, especially how these rules take advantage of the nature of programming. According to Scientist One, in the case of Baba Is You, the rules in this puzzle game exist literally within its own world, ready to be remixed. Each stage is a small 2D space containing various objects and characters, along with corresponding words that describe the rules of the puzzle. To solve each puzzle, the player must change the preset rules of the stage by rearranging the words to create new rules altogether. Players can modify the rules written on the stage to complete the puzzle in another way entirely. Every word on the screen is a movable tile. As an example, as the Baba, players can push the "Win" tile around the stage, changing "Rock Is Push" to "Rock Is Win." Now players can complete the puzzle by touching the rock. For her, Baba Is You is a game that makes rulemaking fun and rewarding in a software world that could otherwise seem very restrictive. See Figure 12 for a screen capture of Baba Is You.

Figure 12. Screen capture of Baba Is You (Teikari, 2019)
https://cdn.akamai.steamstatic.com/steam/apps/736260/extras/image1.png?t=1656225237

Technologist One also enjoys thinking about the process of creating the world by designing a set of "mathematical and procedural ways" to represent our current world. He felt that this challenge helps him make sense of the real world in a somewhat abstract and predictable way, which helps manage uncertainty. For example, Technologist One imagines the power of rules to establish predictable outcomes in ways that are not always possible in the real world. However, Technologist One also voiced his frustration with thinking about worldmaking in the context of a set of rules. For example, when he interacted with the research instrument, he realized he could not instruct it to make whatever kind of world he imagined, as he could with drawing a picture or writing a novel. In the digital interface, there were predefined concepts like "jump, "speed," and

"movement," which were already programmed. While to Technologist One abstract rules and computational power offer clarity and efficiency, he acknowledged that they can inhibit freedom. Alternatively, he referred to AI creation platforms such as Midjourney, which allows players to generate descriptive images from semantic texts. For example, he used the prompts "cyber peach trees floating in the air surrounded by heavy haze" and "circular enclosed cyber village surrounded by peach trees" to generate the following images.

Figure 13. Two images generated by AI platform Midjourney
with prompts "cyber peach trees floating in the air surrounded by heavy haze"
and "circular enclosed cyber village surrounded by peach trees"

Here, Technologist One simply instructed the AI robot to give visual forms to the verbal prompts without any rules guiding the visual appearance of the outcome. It seemed that while he needs the security of rules to manage uncertainty in a game, he also requires opportunities to express himself freely without being constricted by predefined rules. Contrary to Scientist One, Technologist One thought it was crucial for software to converse directly with natural human language instead of abstracted rules. Similar to the artists, he believed that language can convey the complexity that goes beyond mutually agreed social or algorithmic contracts.

Closed vs. Open System. When commenting on his experience interacting with the research instrument, Scientist Two mentioned that a big motivation for him to play an open-world

simulation game is to realize how earlier choices will "influence the long-term impact" of the worldmaking narrative. In other words, individual agents (players and nonplayer characters) need to adapt to changes as they occur, allowing the world as a whole to evolve continuously without becoming stagnant. While participating in the research, Scientist Two mentioned that he had limited time interacting with the research instrument, so he could not connect the challenges presented by the game, his reactions to them, and how they contributed to the emergence of the game. In contrast, Scientist Two introduced a game he enjoyed playing over the past few years—Rimworld, a surviving space colony game. According to Scientist Two, in this game, players start with three surviving members of a crashed spaceship, who become living colonists of a designated Rimworld colony to which the player is assigned. The game's primary goal is for the player to manage the colonists properly. Each colonist has specific skills, positive and negative traits, and a character backstory (see Figure 14 for screen capture of Rimworld).

Figure 14. Screen capture of Rimworld (Ludeon Studios, 2013)
https://rimworldgame.com/images/screens/mechanoidfight_w.jpg

The base game has an in-game editor. Players can edit their colonists' characteristics, experiences, regions, and beliefs. In addition, Rimworld is known for a large community of modder gamers who like to alter gameplay by opening game files and altering the code. The game visual is very low-fi, making it convenient for modders to experiment with newly introduced rules and observe their impact on the game world. Many players contribute modifications to the original games on this game's Reddit online forum. The moderators of each subreddit can monitor and promote the most popular ones, called scenarios, in the forum. Scientist Two compared playing the game with contributed mods to "reading 1000 different versions of Shakespeare's Hamlets, each Hamlet with its unique characteristics and background stories, which motivates him to make uniquely different choices in that specific edition of the play." Interestingly, some players reported that a "colonist" they created after the previous game release was rebranded as an official NPC with other generative behaviors.

Upon further research, it was interesting to note that Rimworld embodies the design concept called 'emergent storytelling' where, instead of providing a narrative, the game is designed to give players the ability to tell their own story using the game's mechanics. Rimworld's story systems remember when big events happened and who was involved in the game world. Social and combat logs make discussions and fight very descriptive so that players can get seriously invested in the lives of the colonist characters. The number of systems working together behind the scenes creates this kind of believable world. Here, crops grow, plants spread, and animals mate, migrate, and prey upon each other. Colonists have opinions, moods, and relationships that change over time. The complexity created by an almost infinite set of possibilities to redistribute resources motivates players to find the best ways to optimize their

strategies. For example, some players appoint a manager who automatically assigns jobs to other colonists to keep the colony stocked with wood and meat and manage livestock. This means the player no longer needs to watch dwindling supplies, as they will be topped up soon. Other players introduce the concept of pregnancy and children to their game, which allows the player to increase the reproductivity of their colony. Rimworld leverages a hugely creative fanbase of players who keep expanding on the original premise. The game's openness motivates players and enriches the overall framework of the intended narrative.

Similarly, Scientist One also commented on the importance of the game as a system that can stay open. On this point, she compared two examples. The first example is Conway's Game of Life. The Game of Life (an example of a cellular automaton) is played on an infinite two-dimensional rectangular grid of cells. Each cell can be either alive or dead. The status of each cell changes each turn of the game, depending on the status of its eight neighbors. For a cell to stay "alive," it must be surrounded by two to three live neighbors. On a player's turn, one must kill one enemy cell and "awaken" another empty cell. Thus, if players want to keep the game going, they must choose to kill or awaken in a way that optimizes their chance of survival (see Figure 15 for screen capture of Game of Life).

By contrast, Scientist One cited the Emissaries Trilogy, simulation artworks by artist Ian Cheng. This artist has referred to his simulations as "a videogame that plays itself." Scientist One thought a game should consider player-introduced uncertainty, meaning that the system is always open to challenging feedback. Therefore, she does not think simulation is the most accurate way to describe a game, which undermines the importance of the game as an open system, as referenced by Scientist Two.

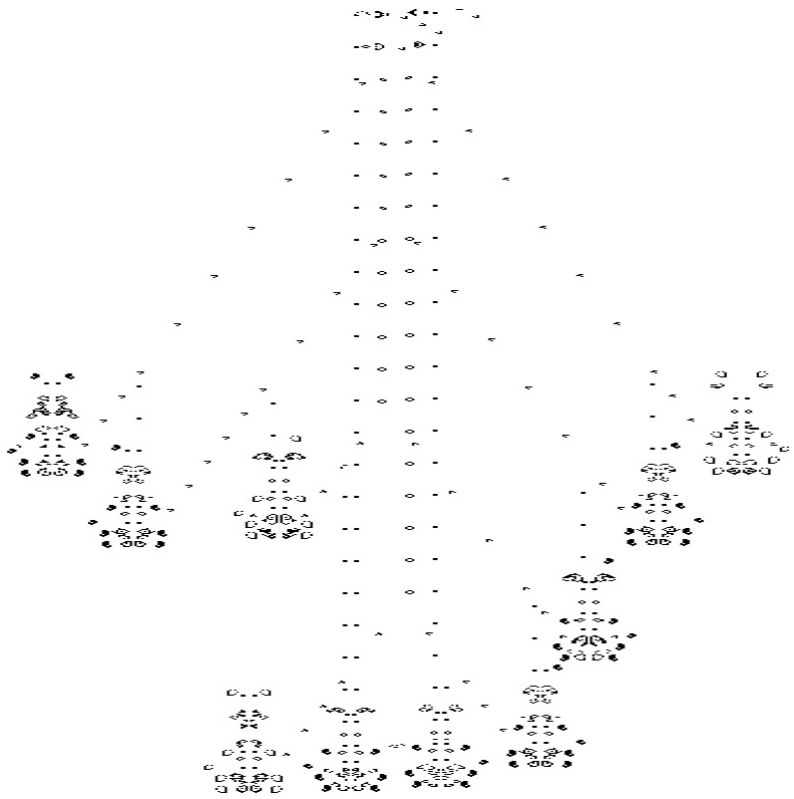

Figure 15. Lipa C. Conway's Game of Life (unknown date)
http://pi.math.cornell.edu/~lipa/mec/4life2.png

Theme Three: Game as Hacking

Uniquely different from both the artists and the scientists, Technologist Two saw playing primarily as hacking and modding (modifying a game at a software level) the original game. He mentioned that he had played video games from a very young age. His favorite story that he and his brother played with their father was Golden Eye, a 1997 first-person shooter videogame; the brothers were 5 and 7 years old at the time. The boys beat their father so badly that he stopped playing with them. One could infer that from a young age, Technologist Two realized that in the world of video games, attributes that allow one to gain power in the physical world, such as physique or age, do not add much to a player's success in the virtual world. Therefore,

Technologist Two associated the act of play with a sense of revolt or intervention against authority.

When reflecting on the experience of interacting with the research instrument, the Technologist Two mentioned that he was constantly thinking of ways to create operational logic that could somehow create outcomes that one would not expect from a worlding system as such. This "playing as hacking" behavior is also consistent with a few other games that Technologist Two mentioned. For example, one of his fondest gaming memories was playing Apex Legend, a battle royale-hero shooter game. Through sheer coincidence, he discovered a technique called bunny hopping. He took advantage of this hack and played the professional Healer in a team raid. When engaged in combat, he performed this bizarre, rapid high jump while healing players nearby, making him invincible from spells and incantations. As a result, his team would be much harder to defeat.

Similarly, Technologist Two shared another experience of playing a game called Need for Speed_Undergrounds II. When he first began playing this game online with his friends, there was no way to drive into certain open areas outside the designated racetracks. Later, while wandering, he discovered a tiny crack along the highway. Beyond that point, players can enter a "free roam mode" instead of speeding against each other along predefined routes, as in a regular Formula X race. Technologist Two and his friends lined up on the highway and passed through the crack one by one, transforming the game world into something entirely different. Later, he learned about other game genres, such as Anarchy Chess and GunZ: The Duel, where the whole system of behaviors is designed to encourage player transgression of the original game.

Unexpected Findings Emerging as a Result of Participant Responses

Throughout the research process, all participants were asked to provide feedback on video games as a framework for creating virtual worlds. They were prompted to compare their past experiences playing games with their experience interacting with the research instrument. As a result, all six participants shared their conceptual, practical, or analytical views on video games. Two additional themes emerged during the research process: Condition of Player Agency was mentioned 20 times, and Gaming as a Tool for Contemplating the Future was mentioned four times.

Agency in Physical vs. Virtual Reality

During the research, several participants commented on the blurring boundary between the physical and virtual worlds. Artist One noted that due to COVID, "everything is moving online," resulting in an increasing amount of post-COVID life being "lived in video games." However, Artist Two expressed a different viewpoint, suggesting that it is important to maintain a distinction between the real and virtual worlds. When discussing her experience with the research instrument, she described a sense of unease and liminality as "many irregular meshes appear in a world with several layers of color gradually, all moving towards the center somehow." From this comment, it can be inferred that Artist Two believed that individual agency in simulated reality can operate differently from physical reality, which is becoming increasingly blurred.

Illusion of Agency in Virtuality

Technologist One expressed a sense of boredom and fatigue about the world of gaming in general. He felt that sometimes gaming feels like a dead world, with many monsters and mobs behaving in a way one could well expect or anticipate. They may look vibrant and beautiful, like animals in the wilderness, but they behave very unpredictably, waiting for a player to hit them

before doing anything. Technologist One thought that this was related to the fact that many games try to motivate players to achieve a one-dimensional competitive goal at its core. Therefore, most efforts to develop a new game go into simulating computational creatures that are mobile enough to be killed instead of creatures that have real experiences or are alive.

Metagaming

When describing their experience with the research instrument, many participants mentioned they felt surprised by the radical level of agency implied by the unique design of the gaming interface. For example, Artist One enjoyed the experimental aspect of the game or rulemaking. She thought that it was a gesture of the original game designer to assume that players also have their own thoughts about how the rules of the game should be designed. Similarly, Scientist One assumed rulemaking is like multiple choices before interacting with the research instrument. Still, she was surprised that players were given access to the backend code blocks to modify any rules of the virtual world in any way they wished.

On a related note, Technologist Two mentioned an interesting Reddit online community called Anarchy Chess. One wants the game of chess to remain the same when playing the regular version; however, Anarchy Chess features a meta-chess game that allows players to make up any rules as they progress to each additional game round. This unique version of chess is popular among high school players. Technologist Two mentioned that interacting with the research instrument reminded him of such bizarrely liberating alternatives which also exist in the real world, although they only enjoy a tiny cult following.

Summary

For this study, each of six participants (two artists, two scientists, two technologists) was asked to comment on the concept of worldmaking, as derived from past experiences of playing

video games and their hands-on interaction with the research instrument. Overall, participants emphasized the importance of narrative for acts of the play. However, there was a visible difference in how artists, scientists, and technologists interpreted the role of the player and the concept of a play within the process of virtual worldmaking. The artists' responses primarily focused on personal and intimate descriptions of their prior experiences interacting with the research instrument and other games they played. Instead of being concerned with how things work or function in a gaming environment, the artists focused on how their play experiences were intrinsically valuable—meaningful in and of themselves, not as a means of understanding another topic. The scientists expressed that the reality of a game exists beyond the purview of player construction. It also resides in the level of mechanics or rules embedded in the algorithm of the software system. They were both interested in what extent the change of initial conditions of the system can invite out new behaviors of the players and vice versa. Uniquely different from both the artists and the scientists, the technologists saw the play as a set of actions that players can take to disrupt the boundary of the game. Different from modding, which one scientist mentioned as a systematic remake of the original game by the players, one technologist commented extensively on hacking—a less purposeful and more distinctive form of remaking that does not have an evolutionary goal in mind.

Chapter 5

DATA ANALYSIS

Introduction

The findings of Chapter 4 are used as a basis for considering new ways of understanding the practices and implications of virtual worldmaking in this section. This section organizes the findings into five themes: Visual Narrative, Operationality, Networked Agent, Forces of Steering, and States.

Visual Narrative

The data collected from the previous chapter suggested that all participants emphasized the importance of the virtual world as visual storytelling. Among them, the two artists especially focused on designing the visual style of their avatars as well as the overall look of the virtual world. In addition, they focused on designing the audio and visual effects of the avatars' behavior in the world, such as bumping into obstacles and meeting other virtual creatures. They primarily viewed video games as a visual medium and were attracted to their visual aspects. They often discussed the importance of color, shape, and realism in the research instrument and their favorite gaming experiences. One artist particularly enjoyed the chaotic color contrasted in games and suggested adding a feature for players to change each other's colors during encounters. Visual representation is crucial in their virtual worldmaking experience by enhancing immersion, aiding navigation, conveying information, establishing a unique aesthetic, providing feedback, and creating emotional connections.

Indeed, as video game graphical technologies have improved in recent years, video games have grown closer to immersing players inside highly realistic virtual worlds. Starting from the 1970s, videogame as an industry evolved from the primordial elements of Pong into the culture-

defining medium demonstrated by early cinematic games such as Call of Duty and Grand Theft Auto. From there on, cinematic games continued to achieve staggering commercial success, accumulating billions of dollars in the following decades. In online videogame forums, players frequently share excitement about iconic big-budget cinematic games such as Red Dead Redemption, Metal Gear Solid, and Tomb Raider. In particular, the Uncharted series is one of the most commercially successful 3D adventure game franchises ever. Major videogame publications have widely credited the series for significantly raising the standards of single-player games. The game features dynamic, lifelike characters in believable three-dimensional worlds that rival Hollywood action-adventure films and intricate gameplay mechanics closely modeled after real-life outdoor recreational experiences such as rock climbing, speed racing, and more. In-game characters with high-definition freckles make it difficult for players to move their eyes away. Players feel convinced to invest their time and attention in the virtual world because they instinctively feel that Nathan Drake, the main player character, is alive. The players are standing next to them, breathing the same air and marveling at the same mountains below their feet. To these players, hyperrealistic cinema has become the virtual world's currency. Similarly, during the research process, many participants stressed the importance of making players believe in the fictional setting of the world. The two artists emphasized doing so through formal qualities similar to the abovementioned opinions.

Operationality

During the research, several more seasoned players mentioned that to play in virtual worlds, they often spent long hours cutting down trees, gathering resources, strengthening their forts, and fending off invaders. They questioned the idea of using powerful computational engines to simulate an alternative world that looks and functions like the one they already inhabited in

physical reality. They feel as if they are inside an immersive virtual world that evolves with mundanely simple clicks. If Play in the virtual world looks like Work in the real world, what is new about the Metaverse?

Similarly, leading game scholars and practitioners have argued that the real power of the videogame lies above and beyond realness or immersion. American game developer Anna Anthropy (2012) believed print literature and cinema audiences cannot fail a book or movie like a player fails a videogame. She referred to videogame as the medium of failure. During this researcher, one scientist participant mentioned a few game studies scholars who had similar views. She mentioned that Danish game designer Jasper Jul (2005) who claimed, "A video game is half-real: we play by real rules while imagining a fictional world. We win or lose the game in the real world, but we slay a dragon (for example) only in the world of the game." Jul believed that video games can simultaneously embody two modes of expression—telling a story and interacting with a set of procedural rules. To play a video game is, therefore, to be immersed in the backstory of a fictional world while embracing the natural consequences of our actions as exactly how we would live in the real world. In her discussion, the scientist participant also referred to Espen J. Aarseth (1997), a Norwegian scholar specializing in game studies and electronic literature. Aarseth used hypertext literature, a type of nonlinear storytelling that requires considerable audience effort to achieve the narrative outcome, as an example of a text that cannot be read passively but must be actively "played." The scientist participant also referred to game theorist Ian Bogost, who described games as combining social systems, films, software, and hardware. In terms of software, both of the games discussed highlight the importance of rules. Furthermore, they encourage players to recognize that games are software, and players can gain

insights into the underlying logic of games, including how the rules leverage the programming environment.

More specifically, during the research, one participant shared that the research instrument exposed all the backend rules of the game world, which shared a similarity with one of her favorite games called Baba Is You. Both games demonstrated operationality, where repeated actions can transcend the players' perception of the game world. Both games encourage players to recognize that games are software and learn about implicit rules and how to use programming. Both games make rulemaking fun and rewarding in a software world that could otherwise seem restrictive.

Making a virtual world is not just about duplicating the natural world in the simulated one. Instead, it involves constructing a new world using existing elements, much like creating a map (Goodman, 1978). A map does not merely capture what already exists but also systematizes and reveals the field, providing a perspective that helps players derive meaning from their experiences. The design of a world is not a conclusive, objective reality but constantly evolves through symbols and representations. Language, art, and science are examples of such symbols, and they play an active role in shaping our understanding of the world. Therefore, those who inhabit a world should consider themselves world makers who continuously create and recreate their world through symbols and representations. One of the best ways to understand reality is to construct alternative possibilities concerning the one close at hand. The distant reflection invites alternative visions and directions, creating potentiality (Parisi, 2013) for the time and space one inhabits at the present moment.

Networked Agent

During the research, half of the participants described their in-game experiences by focusing on virtual worlds as spaces of feelings. For example, Artist One imagined a world that felt "spooky, surreal, and cozy" to her, while Artist Two felt that the game was not dangerous but might be "depressive" due to low-render quality and lack of sound effects. Technologist Two favored the roleplaying aspect of the virtual world, comparing it to reading a good novel. In the narratology tradition, the hero's journey or the monomyth (Campbell, 2004) is a term that describes the tale of a hero. She leaves the comfort of her homestead, with her faith and fortitude trailed through temptations, crises, and catastrophes inside the metaphorical belly of the whale. Finally, she comes home, changed and ready to change the world around her.

In *The Hero with a Thousand Faces*, Joseph Campbell (2004) argued that this monomyth follows a pattern of departure, initiation, and return. More specifically, he described this narrative template as "A hero ventures forth from the world of common day into a region of supernatural wonder: fabulous forces are there encountered, and a decisive victory is won. The hero comes back from this mysterious adventure with the power to bestow boons on his fellow man." Campbell contended that the hero's journey is a universal human experience reflected in myths and stories across different cultures and periods.

In a virtual world, the hero's halo is transferred to the player through a videogame's digital interfaces such as mice, buttons, and joysticks. This allows players to take on the role of the hero and experience the hero's journey in a virtual world through the interface of the player avatar. During the research, one participant recalled spending hours perfecting his virtual look in a videogame he played. Indeed, avatars can be the key to offering more intense and satisfying game experiences. They can increase the feeling of being transported to another world, provide an

enhanced sense of agency, and satisfy the need to feel connected to other players and nonplayer characters. Ten years after releasing the iconic adventure Journey, partly inspired by Joseph Campbell's writing, game developer Jenova Chen recounted the unexpected effect of roleplaying via virtual characters:

> When they played through the game together, it helped them to grieve. It helped them to let it go, knowing their loved one was going to a better place. I never thought the game would have the power to be essentially therapeutic, to help people, but it's changed many people's lives, and that's the biggest surprise to me. (Sinclair, 2022)

However, contrary to the artists, the two scientists discussed games as interactive networks of systems and suggested that defining a game only from a storytelling perspective is problematic. When commenting on in-game experiences, Scientist One referred to scholars from different disciplines who described gaming experiences from a systematic perspective with clearly defined, verifiable rules. Scientist Two believed that abstracted systems reveal constant rules and variables that motivate individual actors to take action.

Game studies have shown that interactivity does not just extend from real players to virtual avatars. An effect in the reverse direction also exists, whereby players unconsciously conform to the expectations of the virtual avatar and the virtual world in which the avatar resides. In other words, virtual avatars and their virtual conditions shape their human owners. This phenomenon is named the Proteus Effect, after the Greek god who could change his physical form (Blascovich & Bailenson, 2001). Avatars are not just ornaments—they subject players to a virtual narrative governed by procedural rules, which shape the identity of real players embodied in that world. In other words, the Proteus Effect describes the phenomenon of people conforming to the norm in a virtual social system. The Proteus Effect can be further understood by examining how systems theory explains the relationship between the parts of a system and the characteristics of the system as a whole.

Systems are not static but dynamic entities of interconnected, interdependent parts, members, or agents. One of the first contemporary uses of the word system appeared in publications in 1948. Scientist Ludwig Von Bertalanffy used the term to describe various organismic scientific phenomena he observed as a biologist. The human body is one of the most ubiquitous biological systems we encounter daily. When we feel cold, our muscles shiver to generate heat and warm our bodies. When we are hot, we sweat and evaporate heat to cool us. Without paying conscious attention, our body automatically maintains a standard temperature range to keep us comfortable. Since this type of system always takes action to cancel out excessive effects and bring back the current state to its norm, we refer to the canceling process as negative feedback. Systems involving negative feedback tend to resist change and maintain a stable internal environment. System theory refers to this tendency as homeostasis, and the stabilizing state is equilibrium. Besides natural science, negative feedback is widely adopted in engineering processes and machines. For example, there is a cruise system built into cars. It uses control actions to ensure a stable driving speed without delay or overshoot.

Forces of Steering

When discussing the concept of the Networked Self, one technologist participant expressed boredom and fatigue with the contemporary commercial gaming world. Despite their visually distinctive designs, he observed that many games feature predictable monsters and creatures. He thought this predictability was attributed to the games' focus on achieving competitive, one-dimensional goals.

Consequently, game development prioritizes creating creatures that can be easily predicted and defeated rather than non-player characters that offer complex or lifelike experiences. This results in gameplay that feels more like tedious virtual labor than meaningful engagement.

Control

Chapter 2 visited historical perspectives on Cybernetics, the science of building regulatory and purposive systems using modern automation technologies. It also examined the effect of Cybernetics in normalizing culture in post-World War II society.

Similarly, as we can see from the research data, this normalizing tendency is also prevalent in some virtual simulation worlds. For example, Super Mario Kart is a multiplayer go-kart racing videogame that was first released by Nintendo in 1992. In this game, negative feedback controls player engagement by creating a sense of challenge and competition. Negative feedback in the game typically takes the form of obstacles, such as shells and bananas, that can be used by other players to hinder a player's progress.

When a player is hit by an obstacle or their character falls off the track, they experience negative feedback in the form of a delay in their progress or a loss of momentum. This feedback encourages the player to be more strategic and cautious in their gameplay and to avoid repeating the same mistake in the future.

Additionally, negative feedback is used to create a sense of rivalry and competition between players. When a player hits another player with an obstacle, they receive feedback in the form of a successful hit, which encourages them to continue to engage with the game and strive for victory. This creates a sense of engagement and motivation for the player as they work to overcome obstacles and compete with other players to achieve their goals. Overall, negative feedback in Super Mario Kart controls player engagement by creating a challenging and competitive environment that encourages players to strive for victory and improve their gameplay skills.

Super Mario Kart's enjoyable and engaging gameplay can be attributed to the negative feedback design principle. As a classic racing game with many sequels and spin-offs, it caters to a large audience that appreciates competitive experiences. Incorporating competition increases a game's marketability and appeal. Such elements heighten player engagement by motivating them to refine their skills, outdo others, and attain higher rankings. Additionally, competition fosters replayability, as players revisit the game to retain or elevate their standings. Competition can serve as a core game mechanic that drives players to progress, master new skills, and complete challenges. This can make the game more appealing and satisfying for players who enjoy overcoming obstacles and achieving goals. Competitive games often offer opportunities for developers to monetize their products through in-game purchases, season passes, or cosmetic items. These monetization models help developers sustain their businesses and continue to create new content.

As discussed in Chapter 2, when players are exposed to both personal and network-level motivations, it can be challenging to maintain a clear understanding of their ultimate motivation during gameplay. If network motivations overpower intrinsic, personal motivations, players may feel forced into labor rather than enjoying the game for what it is.

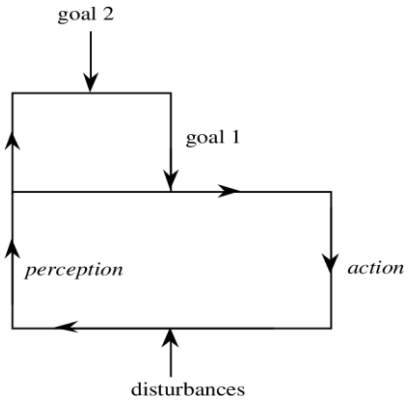

Figure 16. Relationship between first and second order Cybernetics

When competition becomes the main focus, it can limit exploration and creativity, causing players to prioritize winning and leading to underutilization of the open-world design. Excessive competition can also result in toxic behaviors, such as harassment and cheating, creating a negative gaming environment that deters player engagement.

Moreover, a competitive focus can lead players to concentrate on objectives offering rewards, resulting in a shallow gaming experience with diminished satisfaction. Constant competition may cause stress and burnout, especially when progress or rankings are at stake, discouraging players from continuing the game.

Emphasizing competition in open-world simulation games can also alienate players who prefer noncompetitive, cooperative, or solo experiences, limiting the game's appeal and audience.

Acceleration

In addition, systems do not always narrow down. Counterbalancing the effect of negative feedback, a positive feedback loop reinforces causal relationships, causing the same thing to happen over and over again, stronger in each iteration. In the physical reality, an example of a positive feedback loop is the phenomenon of "gentrification" in urban neighborhoods. Gentrification occurs when middle- and upper-class individuals or businesses begin moving into a traditionally working-class or low-income area. As more affluent people and businesses enter the neighborhood, property values and rent prices increase, making the area more attractive to other higher-income individuals and businesses.

This influx of wealthier residents and businesses often leads to improvements in the neighborhood, such as better infrastructure, increased public safety, and an enhanced variety of services and amenities. These improvements, in turn, attract even more affluent individuals and

businesses to move into the area, further raising property values and rent prices. This positive feedback loop continues, leading to a rapid transformation of the neighborhood, which can ultimately result in the displacement of long-time residents who can no longer afford to live there.

A similar, virtual gentrification phenomenon was also observed during the research. During the gameplay phase of the research, participants were given opportunities to contribute anonymously to rules to determine how to interact with each other when their virtual avatars encounter each other in the virtual world. One anonymous participant created a virtual creature named Deity. The deity was programmed to seek other virtual creatures at random intervals. Upon touching, depending on how powerful the others are, the deity would decide to either clone the other party or attempt to erase it. Once the computational simulation starts, this virtual avatar would quickly "kill" others within 30 seconds of time, resulting in greyed-out carcasses lying all over the field.

```
public override void IntervalAction(Thing other)
if (Random(0, 10) > 3)
{
   Seek(other);
 }


 public override void OnTouch(Thing other)
 {
 if (other.vertexCount > 100)
       {
           Clone(other);
       }
       else
       {
           Erase(other);
       }
  }
```

Figure 17. Code snippet contributed by anonymous participant

States

Chaos and Stagnation

During the playtest session, limited players interacted with the research instrument independently, within a short period of time. As a result, a limited number of states of the world was observed. Once the simulation starts, the virtual world is quickly populated with bizarre, idiosyncratic behaviors. In the chaotic state, the interactions between individual agents appear nonlinear. Virtual creatures can be seen running towards or away from each other, self-cloning, generating offspring, and transforming into different shapes and colors. As a result, the simulated world displayed a seemingly disordered state, lacking any coherent patterns. While chaos represents a complex, unpredictable, and rapidly changing state in a system, stagnation refers to a period of little or no change, growth, or development. As mentioned earlier, if any player programs highly disruptive rules that result in erasing or depleting other players' creatures, the world may transition from chaos to stagnation.

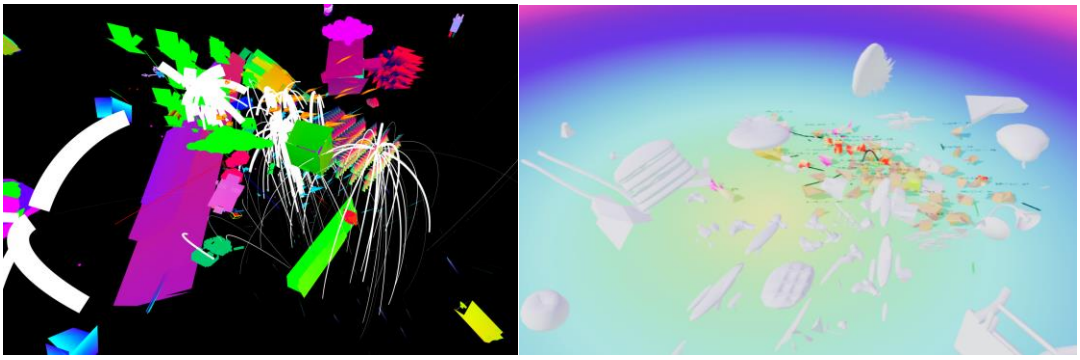

Figure 18. Selected screen captures of the simulated result of the virtual world

Upon observing the simulation outcome, several participants mentioned a more extreme state they had previously encountered. Compared to Chao and Stagnation, which is usually a result of unbalanced positive and negative feedback, this state is caused by a complete lack of feedback, rules, or regulation.

Anarchism

More specifically, one participant who is a technologist mentioned a board game he follows called Anarchy Chess. Also called Anything Goes Chess, it is a chess variant that changes the rules and how the game is played to promote greater individualism, creativity, and unpredictability. The basic rules of movement and capturing pieces remain the same, but players have greater freedom in determining how the pieces can move. In Anarchy Chess, players can customize their pieces by choosing different movement patterns, including diagonal pawn moves, forward moves for bishops, and backward moves for knights. Players can create new pieces and modify the board to introduce new obstacles or challenges. Anarchy Chess aims to create a more open and dynamic game that encourages players to think creatively and strategically. The game reflects the values of anarchism, which prioritizes individual freedom and creativity over rigid systems and hierarchies. The lack of strict rules and structure allows players to focus on enjoying the game, experimenting with new moves, and discovering interesting combinations and scenarios.

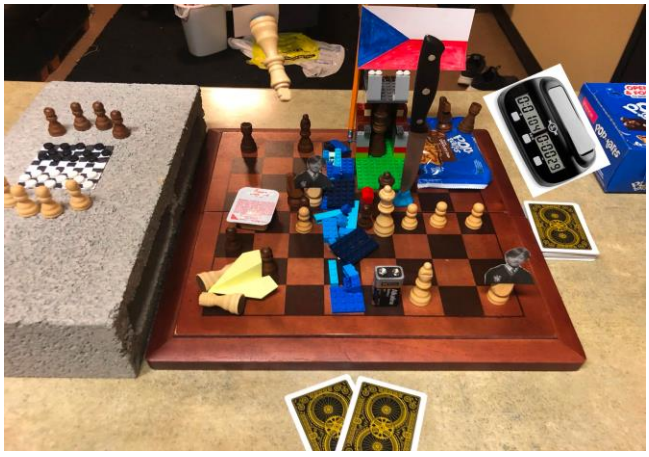

Figure 19. Photo featuring an Anarchy Chess game [photography] (Scurlocc, 2022) https://preview.redd.it/aw0qqnupc2p71.jpg?width=1080&crop=smart&auto=webp&v=enabled&s=eb0e5f8f3f180aab79804ccc00fdcb56cfecf35e

Another technologist cited another instance of anarchism in gaming. He encountered it in a long-running anarchy server 2b2t (2builders2tools) of Minecraft's multiplayer online game world. Founded in December 2010, 2b2t is one of the oldest Minecraft servers and has hosted over 603,000 players on its procedurally generated map, creating over 9.5 terabytes of player-generated data. It is also one of the longest-running anarchy servers in the game, with no rules, authority, or resets since its inception. This makes it a valuable source of information on player-initiated behaviors such as griefing and hacking in a world without rules or consequences. New players, often called "newfags" by more experienced players, must rely on scarce resources and skills to survive in the harsh and chaotic environment of 2b2t, facing well-armed and experienced players as they attempt to leave the central spawning zone, which has been devastated by over a decade of conflict (FitMC, 2021). More specifically, in 2b2t, server-wide chat frequently circulates spam, trolling, trash-talking, racial slurs, death threats, and Nazi propaganda. Links to obscene content and screamer videos are also standard. Players lie to each other to send them to in-game locations with traps. A common rule among players is not to trust others. Traps are placed around the area where players first join the server: pits of lava, areas lit on fire, and portals that lead to lava or enclosed areas of obsidian that force players to disconnect and reconnect and wait on the queue again. Some players create enormous obstacles called "lava casts," in which water and lava pour down stone staircases, creating mountains of jagged cobblestone. These structures surround the spawn area; many are as tall as the map's height limit. Experienced players reside in the far corners of the spawn area, which is well-stocked with armories and consumables. As a result, the map is less destroyed further away from spawn, allowing trees and animals to be preserved. The server has no etiquette regarding ownership—any objects or structures can be destroyed at any time if found by other players. Technically savvy players hack

into the system to expose coordinates of player hideouts, sometimes bombarding structures that were years in the making with explosives in the blink of an eye. Players of 2b2t have compared life in the server to descending into a drug cartel hideout or news reporters traversing war zones. The rare times that players go out of their way to bestow gifts and welcome others can seem almost shockingly heartwarming.

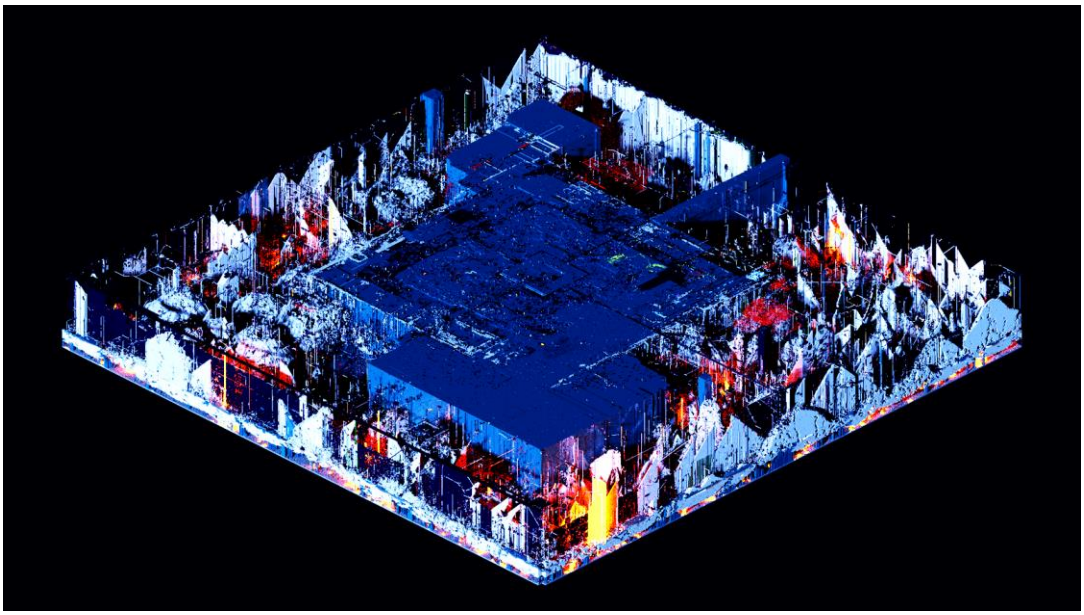

Figure 20. A render of 2b2t showing the amount of destruction caused by 11 years of no rules on a Minecraft server (Copper132, 2022). https://commons.wikimedia.org/wiki/File:2b2t_Spawn_by_Nightfall.png

The game 2b2t is a manifestation of the State of Nature project based on the 17th-century philosophy of Thomas Hobbes. Regarded as one of the founders of modern political philosophy, Hobbes researched the question: What would the world be like without government? According to Hobbes's research, in the "State of Nature,"[23] or an anarchist state, regardless of one's physical or intellectual strength, all people act according to their natural will. Everyone is subjected to having physical and intellectual work disrupted and important belongings destroyed by others. As a result, Hobbes claimed that in the State of Nature, human energy is primarily exhausted on a

basic level of self-preservation. There is no time to devote to value creation beyond the basic instinct of survival. Hobbes famously described the human condition in the State of Nature as the state of the fear of war.

Emergence

Emergence occurs when complex systems, patterns, and properties arise from simple interactions among smaller components without being directed or controlled by any central authority or structure. In natural science, emergence can be observed in various phenomena, such as birds flocking, insects swarming, and cells and tissues self-organizing. These emergent behaviors are not predictable from the behaviors of individual components; they arise from collective interactions. Emergence requires the vitality of a system, which in turn depends on individual agents' level of trust towards each other.

Furthermore, interactions among the components of a system must be nonlinear and often involve feedback loops. This means that small changes in one part of the system can have a cascading effect on other parts, leading to complex and often unpredictable behavior. Emergence can also occur when there is a high degree of connectivity and interdependence among the components of a system, leading to the emergence of new patterns and structures.

During the present research, the participants pointed out instances in the research instrument or prior digital interactive experiences they had engaged with that demonstrated the emergent qualities of a virtual world.

Narrative Emergence

Although virtual worlds often have a predefined backstory or worldview, players may create emergent narratives through their in-game actions and interactions. These stories can be deeply personal or encompass entire communities, and they can shape the game world and the

experiences of other players. When interacting with the research instrument, some players were inspired to create narrative elements that transcended the boundary of the original game world. For example, the original game interface was designed in English only. However, some players programmed in-game dialogues with foreign languages representing their cultures and codified languages that others cannot easily discern.

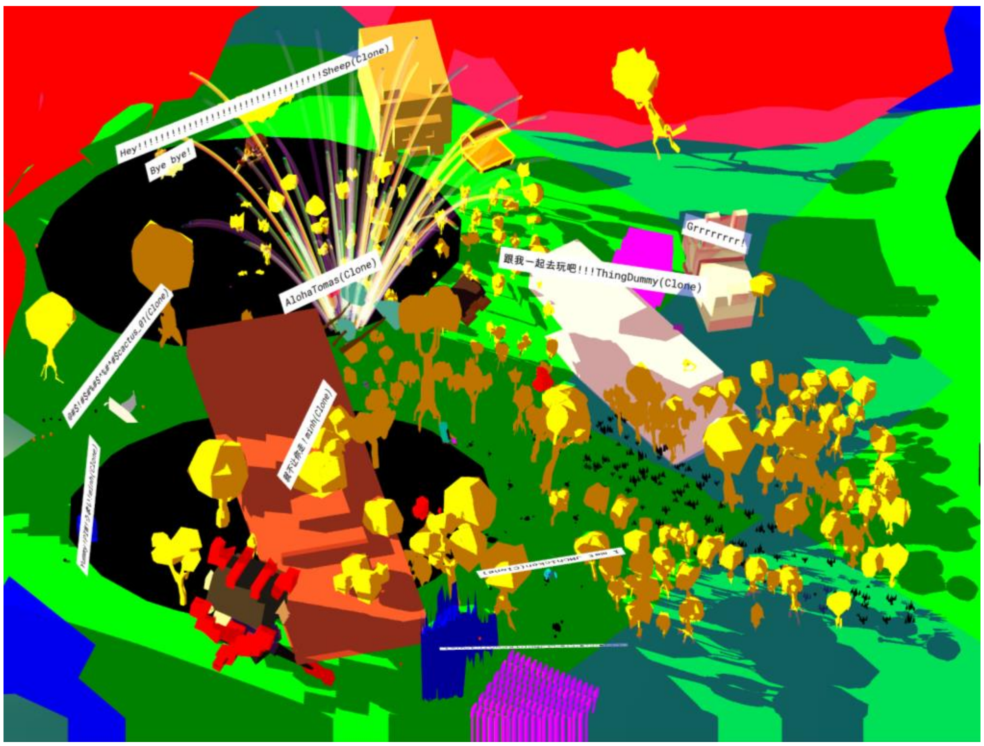

Figure 21. Screen capture of foreign and codified languages seen in the research instrument

In addition, several participants mentioned narrative emergence in a number of commercial open-world games they have played in the past. One participant played the open world game Animal Crossing with a friend during the pandemic. Her friend used found objects to create a shrine and invited friends to have virtual tea parties inside. During the COVID-19 pandemic, people worldwide spent more time indoors, looking for ways to connect with others virtually. Animal Crossing: New Horizons, a game that allows players to create and customize virtual islands and interact with other players' islands online, became a popular choice for many.

With its open-ended gameplay and emphasis on creativity, players began to share their experiences and stories on social media, leading to a surge in player-contributed narratives. These narratives ranged from heartwarming tales of virtual friendships and community building to humorous and bizarre happenings on players' islands. The game's popularity during the pandemic also coincided with the rise of virtual events and gatherings, leading to the organization of several creative and interactive events within the game by the players themselves. For example, players created haunted houses and mazes for visitors to explore. Others organized fashion shows, showcasing their favorite outfits and allowing others to vote on the best looks. Some players have built coffee shops or cafes on their islands, where they serve drinks and snacks to virtual visitors.

Furthermore, another participant, a technologist who has been playing the MMORPG game World of Warcraft for over a decade, shared several emergent narratives he had witnessed. In 2005, a new raid was added to the game, including a boss with an attack that could spread to other players. However, the developers did not anticipate that players would carry the infection outside of the raid, leading to a widespread pandemic that affected thousands of players. From a creator's perspective, this incident is considered a design oversight that failed to anticipate complex play styles. However, from a player's perspective, the ability to transcend beyond the intended play style gave them new dimensions of creativity that preplanned narratives could not offer.

Narrative emergence depends heavily on a good worldview that provides a rich setting with which players can explore and interact. This may include detailed lore and history, unique cultural and societal structures, and a variety of exciting characters and factions with their own motivations and conflicts. The backstory or worldview should also be dynamic, with the potential for emergent narratives and player-driven storytelling. It should encourage players to engage

uniquely with the game world and provide a sense of voice and lasting impact on the overall virtual world.

For example, one participant mentioned the open world game, Death Stranding. Its backstory is often praised for its complexity and intricacy. The game is set in a post-apocalyptic America where supernatural creatures known as “Beached Things” (BTs) roam the landscape. The game’s creator, Hideo Kojima, has cited both Nietzsche and Abe as major influences on his work. Their ideas are woven throughout the game’s narrative and thematic elements. For instance, the concept of the “ubermensch” or “superman” from Nietzsche’s philosophy is borrowed for the game to describe its main character Sam, a type of post-apocalyptic courier tasked with delivering essential supplies and connecting human survivors to a more extensive network in a world that has been devastated by supernatural events. Sam’s journey is often compared to the existentialist journey of characters created by Japanese writer Kobo Abe; these characters grapple with feelings of alienation and meaninglessness in a world that has become fragmented and surreal. The game’s intricate and mysterious plot, both reflecting and deviating from physical reality, has made it one of the best backstories of the virtual world, generating a sense of deep connection with its players.

Lastly, good storytelling in games introduces a coherent worldview, which inspires implicit constraints for creativity. Therefore, narrative emergence can also help generate additional forms of emergence beyond narrative emergence alone. For example, during the research, one participant shared that when he played alternative reality game Dungeons and Dragons (D&D), he observed how a good backstory for a character could provide creative constraints that can enhance the gameplay experience. A backstory can give players a sense of purpose, motivation, and personality, which can help guide their decisions and actions throughout the game. It can also provide hooks for the Dungeon Master to create exciting storylines and

encounters that relate to the characters' past. Additionally, a backstory can establish relationships with other characters and non-player characters (NPCs), creating a sense of history and interconnectedness within the game world. By providing a framework for the character's identity and experiences, a backstory can add depth and meaning to the game while allowing for flexibility and creativity in the moment-to-moment gameplay.

Architectural Emergence

Virtual worlds sometimes feature large, dynamic architecture that can change visually or structurally based on player actions. Players may alter the environment through resource gathering, terraforming, or building structures, among others. These changes can lead to new gameplay opportunities, challenges, and strategies. For example, during the research, one participant mentioned a space called The Uncensored Library. It is a virtual library in Minecraft created by the nonprofit organization Reporters Without Borders. Twenty-four players from 16 countries spent 250 hours designing and implementing it in Minecraft. The space contains books and other publications banned or censored in various countries; it is intended to promote free access to information and ideas. The library is accessible to anyone with a Minecraft account and has been visited by players worldwide. Some famously banned books and articles from the physical world are available in The Uncensored Library. These titles include George Orwell's *Animal Farm* and *1984*, Ray Bradbury's *Fahrenheit 451*, Salman Rushdie's *The Satanic Verses*, and articles from websites of *The New York Times* and *The Washington Post* that are blocked in countries like Russia and North Korea. The library is designed to raise awareness about censorship and worldwide restrictions on freedom of expression.

Figure 22. Screen capture of The Uncensored Library in Minecraft (Reporters Without Borders, 2020). https://www.popularmechanics.com/technology/design/a31700848/uncensored-library-minecraft/

Metagaming

Virtual worlds in multiplayer video games often feature combat and other competitive activities. As a result, players often develop new and unexpected strategies, tactics, and meta-games in response to the game mechanics, the actions of other players, and the game world. This can lead to a constantly evolving state of play as players adapt and counter-adapt to each other's strategies. For instance, in a physical game of poker, players may study their opponents' behavior and patterns of play to predict their next move. This information is not part of the game itself but rather an external factor the players use to their advantage.

Similarly, during this research, one participant mentioned when playing alternative reality games (ARG) Dungeons & Dragons that he frequently uses player knowledge gleaned from real life to make strategic decisions in the current game. In general, he noticed that his friends who scores higher on traits such as agreeableness and conscientiousness in real life tended to play more cooperative characters and engage in more prosocial behavior in game. On the other hand, his friends who scored higher on traits such as extraversion and openness to experience may be more likely to take risks, explore new options, and engage in rule-breaking behavior in game. Additionally, he has noticed that some players may use their characters to explore aspects of their personality that they may not be able to express in their real lives. For example, some of his friends who are shy or introverted in real life may create extroverted characters who are more assertive and outgoing. Since this participant often plays with friends whom he has known for a while in physical reality, he frequently relies on their real-life personas to speculate their in-game motivations.

Aside from real-life human connection, another participant mentioned that the internet, player forums, and group-based chatting platforms such as Discord have drastically transformed the original game's premise. For example, a player of World of Warcraft can engage in virtual play while simultaneously using the internet to search for the best gear and character builds for their class; research optimal strategies for defeating a particular boss or completing a quest; or participate in online discussions to learn from other players' experiences and insights. Additionally, some players may use the internet to engage in activities such as trading virtual items or services for real-world money, a form of metagaming that can be controversial and may be against the game's terms of service.

Overall, virtual worldmaking needs to balance creating a compelling and immersive game world and allowing players to explore and experiment with the game's mechanics beyond its original premise.

Hacking

Sometimes, players may discover and exploit bugs, glitches, or other unintended behaviors in the game's code. These emergent mechanics can become a part of the game's culture and meta-game, with players developing strategies around them until developers decide to fix or remove them.

For instance, during the research, one participant who is a technologist talked at length about associating the act of play with an act of revolt or intervention against authority. When reflecting on the experience of interacting with the research instrument, he constantly thought of ways to create operational logic that could produce unexpected outcomes. This behavior was consistent with his descriptions of playing other games, such as Apex Legend and Need for Speed Underground II, where he discovered and used techniques to transgress the game world and encouraged other players to follow suit. For example, coincidentally, the participant discovered a glitch in the racing video game Need for Speed Underground II that allowed players to drive through a fence and into an unpaved airport. He contacted a few players and exploited this glitch on a regular basis, either by cutting through the airport to skip a significant portion of the track and gain an advantage over other players, or by roaming aimlessly in the airport to undermine the competitiveness of the game in its entirety.

Another participant also mentioned a classical hacking game favored by many independent players called Doki Doki Literature Club. It is a psychological horror game designed to look like a cute and innocent dating simulator. However, as the game progresses, it becomes

clear that a dark and sinister narrative is underlying the seemingly sweet story. The game encourages players to "hack" by breaking the fourth wall and addressing the player directly, urging them to dig more deeply into the game's files and folders to uncover hidden content and secrets. The game also uses a variety of coding tricks and Easter eggs to pique the player's curiosity and encourage them to sabotage the game's source file structures. By engaging in these hacks, players can uncover hidden messages and clues that ultimately help them to uncover extra plots and ultimately reach the game's true ending.

Unlike narrative emergence, which adds to the original premise of the game, hacking often modifies the game's code or hardware structure to gain an advantage or create a new experience that is not part of the original game design. As seen from the examples mentioned, this can include altering gameplay mechanics or unlocking hidden features. Hacking can be done through various means, such as using cheat codes, modifying game files, or utilizing external software tools. Some hacking benefits a small group of players at the expense of others. This type of hacking is considered illegal and can result in consequences such as account bans or legal action. However, certain types of hacking are considered legitimate, such as modding communities that rely on transparent protocols to create and share user-generated content.

Modding

Short for "modification," modding is altering or adding procedural content to an existing video game, particularly in open-world video games. Modding can involve many modifications, including changing gameplay mechanics, introducing new assets, enhancing graphics, or adding entirely new content or rules to the game. Open-world video games, which offer players expansive, nonlinear environments with which to explore and interact, often provide a rich foundation for modding due to their inherent flexibility and freedom.

A game world is both narrative and procedural. The front-end visual renderings of the streets and avatars are simulated by back-end rules typically accessible only by the game's creators. Even without being given access to the official software released by the original game companies, modders still manage to package these unofficial rules into mini-scale software packages or plug-ins and make them available for more players to download via open-source websites. For example, Civilization Five is a popular turn-based strategy series with an active modding community. Even a decade after its release, members have continued to create and upload new mods on the community website. While certain mods offer visual modifications like new skybox and player skins, others provide massive platform-wide changes. These mods can enhance the user interface and speed up aircraft acceleration, giving players an unparalleled advantage on the system level. For example, during the research, one participant mentioned a mod in Skyrim called Sukritact, which changes in-game international diplomacy. It generates a graphic visualizer that allows players to see how every civilization feels about other civilizations. Any player can choose to download and install it in addition to the original code bundle of the game, which allows the player to strategize critical diplomatic moves, such as whom to invade versus ally withs. Both hacking and modding heavily rely on code exploitation as subversion. However, unlike hacking, which often features singular acts motivated by individual interest or curiosity, modding is a reorientation of game mechanics to foster diversity, multiplicity, and continuity. Chaos is not the end goal but rather an instrument for achieving long-term adaptation and evolution.

Modding relies on open-source culture. It involves making the source code of a software or other creative works publicly accessible, allowing other players to view, modify, and redistribute the work freely. The open-source culture encourages collaboration, transparency, and

a sense of community ownership, and it has been influential in the development of the free software movement as well as the growth of online communities and digital commons. Open-source culture emerged in the late 1990s with the growth of the internet and the rise of the free software movement. It reached its peak in the early 2000s, with the success of projects like Linux and Apache, as well as the establishment of organizations like the Open Source Initiative and the Free Software Foundation. However, the movement itself has evolved over time, with some projects gaining mainstream acceptance and support. This has generated huge monetary opportunities, which in turn have reshaped some of the most successful open-source code projects into private, proprietary platforms.

Fortunately, open-source software culture continues to have a significant impact on the modding practice in the game world. It allows modders to access and modify the underlying code of a game or software, enabling them to create custom content and extend the game's lifespan beyond what the developers intended. Modding also encourages players to experiment with the game's mechanics, learn new skills, and share their creations with the community. This collaborative and creative process is an essential aspect of open-source culture, and it fuels the growth and development of modding communities around the world.

In addition to player-contributed mods, some game developers support modding by releasing modding tools, APIs, or documentation to help modders create new content and modify the game more quickly. For example, cooperative play, or co-op, is a creator-contributed modification. Once a player activates it, a game's single-player mode is replaced with multi-player modes, encouraging other virtual players to be temporarily teleported into the each other's worlds and work together as teammates, either against non-player characters (NPCs), Ais, or other teams of real players. For instance, during the research, a participant shared his experience

playing the Co-op mode in Elden Ring, which allows players to enter another player's world and assist them in defeating a dwarf dungeon or boss using a summoning token or a summoning pool. When one kills, one gains runes; if one dies, one loses nothing. Therefore, players can study bosses before facing them in their worlds. They can safely assist other players in completing battles by learning to anticipate the boss's attacks. It is a fun and low-risk method for learning the behaviors of demanding boss AIs. Many players also use this opportunity to test out extreme tactics that are too risky to try out in their game worlds, such as stripping off all armor and weapons to reduce one's defense in exchange for a maximized level of dexterity and agility. Multiple players make manipulating the boss's attention easier, giving time to heal wounded players or interrupt AI attacks. Besides the gold summons symbol which begins cooperative play, the game offers a red summons, which allows players to challenge each other with good will and cardinality.

Lastly, challenging other players is a great way to learn about different builds and reflect on one's tactics. Since enemy behaviors are predesigned and preprogrammed, they tend to be predictable. As a result, when defeating AIs in a game, most players will only try a small subset of the weapons, spells, and items. Playing against other players is a great way to try out completely different weapons and stat choices that are more suitable for duels than AI bosses. For example, Sleep is a status effect in Elden Ring that puts enemies to sleep, giving players a chance to inflict a critical attack. When enemies are inflicted with sleep, they are stunned, allowing players a chance to heal or prepare for a heavy attack. However, many bosses and enemies in the game are resistant or immune to sleep. Therefore, a better alternative is to use a sleep build for duels against other players. Overall, the co-op mod allows players to self-organize whom to play

with and against, effectively allowing them to design their own subgames within the original game.

Summary

All worlds are systematic, but not all systems become worlds that afford habitability, complexity, and openness. Worlds are constituted through processes of locality (Hui, 2021). The world is a model inactivated by the inhabitants. A world has its affordance: What price does each agent need to pay to enter, live, and thrive? The endurance of a world is correlated with "the degree to which its conditions of necessity (material and/or imaginary) compel, or more violently, force, members to affirm its configuration in practice, despite whatever dissenting attitudes may be held, such that worlds able to withstand and absorb such frictions are the most enduring" (Reed, 2021, p. 1). In other words, a world may not last forever. Internal frictions, changes in value, resource scarcity, and more can threaten its vitality.

During the research, several participants mentioned how contemporary multiplayer game worlds hosted on virtual computer servers, such as Rimworld and Animal Crossing, provided the necessary conditions to play out such a complex theory. These MMOs feature a vast, persistent world in which many players—often hundreds or even thousands—participate on the same server. Mediated by rules reliably stored and executed by dedicated computer servers, they offer a simulated social environment to test how players might cooperate or compete against each other under specific world-level settings. Seemingly irrational player behavior in the face of an imminent virtual pandemic raised the question: Is rationality the highest pursuit of the rapidly expanding purview of virtual life?

As this chapter makes clear, many of the responses to the research questions hinted at the fact that inhabiting a virtual world in a networked environment exposes players to unique properties of the virtual world, as follows:

Virtual players do not directly partake in the physical world but through digital interfaces. To players, digital interfaces are not neutral or transparent; they are embedded in larger narrative and procedural contexts. The systems of symbols within the game are fictional. However, the cause and effect generated in virtual worlds are real. Therefore, virtual worlding does not just repeat reality but reflects on reality from a distance, shaping players' understanding of it.

The scale of a virtual world can be virtually infinite, limited only by the computing power and storage capacity of the technology being used. Therefore, virtual worlds can sometimes afford complexity that far exceeds physical reality.

Virtual worlds are networked systems that foreground information exchange at the expense of intrinsic values such as intimacy, diversity, and expression.

Virtual worlds are procedural environments reinforced through a computer algorithm. Such an environment allows a high level of automation, such as Machine Learning and Artificial Intelligence. These algorithms can sometimes generate non-player characters with highly complex behaviors, the effect of which can go beyond human players' level of understanding.

On the other hand, virtual worlds also offer opportunities of expression, metagaming, countergaming, and reorientation that are not immediately present in the physical world. These opportunities are actuated with a combination of narratives as well as procedures-rules programmed and executed by computational apparatuses.

Chapter 6

EDUCATIONAL IMPLICATIONS

Introduction

Video games, which are often highly engaging and interactive, can also be used as a framework of pedagogy. The findings presented in Chapter 4 and analyzed in Chapter 5 provide a rationale for a course in virtual worldmaking in the higher education environment. This final chapter introduces a course entitled Computational Studio: Simulation, designed for undergraduate students with a fine art and architectural background. It presents the design structure and educational implications of the course. The course includes lectures, discussions, laboratory time, studio visits, and artist discussions. For the purpose of inclusion in this dissertation and to show how the research findings can be adapted to a course in higher education, the 7 weeks of the course are included as an example that could be expanded to 15 or 20 weekly sessions.

It is anticipated that most students will enter the course with a background in architectural design or studio art, such as painting, drawing, sculpture, and so on. It is not expected that the students will have prior background in technology to enter this course. However, students are expected to bring a high level of interest in learning about videogame culture, open-world simulation games in particular, as well as related media production technologies.

Rationale for the Course

Worldmaking, in the context of this course, is a cross-disciplinary concept that draws from arts, literature, system analysis, technology, and political theory. It explores the visual construction of a virtual world and its notion, forces of steering, various states, and characteristics of its agents/inhabitants, such as agency, adaptation, and more. It critically analyzes how an

individual makes conceptual and practical decisions. Collectively, these decisions often emerge from the level of the system or world as forces of evolution, disruption, and reorientation. It is hoped that each student in this course will acquire the framework of virtual worldmaking and use it to expand their artmaking practices.

Human collectivism is set to look dramatically different in the coming decades in a world where the lines between physical and digital become increasingly blurred. Every asset, process, or person within or related to a collective will be replicated virtually—connected, traced, and analyzed. As a result, concepts like Play, Agency, and Worldmaking are rapidly being redefined by a control-oriented, computationally simulated virtual environment. Free, open-source game design and development platforms offer thinkers and makers a new way to reflect on the question, "If I can make a conceptually meaningful world, executed by computer algorithms and rendered by graphics engines, what would it be like, and where would I begin?" This 7-week example computational studio course includes a gentle introduction to basic modeling, object-oriented programming, video game development, VFX with Unity, and related production tools such as Blender. Projects may address agency, emergence, generative (parametric) design, artificial intelligence/learning, critical computing, and more.

Overall Structure of the Course

Every project can be accomplished singly (by a single student) or collaboratively (several students). Each subsequent meeting will open with a critique of the previous week's exercise and homework project. The project should articulate the assignment's conceptual, aesthetic, and technical aspects. Projects can be done as a group or an individual project.

The critique session is followed by a 1.5-hour lecture discussion about a specific aspect of worldmaking. Each session will end with a hands-on lab exercise in which students will complete

a short assignment inspired by the lecture-discussion, to be realized in a video game development engine. From time to time, students will be introduced to one-off technical workshops covering the latest media and software technologies that are not included as part of the main lecture series.

It is envisioned that following the first 7 weeks of meetings, as described above, students will start visiting virtual reality labs around the city and be in discussion with practicing artists, designers, and theorists in the field. For the course's final session, students will be expected to produce a virtual simulation or game developed based on an original short story written by the students themselves. Then, they will develop the 2D art and 3D models, which will be programmed procedurally in a game development environment. Students will be able to see examples from previous projects.

Course Goals and Objectives

The course is intended to prepare students to understand worldmaking from system design, media theory, and media production perspectives. By the end of this course, students should be able to accomplish the following learning objectives:

- explore and apply relevant applications in creating simulated worldbuilding (Unity, UnityHub, Blender, etc.);
- define and apply the terminology of simulated worldbuilding in group critiques;
- analyze the artistic system design and media technology requirements that influence design decisions;
- create meaningful simulated worldbuilding projects that can address intended audiences and contexts.

Evaluation

Evaluations will be carried out qualitatively and quantitatively. Students are expected to demonstrate reasonable weekly progress by documenting weekly experimentation in an online blog. Instructor will offer written feedback and provide future directions. In addition, there will be a midterm and final critique, whereby students will be invited to present their progress from conceptual, visual, and technical perspectives. Oral feedback will be given by the instructor and students at the end of the presentations. Further written feedback will be offered by the instructor. A final letter grade evaluation will be assigned to each student based on whether they have fulfilled the learning objectives of the course listed above. Students' personal and professional interests, as well as their previous level of media art, design, and production experience, will also be taken into consideration.

Final Project

Students are expected to synthesize selected content from a weekly homework blog, which will culminate in a conceptually coherent, technically well-executed final project documentation. Below is a suggested structure for the final project proposal:

1. Inspiration

   Be personal. Think about a feeling you had, something you noticed, a relation or a question that always seems to be on your mind. Include some visual reference here—concept maps, images, sound, gifs, artists' websites, favorite novelists or movies, or comic books. The more, the merrier.

2. Worldbuilding

   Think about your world's environment, culture, and rules:

- What does your world look like? Is it similar to Earth? Does it have gravity? What is the social structure of the inhabitants? Do they live in a democracy, theocracy, aristocracy, or something entirely different? How many different ethnographic groups does it have? What are their power dynamics?
- Use flowcharts, maps, or glossaries to list the elements and the relationships/hierarchy between them.

3. Point of View
    - What is the point of entry for your story? Will it be first person, third person, or omniscient agent? Write a short story about your game from the preferred point of view. List five keywords for your game world.
4. Visual Structure

    Depending on the nature of your project, structure this section as a mood board:

    - If you are doing narratives, you can work on a storyboard (narrative) and production shot list (recorded video art or audiovisual piece).
    - If you are working on worldbuilding, you should work on a world map and relationship chart.
5. Technical Research

    Use this section to document more technical references. For examples, a creative technologist who has accomplished a similar project, the software you want to try, or some similar tutorial might be helpful to consult with at some point.

6. Prototype

   What experiments have you tried so far? What did you like and not like about them? What next steps might you want to take to develop your project further? Include screen captures of what you have done so far in this section, and list a few more steps for further action.

7. Documentation (omit this section for midterm presentation):

   Depending on the nature of your project, documentation can take on the form of images, screen captures, gifs, short demo videos, infographics, or any structure that helps an audience who is hearing about your project for the first time to understand it, artistically, conceptually, and technically.

   Students are encouraged to reappropriate the structure above to help articulate their own voice, perspective, and creative process. The main objective is to use this writing space to establish a method one can repeatedly utilize to combine conceptual, artistic, and technical inspiration coherently into one voice, accompanied by tangible shapes and forms.

Weekly Synopsis

In this course, students will be asked to immerse themselves in a series of virtual game worlds that are expressive, imaginative, and critically reflective. They will be invited to create their collaborative game, exercising their creativity and critical and imaginative capacities. Please see below for the course planned for each week.

Week One: Worlds

Leading Questions:

Recent research in critical computing culture has raised concerns about the predatory nature of machine learning and its impact on cultural shifts, particularly through its pervasive yet unobtrusive presence in everyday communication. In the visual culture industry, predictive computing has given rise to the emergence of "crapstraction," where best-selling online artworks are crafted to look nearly identical and geared towards online auctions. Meanwhile, the concept of the world has become increasingly divisive, especially in the era of the New Climate Regime, where people cannot agree on what constitutes a habitable Earth. While some acknowledge that the Earth is facing significant climate issues, others remain unconvinced and deny its existence.

What are the forces of steering that are possibly causing the homogenization and radicalization of contemporary culture? Have they happened historically? If yes, what has remained the same and what is new?

Activity:

Listen to the recorded lecture: Why Games? Can an Art Professional Think?

https://www.youtube.com/watch?v=TQG5HUxNRbk&ab_channel=LOOPBarcelona

Learning Outcome:

Create a simple virtual world in Unity and explain its notion, rules, and forces at work.

Week Two: Objects

Leading Questions:

Inanimate objects, or things may not be merely passive and lifeless entities but possess their unique form of agency. These vibrant things, including rocks, rivers, and machines, profoundly impact human society and politics. What are objects? What are the similarities and

differences between physical, digital, and computational objects? What are the implications of recognizing the agency of nonhuman entities for personal expression, politics, and democracy?

Activity:

Listen to recorded lecture by Jane Bennett: Powers of the Hoard: Artistry and Agency in a World of Vibrant Matter

https://vimeo.com/29535247

Learning Outcome:

Create a simple object in your Unity project and program it with its behaviors.

Week Three: The Language of the System and Negative Feedback Loop

Leading Questions:

In system design theory, negative feedback refers to a type of feedback loop in which the output of a system is used to regulate the input of the same system in such a way that it reduces or counteracts the deviation from a desired or set point. In other words, it is a process that uses the result to make adjustments in the initial stages to decrease the error or deviation from the desired outcome. Do men, animals, and machines have distinctive qualities within themselves, apart from their web of relations constituting them as discursive or networked entities? What is the role of negative feedback in a system?

Activity:

Read *Men, Machines, and the World* by Norbert Wiener

https://www.robertspahr.com/teaching/hnm/wiener_men_machines_and_the_world_about.pdf

Learning Outcome:

Program interactive behaviors of your controller and NPCs in your world. Explain how they relate to and affect each other as a collective.

Week Four: System as Control

Leading Questions:

Media theorist Brian Holmes applied cybernetics theories to the social and cultural realm. He argued that the Nielsen rating system, attached to early TV sets in the 1940s, exemplified the Cybernetic Hypothesis operating at the societal level. The Nielsen ratings reflected which TV programs the public wanted to see, allowing producers to adjust their investments to meet popular demands. According to Holmes, this created a perfect machinic equilibrium enabled by machines and fulfilled by humans. He asserted that the cybernetic feedback logic, initially used in military operations, expanded to politics and economics during the postwar era. This formed a continuous self-validation process reinforced by invisible data, Panopticon. Holmes explained that this recursive logic of second-order cybernetics expanded into higher-order cybernetics through an onion-skin structure, where complexity becomes incomprehensible to humans. By participating in digital communication, the observer of lower-degree cybernetics is transformed into the observer of higher-degree cybernetics, according to Holmes.

An informatic system such as the internet is decentralized in modern society. Can a decentralized system form control? If yes, how? Can you identify the relationship between the Observer and the Observed in your daily life? How does such a structure expand vertically and horizontally?

Learning Outcome:

In a virtual game environment, identify, design, or implement forces of control.

Week Five: From Negative to Positive Feedback

Leading Questions:

Besides negative feedback, positive feedback is another vital force in steering a system. Historically, artists from different artistic moments have adopted collaborative making to redefine the boundary of creative expression. One wants the game constantly to be the same when playing regular chess. However, Anarchy Chess features a meta-chess game that allows players to make up any rules as they progress to each additional game round. This unique version of chess is popular among high school-age group players. What examples of positive feedback can you think of in the real vs. virtual world? What are their effects?

Activity:

Watch recorded documentation on the Fall of Minecraft's 2b2t.

https://www.youtube.com/watch?v=elqAh3GWRpA&ab_channel=FitMC

Learning Outcome:

Create a madness machine that is propelled by positive feedback alone.

Week Six: Complex System

Leading Questions:

Nils Aall Barricelli was a Norwegian mathematician and scientist who made significant contributions to the field of artificial life and bionumeric research. His research aimed to study the behaviors and evolution of living systems through computer simulations he developed in the 1950s and 1960s. By creating virtual environments, bionumeric universes, that replicated the behaviors and characteristics of real-world ecosystems, Barricelli was able to study the evolution of living systems systematically. His work revealed the agency of cybernetic systems. Similarly, philosopher Alfred North Whitehead looked at the concept of agency through the lens of intensity

and survival. Whitehead believed that an entity's intensity, or the degree of its activity or vitality, was closely related to its ability to affect and be affected by other environmental entities. He also believed that an entity's survival, or its ability to persist and undergo change over time, was fundamental to its existence in the natural world. These conditions of individual, autonomous agents interacting in the world enable them to adapt to change, which is a crucial aspect of the continuity and complexity of a system at large.

How is a computationally simulated world similar to and/or different from a physical world? What is the integral force that is pushing this world forward?

Activity:

Read Chapter IV, Computable Creatures, of *Uncomputable* by Alex Galloway

Learning Outcome:

Create a simulated world composed entirely of computational objects, or AIs.

Week Seven: Reorienting the Virtual World

Leading Questions:

When open-world videogame Cyberpunk 2077's Night City was first shown off, many people seemed surprised about how sunny it was. Bright blue skies are not what the mind immediately conjures up when players think of dystopian cyberpunk cities, even if they are in the California desert. Later, a player named Essenthy published a mod that allows players to escape the terror of the great blue void by replacing it with something gloomier. Instead of sunshine, players can enjoy fog, pollution, toxic fog, clouds, overcast, and the most cyberpunk of them all: plain rain. Players will still see other kinds of weather, but the mod-reinforced one will become the most common type.

In contrast to hacking and performative gestures, modding is a player-initiated injection of game mechanics, rules, conditions, and protocols, with the ultimate aim being fostering long-term diversity and multiplicity.

What are the similarity and differences between hacking, performance, and modding?

Activity:

Read the Cybernetic Hypothesis by Tiqqun

https://theanarchistlibrary.org/library/tiqqun-the-cybernetic-hypothesis

Learning Outcome:

Design zones of poetic revolt in your virtual world which allow the individual player to enjoy momentary unflattening and forces the system to stay open.

Summary

When people inhabit a virtual world within a networked environment, they are exposed to distinct characteristics of the virtual environment, the complexity of which can far exceed the

physical world. Therefore, when designing and developing virtual worlds, students should consider the following factors:

1. Interface Transparency. Students should know how the interface reframes what the player can and cannot see when inhabiting a virtual world and make design decisions that communicate various intentions as transparently as possible.
2. Reflection and Mapping. More critical than designing experiences, makers of virtual narratives should think of themselves as helping players to reflect on and map out different models of alternative reality and provide a sense of direction and closure to the players' perception of physical reality.
3. System Thinking. Besides designing on the level of properties and behaviors of individual digital objects, students should also consider design conditions on the system level. They should know how negative and positive feedback influences player behavior and steers the virtual world towards different states. They should use design languages to communicate these system conditions clearly to the player. Makers of virtual worlds should explore narratives and rules that result in a fundamental sense of connectedness rather than a networked connectedness that relies on exchanging information. Students can help players relate to each other and their environment by prioritizing intrinsic instead of exchange value. Finally, it is essential to emphasize the importance of ethical reflection when designing and launching highly automated procedural worlds catalyzed by AI. Makers of virtual worlds must strive to create worlds that are not only engaging but also ethically transparent and responsible.

The challenge is to design virtual worlds that balance individual freedom and responsible participation. This requires unlearning and relearning fundamental notions and structuring virtual

societies for human and nonhuman elements to flourish. The balance between freedom and constraints and questions of allocation, decision-making, trust, and accountability must also be addressed.

Chapter 7

CONCLUSION

Introduction

Overall, this research explored the unique perspective of rulemaking as Play in virtual worldmaking. The metaverse landscape is a complex interplay of control, emergence, and collectivism, which all artists, scientists, and technologists experience. The research showed that gaming conventions such as narrative emergence, architectural emergence, metagaming, hacking, and modding can potentially empower individuals and communities to resist the homogenizing tendencies of prevailing software system. Virtual worldmaking is a platform for creative expression, collaboration, and agency for diverse individuals. The various themes, such as games as storytelling, games as system, and games as rulemaking, revealed the possibilities when virtual inhabitants reimagine the rules and conditions of alternative virtual worlds. In addition, this research also contributes to developing a new educational framework that integrates rulemaking as play into virtual worldmaking. This framework aims to create a learning environment that cultivates creativity, complex system thinking, and a critical understanding of computational media and its social impact. As the influence of algorithms and software systems grows in daily lives, it becomes increasingly important to identify methods that allow individuals to challenge forces at the system level and explore alternative possibilities for collectivism in the virtual realm.

Given the problem of software being increasingly withdrawn in presence but omnipresent in its effect to control and normalize, this research was designed to study software culture within the context of virtual worldmaking. Six participants, all identifying as experienced videogame players, were invited to participate in the research. A game, designed by the researcher, was the primary instrument of examination. Conventional video games largely rely on digital interfaces to

enact predesigned in-game rules. For this research instrument, a web-based code editor is designed to enable users to define player-contributed rules. Participants were invited to first talk about worldmaking conceptually. Then, they were asked to participate in virtual worldmaking through interacting with the research instrument. Lastly, they were asked to reflect on their interactions with the research instruments, as well as drawing references from past games they have played or read about.

Tensions and Conflicts

The findings from the study suggested that all six participants demonstrated some level of awareness of conflicts residing within the virtual world. First, the conflict between creator and players in the virtual world arises from the tension between the intended experience that the game developer wants to convey and the players' desire to create their own experiences within the game world. While the game designer may have a specific narrative or gameplay in mind, players often have goals and motivations that can lead them to play the game unexpectedly or create their own emergent narratives. This tension has further led to participants reflecting on the players' role in shaping the game experience and designing games to allow greater player agency and creativity.

From a creator's perspective, the videogame industry comprises commercial enterprises. Thus, the pursuit of profit is a significant motivating factor. Video games are created to generate revenue for game publishers and developers, as they are an expensive and time-consuming process that requires a significant investment of resources. However, from the players' perspective, video games offer an outlet for critical reflection and personal expression, which do not necessarily lead to commercial success. As a result, cybernetics, an omnipresent, recurring logic of control, is implemented in the virtual world to create the illusion that players are

seemingly acting according to their interests, while fulfilling the creator's interest from a higher order.

In addition, the findings also suggested the presence of the conflict between human and nonhuman elements in the virtual world. This conflict can take many forms, such as fighting against or alongside nonhuman characters, controlling and directing the actions of nonhuman units, or navigating the rules and mechanics of a procedurally generated game world.

Multiple Perspectives on Virtual Worldmaking

In addition, the research also suggested that the professional backgrounds of the participants shaped them to view virtual worldmaking differently. The two artists primarily saw their activities as personal expression. They focused on using visual and literary languages to convey their intimate personal experiences in the virtual world. The two scientists reflected on their activities in the virtual worlds as conducting social experiments in complex systems. They emphasized observing how their actions shaped the system alongside preexisting systematic forces. Lastly, the two technologists talked at length about playing in the virtual worlds as hacking. They were primarily motivated by adopting an unconventional style of play, spatially as well as procedurally, to force the existing premise of the world to glitch.

Overall, it can be summarized that the artists emphasized human sensibility as a precondition to feel emotionally immersed in a virtual world. The technologists saw individual actions as ways to transform emotional investment in a world as a force of its progression. The scientists acknowledged a virtual world as a complex, unified entity shaped simultaneously by individual, social, and systematic forces.

Collective Rulemaking as Play

By setting the findings of the study within the context of virtual worldmaking, the researcher argued in the analysis that emergence has become an increasingly important topic in gaming in recent years because it allows players to reorient objects, characters, interactions, behaviors, or even the entire setting of the original virtual world designed by a small group of designers and developers.

Compared to the dominant modes of play in the virtual world, which rely largely on digital interface design accessible to a small group of professional game makers, rulemaking may sound like a radical mode of play. However, it can be traced back to some of the earliest play experiences in human history. Discovered in the 1920s, the Royal Game of Ur is a multiplayer board game. The oldest known rules, from 177-176 BCE, were found on a Babylonian cuneiform tablet, while a similar set from around 300 BCE was found on a Hellenistic tablet. Irving Finkel, a curator at the British Museum, reconstructed a third set of rules based on both sets and additional artifacts. Throughout human history, the rules of the game were collectively revisited and modified multiple times. The revised rules were often carved onto durable materials such as rock plaques, which positioned rulemaking at the very center of the idea of play.

Demonstrated by the discovery of the Royal Game of Ur, rules of game were once socially constructed, transparently documented, and regularly modified. However, in virtual worldmaking, rules are transcoded into technical language, packaged into software forms, and saved on hard discs of computers. Apart from the exception of modding, it is challenging for average players to access and change the rules of virtual worlds. The artists repeatedly expressed difficulty contributing rules to their virtual worlds during the research. Even though they provided many expressive ideas of how they would like to make their world, it was complicated to implement

those rules in the virtual worlds. By contrast, the scientists could identify and analyze the effect of the rules on their virtual worlds, but they were also unable to change them. The two scientists were the only ones who felt comfortable rewriting the game's rules at will. However, as the Royal Game of Ur artifacts suggested, the rules have evolved as different groups of players experimented with new strategies and techniques. Additionally, the game has variations with slightly different rules in different geographic regions or social contexts. Centering rulemaking as play allows players to reorient virtual worlds and make them intimate and diverse.

Virtual worldmaking is composed of frontend visual renderings of backend procedural rules. As a result, even though various levels of rulemaking allow players to transcend the original premise of the world, only modding allows these rules to be systematically distributed to all players, allowing them to self-organize permanently into almost infinite subworlds. Often, this practice results in injections of structural change to a virtual world or environment. Due to codified structural change being efficiently distributed over open-source platforms, modifications can have a much more diversified impact than other rulemaking forms. For instance, the 1998 first-person shooter game half-life has one of gaming history's most vibrant mod communities. Over the years, popular mods of the original game have evolved into entirely new games, such as Counter-Strike, Cry of Fear, Black Mesa, Day of Defeat, Dear Esther, Dino D-Day, Nuclear Dawn, and The Stanley Parable, among others. These new games vastly expand on, deviate from, or even contradict the original game's concept, narrative, and rules of play, fostering a community of players and cultures unique from the other spin-off games.

However, it is important to mention that narrative emergence, although it cannot instill rules at the structural level, still plays an important role in forming the condition for rulemaking. Narrative can help players immerse and emotionally invest in the vitality of a virtual world. The

relationship between individual inhabitants and the backstory of the overall world also naturally generates creative constraints. Together, immersion and creative constraints provide the necessary condition for a player to be motivated to make new rules to evolve the world towards more desirable states.

Further Research on Collective Intelligence

Moreover, studying collective rulemaking in open-world games has also led to insights into other areas, such as artificial intelligence.

Currently, there are several competing technical approaches to artificial intelligence. One prevailing approach is called neural networks. It involves designing and training a system of layered nodes or neurons that can learn and improve over time based on input data. This approach is based on the structure and function of an individual human brain. It can solve many problems, including image and speech recognition, natural language processing, and decision-making. However, Neural network-based models of artificial intelligence have some limitations. Neural networks can be difficult to interpret, so it is not always clear why they are making a particular decision. Neural networks can become too specialized for the training data and may not generalize well to new data. They require large amounts of data to train effectively. This can be a challenge in fields where data are scarce. Training neural networks can be computationally intensive and time-consuming, hindering widespread adoption. In addition, neural networks can be vulnerable to adversarial attacks, where an attacker intentionally feeds the network, misleading data to cause it to make errors. Lastly, neural networks are good at identifying patterns in data, but they are incapable of creative thinking or problem-solving in the way humans are.

On the other hand, the collective intelligence approach involves creating a system that leverages the intelligence and expertise of a group of individuals or entities to solve a problem.

Theoretically, the collective intelligence approach is supported by the theory called "A Thousand Brains," proposed by neuroscientist Jeff Hawkins (2021). The central idea behind the theory is that the neocortex, a part of the human brain responsible for higher-order functions such as perception, cognition, and decision-making, is composed of numerous small neural networks or modules, each capable of learning and representing complete models of objects and concepts. These small neural networks, referred to as "a thousand brains," function both independently and in concert with each other, enabling the brain to understand and interact with the world. Instead of a single centralized location for intelligence, the theory posits that the neocortex contains numerous instances of intelligence distributed across its structure. The "A Thousand Brains" theory challenges traditional views of intelligence and has implications for artificial intelligence (AI) research. If the theory is accurate, it could influence how AI systems are developed and prompt new approaches to creating artificial general intelligence (AGI) that more closely mimics the human brain's architecture and functionality.

The "A Thousand Brains" theory provides a new perspective on the organization and functioning of the human brain, and it has the potential to impact our understanding of intelligence and the future development of AI systems significantly. Open-world simulation games often involve large groups of players who work together towards a common goal. They are becoming increasingly popular as a platform for research on collective intelligence. The interactions between players, as well as the interactions between human and nonhuman elements in the virtual world can provide valuable insights into collective decision-making and problem-solving processes. Researchers have used open-world video games to study a wide range of phenomena related to collective intelligence, including the emergence of leadership, the role of communication in group decision-making, and the effects of diversity on group performance. In

addition, these games provide a unique opportunity to study the behavior of large groups of people in a controlled experimental environment, which can be difficult to achieve in the real world. In the future, using open-world video games as a research platform could continue to advance our understanding of collective intelligence.

Summary

Taken together, this research delved into rulemaking in virtual worldmaking, highlighting its potential to empower individuals against the homogeneity of standard software systems. It examined the inherent conflicts in virtual world narratives, commercial objectives, and gameplay dynamics. The findings underscored multiple views on virtual worldmaking from the arts, science, and technology. It explored the transformative power of modding and the crucial role of narrative emergence in fostering player creativity. Additionally, the study revealed the potential of open-world video games as platforms for researching collective intelligence, an approach that could shape future AI development to reflect human brain functionality more closely.

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Appendix A

Email Invitation to Participate in the Study

I am a doctoral candidate in the Art and Art Education program in the Art and Art Education program at Teachers College, Columbia University. I am currently recruiting participants for my doctoral research.

In my research project, “Collectivism in Simulation Games,” I explore the conditions and effects of collectivism in open-world simulation games. The study aims to explore the defining characteristics of collective play in open-world simulation games. Depending on your previous experience playing simulation games, your partaking in the study would entail playing a few commercial simulation games and a scripting-based simulation game designed specifically for this research project. Afterward, a reflective interview will be conducted. Partaking in the study might provide some insight into individual and collective agency exercised through online gaming environments and its effects on our immediate reality. The awareness might benefit understanding group psychology and creativity mediated through computational media.

Looking forward to hearing from you.

Sincerely,

Zhenzhen Qi

Appendix B

Informed Consent to Participate in the Study

DEPARTMENT OF ARTS AND HUMANITIES

Architecting Emergence: Collectivism in Simulation Games

Principal Investigator: Zhenzhen Qi, Research Fellow, Doctoral Candidate

DESCRIPTION OF THE RESEARCH: You are invited to participate in a research study on the prospects of collective play in simulation games. By participating in the study, you will provide data in the form of playtest recordings as well as reflective interviews regarding your experiences of collective activities you engaged in playing a selected group of simulation games. As such, the purpose of the study is to explore what can be found out about the defining characteristics of the experience of collectivism in a game play taking place in open-world simulation game platforms. You may qualify for this study because you are above 20 years old and have some video gaming experience. You will be invited to play a few simulation games curated explicitly for the purposes of this research. You may use audio, video, images, and texts to describe your in-game experiences. Three researchers will act as judges to detect and determine after predefined evident criteria if entries are valid to be included in the research. The level of detail regarding the incident provided by you as a participant is critical in this process.

BENEFITS AND RISKS: By participating in this research, participants may develop an awareness that could benefit agency, the team plays, problem-solving or complex thinking. However, such indirect benefits cannot be guaranteed. The risks associated with this study are minimal. Based on my experience conducting similar pilot studies, participants might experience certain negative in-game play styles that could be considered harmful, such as griefing and trolling.

CONFIDENTIALITY: Legal names of participants will not be collected as part of this study. Participants will be asked to input pseudonyms in the playtest sessions to protect subject confidentiality. The same pseudonyms will be used on the transcriptions of the reflective interviews and subsequent research documents to ensure traceability. Additionally, all research documents will use vague language to disguise any specific information that may link participants to the study.

DATA STORAGE: All recorded data, such as audio recordings, video, and computer screen captures, will be stored on a password-protected hard drive in my personal laptop. All signed consent forms will be kept on the same hard drive. Research documents, such as transcriptions, will be stored on my password-protected laptop. Again, these documents will not reference the participants if the laptop is lost or stolen. No information other than the signed consent forms and recordings will be kept on this laptop. Regulations require that research data be kept for at least three years.

TERMINATION: The study is officially over when you have completed the playtest sessions and reflective interview.

However, participation in this project is completely voluntary, and you are free to stop or withdraw my participation at any time without any penalty.

PAYMENTS: Participation in the study is completely voluntary. There will be no payment for your participation in this study.

TIME INVOLVEMENT: Depending on your prior experience playing simulation games, your participation will take approximately 10-10 hours over one week. The following time breakdown will provide a rough time outline of the data collection process:

● Playtest of a commercial simulation game (30 minutes to 2 hours, depending on prior experience)

● Playtest of a script-based simulation game specifically designed for the purpose of this research (30 minutes)

● Reflective interview (60-90 minutes)

HOW WILL RESULTS BE USED: The results of the study will be used as part of my dissertation requirements in the Program in Art & Art Education at Teachers College, Columbia University. Research reports might also be given at education conferences, presented at meetings, published in journals, and used for other educational purposes. In all cases, your identity will not be disclosed if this was prior requested.

CONSENT FOR RECORDING: Audio recording (and/or video recording – specify which one or both) is part of this research study. You can choose whether to give permission to be recorded. If you decide that you do not wish to be recorded (choose the correct sentence), you will not be able to participate in this research study.

____I give my consent to be recorded

____I do not consent to be recorded

My signature below means that I agree to participate in this study and consent to all terms mentioned hereinabove. I understand that all signed forms will remain confidential. Participants may keep a blank form if desired.

Participant's Name: _____
Participant's Signature: _____
Date: ____/____/_____
Notes
Sub Questions:

1. To what extent does select literature suggest that current software systems function as forces of control and normalization in contemporary informatics society?
2. Given the predominance of forces of algorithmic control, what kind of design of virtual world could generate the emergent forces to open up a creative software system established by collaborating players?
3. What might be learned from six to eight participants collaborating in creating a simulated virtual world(computer game) about how an open system of play or practice contributes to new ways of virtual worldmaking?

Appendix C

Coded Profiles

Coded Profiles by Value

Participant	Transcript Quotes	Descriptive Codes	Summary	Potential Theme	Subtheme
Artist One	In her earliest sense, literature, and games have always been bonded together	literature, game	as narrative	Game As Storytelling	
Artist One	In those video games, the player is a character, and there is a story to be inactivated.	inactivation	play as enactment	Game As Action	
Artist One	The dialogues in role-play games such as the legend of sword and fairy can sometimes become very boring	dialogue, boring	the limit of narrative game	Game As System	
Artist One	On the other hand, In the Age of Empires and Command and Conquer series, she felt that she has more room as a player to imagine and make. There is no dialogue, but a backstory.	imagine, make, dialogue, backstory	narrative vs. simulation game	Game as Figurative vs. Abstract Narrative	
Artist One	Compared to narrative games the artist played as a child, she got really excited playing strategy games like these later on. The stories became secondary to what player operations.	narrative, strategy, operation	game as storytelling vs. game as strategy	Game as Figurative vs. Abstract Narrative	
Artist One	The artist was able to construct an order here, in this tiny island of hers. It's pretty healing. The artist was mostly drawn to these games because of their visuals.	healing, order, visual	play as healing.	Game As Relationship With Self and Others	
Artist One	The artist always feels that we can combine all these elements in a wider context.	combine, wider, context	game as trans-disciplinary in nature	Game As System	
Artist One	Especially nowadays, with everything moving online, we cannot disagree, our virtual lives are after all the life of video games.	virtual lives	life as game	Conditions of Player Agency	
Artist One	The world the artist put together is probably spooky, surreal, and cozy.	world, spooky, surreal, cozy	a world should feel spooky, surreal, and cozy	Game As Storytelling	

Artist One	The artist said she was scared by the code. As a creative writer, the artist has never worked with code first-hand.	code, scary, writer	coding literacy	Game As Action	
Artist One	She felt a weird pleasure in the chaos of colors.	chaos, color	a world should feel chaotic	Game As Storytelling	
Artist One	Does the worldmaking game become different when we enter the world of Metaverse?	different, metaverse	what's different in the metaverse	Future of gaming	
Artist One	The artist really likes how this game is experimenting. It assumes that players also have their own thoughts.	Experi-menting, own, thoughts	player can have different experiences in the same game world	Conditions of Player Agency	
Artist Two	More specifically, she enjoys the Danganronpa series because of the richness of the plot, character, and worldview. The game was originally conceived as a basic visual novel but, as visual novels were growing less popular, new gameplay elements were added to make it stand out.	richness, plot, character, worldview, visual, novel	richness of narrative	Game As Storytelling	
Artist Two	Besides the noteworthy visual narrative element, simulation has always been a hidden theme for the whole series. By the end of Danganronpa V3, the plot even extended to a conversation with the players outside of the screen, leading to a meta-game revelation ending and bringing the game's depth to another level.	simulation, conversation, meta-game, depth	simulation, and conversation adding to depth of game	Figurative vs. Abstract Narrative	
Artist Two	As for game-level design and mechanics, it is a successful fusion of multiple categories including text adventure, gal game, action game, and puzzle game, with no specific expectation of the players to be the top experts in each of the categories.	fusion, multiple, categories, none-expert	game being multidisci-plinary in nature	Game As System	
Artist Two	It is a pixel simulation game with a simple plot and mechanism to play. It intertwines the history of the Soviet Union into the fictional background, and the familiarity helps make the player immerse in the character soon.	immersion, character, history, fiction	immersive storytelling	Game As Storytelling	

Artist Two	The successful usage of historical elements and subtle choice of information build the world in a unique way, strengthening the power difference between individuals and a nation.	difference, individual, nation	difference between individual and nation	Game As System	
Artist Two	The game begins as a typical gal game, while the plot and characters gradually deteriorate into twisted ones and bring a meta-revelation about the essence of gaming in the end.	twisted, meta-revelation	narrative helps build meta-revelation	Game As Storytelling	
Artist Two	It includes a certain kind of eeriness and liminality, showing that this is a place different from real world or some realistic simulations.	eerieness, different, real, world, realistic	game different from real-world	Conditions of Player Agency	
Artist Two	The world is not dangerous at all as the creatures won't eat players and the NPCs won't attack them, but it is depressive to some people with low-render quality and silence everywhere.	dangerous, depressive, low-render	world that feels dangerous and depressive	Game As Storytelling	
Artist Two	If players live inside it long enough, they would be homogenized into the creatures or NPCs, and forget about their original self.	homogenized, the origin of self	normalization of the world	Game As System	
Artist Two	The artist described her initial reaction to the research instrument as many meshes appear in a world with several layers of color gradually, all moving towards the center somehow. Some of the shapes are highly irregular while some of the shapes are recognizable.	color, layer, moving, shape	visualization of the world	Conditions of Player Agency	
Artist Two	The artist didn't feel much playing in the process as most of her work is done when setting the parameters and function. More labor could be devoted from the side of the player. The process is more like "hmmm…interesting, let me wait and see how it transforms," so it's more like a watching process, though she understood this is part of her labor in the rules of the world.	not play. watching. rules. world	setting rules and observing the world	Conditions of Player Agency	

Artist Two	However, the actions like erase, clone, seek are not so distinctive from each other once they are all happening at the same time between many objects. So most of the time she was able to see collisions happening, but the speed of regeneration obstacles her from recognizing what exactly is happening, though there are texts and numbers upon the meshes.	chaos, color	chaotic world	Game As System	
Artist Two	The part of setting parameters is like many traditional games, but in most games the customization of a character does not lead to essential change of its narrative, while the change in this game, the artist believed, could be described as essential or ontological. Also, there isn't a clear narrative of the whole process, but the artist would like to view it as a highly-abstracted version of a narrative, in which the events between characters are simplified into change of shape and color. So there is still a "story," but not built upon a traditional human idea of a story.	ontology, abstract	narrative can be abstract or ontological	Figurative vs. Abstract Narrative	
Artist Two	The space for her own imagination is not a lot for, as she might still be viewing it from a human perspective, and she considers that something more specific would refresh her perception.	specific	details help generate imagination	Game As Storytelling	
Artist Two	The artist finds different people view simulation with individual preferences. For example, she would prefer to compare the common and uncommon features of the simulated world and real-world, while some people might focus on the generating mechanism in the code or design level, etc.	difference, simulation	the multiple perspective of simulation	Game As System	

Scientist One	To her, art can be a speculative method to comprehend systems. Sound art is another thing. Sound implies organization in time, and the latter is ultimately what interests me. The scientist used to write an introduction for a book called *The Brain Is A Time Machine* in 2019. It is about a scientific account about time. Time for her is something that can be repeated reliably. The scientist is interested in rhythm, the relationship between the previous note and the next note, the difference between permutation interests me.	speculative. method. difference. repetition. reliability	art as a method of speculation	Game As Action	
Scientist One	Radio waves can transcend physical barriers. It's a primitive technology. It's almost more politically radical than visual arts. The scientist is more interested in activism that has the potential to revolutionize.	activism. revolutionize	action that leads to difference	Game As Action	
Scientist One	But more, they make players realize that game is a software, and players can learn about implicit games, but more how these rules take advantage of the nature of programming.	rules. nature. programming	game as the effect of programmed rules	Game As System	
Scientist One	If a film is rewound, it is deterministic. But if a game is rewound, it can inspire potentially unlimited amount of outcome, which cannot be predicted by anyone including the gamemaker him/herself.	film. game, deterministic, generative	difference between film and game	Figurative vs. Abstract Narrative	
Scientist One	Even for Ian Cheng's work, the artist changes software, but he doesn't take any input. So it's closed. Conway's Game of life is also like that. However, a game always takes into consideration of a game player's experience, which makes it an open system, which takes into consideration of player introduced uncertainty from day one. So, The scientist doesn't think simulation is the most accurate way to describe a game.	player. closed vs. open system	close vs. open system	Game As System	

Scientist One	Do game designers need to ensure that even searching internet still cannot exhaust some element of surprise?	internet, search	internet being part of gameplay experience	Conditions of Player Agency	
Scientist One	But in a game like Beginner's Guide, players shape a world, but also in a larger world part of which is not designed for you. You end up going back and forth between two worlds, one of which is broken for you.	back and forth. worlds	traversing between multiple worlds	Game As Action	
Scientist One	Now we must see how territories and model of governance take their form in virtual layers, which we are not yet used to seeing or comparing alongside the model of government—citizens as we know of.	governance, virtual, layer, citizen	how does governance look in virtuality	Conditions of Player Agency	
Scientist One	Something very interesting is that the scientist assumed rulemaking is something like multiple choices, but she was really surprised to see that the actual code block was presented to the player participant.	rule, making, choice, code	form of rulemaking	Conditions of Player Agency	
Scientist One	Similarly in Journey, designers can limit the ways players can interact with each other, for example, not being able to push someone off the hill.	designers. limit. players	player behaviors are shaped by the rules.	Conditions of Player Agency	
Scientist One	It is possible from a system and statistical point of view, but very hard to achieve in reality. Human rationality is a big obstacle. Measurement of efficiency is also questionable. the efficiency is very singularly defined.	system. statistical. rationality. singular	human irrationality poses risk to a system	Game As System	
Scientist One	The problem with this term is that there are scholars from different disciplines contributing perspectives from outside the purview of storytelling that cannot be unified by this term.	different. discipline	different scholars view gaming differently	Game As System	
Scientist One	Game is powerful because it contemplates the potentiality of future which is related to the present in an imaginative, but not causal or suggestive way	potentiality, future	game as tool to contemplate the potentiality of future	Future of gaming	

Scientist One	Hunicke, LeBlanc, and Zubek also wrote in *Mechanics Dynamics Aesthetics* of game design, that the player experience of a game is produced by the player's interaction with the dynamics of the game, which are the emergent effects of mechanics or rules designed by the designers. The reality of a game is a player construction, but one which also exists at a deeper level, the level of mechanics, or rules in the context of this research.	interaction, mechanics. rule	play as players perception of the rule, not the rule itself	Conditions of Player Agency	
Scientist One	Another term that's very relevant to this game is operational logic, which refers to the idea that games exist on multiple levels, but some are more real, or material than others.	operational logic	game exists on multiple levels	Game As System	
Scientist Two	He especially likes simulation and worldbuilding games, for example, city skyline. It's very much like a worldbuilding game. From a player expective, it's a very simple game, just accumulating.	simulation, simple, player, accumulating	simulation from a player perspective	Conditions of Player Agency	
Scientist Two	Some Japanese modders recreated the entire landscape of Japan, with details down to street architectures, traffic signs that exactly replicate the original ones in Japan.	modding	game as modding	Game As Action	
Scientist Two	When I started high school, I started to feel AAA was boring. It's ironic. After I started playing Elderscroll, Fallout, and most importantly, Fallout New Vegas, open-world RPG, I started to realize that narrative was really important. Good narrative made me feel much more interesting. the scientist is not grinding, but experiencing. I really invested in the narrative.	boring. good. narrative	good narrative is important to a game	Game As Storytelling	

Scientist Two	These games made me realize that choices I made will influence the long-term impact of the narrative. You will notice that choices players made really early on will affect your relationship with certain factions, which will really influence the ending of the game players can see.	choices. impact of narrative	short-term player choice has long-term impact of narrative	Game As System	Complexity
Scientist Two	Rimworld is a surviving space colony. Players start with three surviving members of a crashed spaceship. The base game has an in-game editor. Players can edit the characteristics, experience, region, and beliefs of each player. There are lots of modders who will contribute new objects, gears, etc. The game visual is very low-fi, making it convenient for modders to contribute rules.	editor, low-fi, convenient, modder	games with limited visuals help modders contribute rules	Game As Action	Simplicity of narrative motivates action
Scientist Two	On this game's reddit, there are many different sub-reddits, the moderators of each sub-reddit will decide. The most popular ones are mods, scenarios, how a scenario is designed (some scenarios are worth sharing from your own game-play). It's almost like 1000 Hamlets, each with its own unique characteristics), stories (a single player experience. For example, in the next playthrough, a player realized that a player controller he/she created in the previous round was rebranded as an NPC with additional generative behaviors).	reddit mods	reddit being an important part of playing games	Game As System	Complexity, Close vs. open system
Scientist Two	Firstly, he thinks that the mode of narrative is very interesting, almost like a meme. The backstory of the game is hidden inside the details embedded in environmental design, item design, and item description. Every single item, timing, character's path is strictly reflecting part of the overall narrative.	interesting. hidden. overall narrative	hidden details that are aligned with overall narrative make a game interesting	Game As Storytelling	Motivation

Scientist Two	What he wants is a slightly different setting each time at the beginning and seeing the difference in the results. The parameters he will experiment is total resources, geography, distance, isolation, traffic, individual's motivation.	difference. repetition	game as difference through repetition	Game As Action	Hacking
Scientist Two	There will also be a cost, exhaust some kind of resource so that altruism isn't easily accomplished.	Cost, altruism	game should have limits and constraints	Game As System	Close vs. open system
Scientist Two	The scientist thought this research instrument is somewhat similar to the worlding thought experiment he had earlier on. He felt very said game companies are no longer making MMO games MMO RPG like World of Warcraft, Final Fantasy, Elderscroll online after Minecraft, and he wonders why. The scientist thinks that like himself, there are still a lot of people who enjoy the experience of building a community with others online.	MMO RPG	the dissapearance of MMO RPG as a genra	Future of gaming	Gaming As a Tool For Contemplating Future
Scientist Two	Minecraft allows players to charge for secondary universe access by selling access to the server. Fortnight allows players to sell scenarios/minigames/ mechanisms. Metaverse is starting to have landlords, which in turn enables the original game developer to become the mega-landlord. How is it different from the app store? Experience of play is transformed to the experience of work (for original game developer).	economy. metaverse	the economy of metaverse	Conditions of Player Agency	Game economy vs. real economy
Scientist Two	The scientist is interested in human motivation. He wants to know when you put beings with different motivations together, what will the finalized result be, in a stylized way at least? He is also interested in group scenarios.	human, motivation	game as a tool for experimenting with human motivation	Game As System	Human Motivation

Technologist One	He felt really immersed in the stories as if he had really known those characters for years. For a few weeks or months during and after playing the RPG game, he felt like he was really the protagonist. He felt their happiness and sadness.	RPG (Role-play games), protagonist, immersed, known	details of character help a game to be immersive	Game As Storytelling	Visual Storytelling: Color, Shape, etc.
Technologist One	Many RPGs are inspired by ancient mythologies, so the game world is very beautiful and wonderous.	mythologies. beatiful. wonderous.	games as mythologies	Game As Storytelling	Poetics. Healing. Motivation
Technologist One	The music is equally pleasing. The whole experience is very immersive, not in the sense of wearing a VR headset, but the sense of intimacy from reading a good novel.	immersive, intimacy, novel	games feels like the intimacy of reading novel	Game As Storytelling	Feelings, Initmacy
Technologist One	To the technologist, storytelling and role play games are his favorite genre, because he likes seeing a person going through his or her life with a complex, bitter-sweet experience.	complex, bitter-sweet	games should afford complex experiences	Game As Storytelling	Feelings
Technologist One	It's mostly about battle and mythology. However, the music elevated the game to a new emotional and psychological level through music—a universal abstract form of storytelling.	music, abstract	music as abstract storytelling	Figurative vs. Abstract Narrative	
Technologist One	Instead, he then reinterpreted this question as "how can we take advantage of the easiness of creating computationally simulated world to help people make decisions in the real world?"	easiness, computation, simulation, decision, real, world	simulation as decision making	Conditions of Player Agency	Agency in simulated vs. physical reality
Technologist One	The technologist enjoys thinking about the process of creating this world—how to figure out a mathematical and procedural way to represent our current world. He feels that this question will help him make sense of the real world in a somewhat abstract and predictable way, which helps manage uncertainty.	process, mathematical, procedural, abstract, predictable, uncertainty	abstract representation as making sense of the world	Game As System	Abstracted Complexity

Technologist One	When the technologist interacted with the research instrument, he realized he couldn't tell the world simulation engine to make whatever kind of world that he imagined in his mind. In the demo scripts, there were already concepts like "jump," "speed," "movement," which were already predefined in a programmed way.	simulation, engine, pre-defined	simulation feels pre-defined	Game As System	Abstracted Complexity
Technologist One	The technologist felt that it's an example of an open-ended tool, which allows him to be immersed in his own world while using it.	open-ended, immersed, world	open-ended tool	Game As System	Abstracted Complexity
Technologist One	The technologist seems to be commenting on the difference between an engine, platform, or tool that makes worlds, versus a world that allows inhabitants to make certain choices within. He thinks that most video games belong to the latter category.	engine, platform, tool	game as engine, platform, or tool	Game As System	Multiplicity
Technologist One	For example, in Call of Duty, in order to participate in the game, players need to believe they are entering into this virtual world as a WWII soldier. In a way, players are contributing something to a world that already exists, so (by way of entry of this world), players need to (know and) obey the rules that are already established in this world.	visual, already exist, know, obey, established	making a new world vs. contributing to existing world	Conditions of Player Agency	Metacognition
Technologist One	When faced with the research instrument, the technologist had a clear realization about the mutually stimulating relationship between creativity and limitation. He wished that someone would tell him what he cannot do, which will help him get creative.	limitation, creativity	limitation is a necessary condition for creativity	Conditions of Player Agency	Constraint vs. Freedom
Technologist One	The collectivism aspect of the instrument reminded him of an example called Plague of Blood in warcraft. One player's action will stir up a butterfly effect and directly or indirectly affect other players, even the world itself—landscape, climate, conventions, cultures, etc.	collectivism. butterfly effect.	individual actions affect others and the world in multiplayer games	Game As System	Abstracted Complexity

Technologist One	Snowcrash, the novel that invented the word metaverse depicted fictional world in which the hackers are the all-powerful group of people who have the ability to change how the world works. When the technologist thinks about worldmaking in the digital world, it's heavily linked with the hacker spirit.	hacker, change, world, works, spirit, metaverse	in metaverse, changes can be achieved through hacking	Game As Action	Hacking
Technologist One	There is a very interesting tension here. All games are meant to have clear boundaries. The characters are programmed to perform a fixed number of actions. There is always a very strong urge to break this limitation from the players' community.	boundaries. fixed. urge, break, players	play as breaking the boundaries	Conditions of Player Agency	Constraint vs. Freedom
Technologist One	They are going into the program and changing the file structures. But no matter the method, whether they are using a playful way or a more intrusive way of breaking the game, these players all obtain this sense of freedom, or happiness or pleasure, something very positive, extremely rewarding in the process of players trying to get around the game.	playful, intrusive, freedom, positive, rewarding	breaking can be playful or intrusive. it's positive and free and rewarding	Game As Action	Playful
Technologist Two	Personally, he has played video games since a very young age. His favorite story was that he and his brother played Golden Eye with their father when they were 5 and 7, respectively. The two of them beat him so bad and he stopped playing with them.	young	playing videogame since very young	Game As Action	Playful
Technologist Two	From that point on, the game became a lot more popular than the original, non-hacked version. This story made him become aware of a unique way players can empower themselves by breaking the original game rules.	hack, break, rules	hacking as playing and making games	Game As Action	Hacking

Technologist Two	At some point, he discovered a technique called bunny hopping, another example of hacking the play style of the game. If a player chooses healer as a profession, he or she can perform this rapid high jump while healing players nearby, making the overall team a lot harder to defeat. As a result, the game maker eventually rolled out a software batch to disable this operation, after hearing from less skilled players about the difficulty of performing it, which implied an unfair advantage to more seasoned players.	hacking, playstyle, unfair, advantage	hacking as unfair playstyle	Game As Action	Hacking
Technologist Two	Similarly, when playing regular chess, one wants the game to always be the same. However, there is a reddit discussion forum called Anarchy Chess, which features a meta-chess that players can make up any rules as they progress to each additional round of the game.	rules, same, meta-chess, make up	play as following vs. changing the rules	Conditions of Player Agency	Constraint vs. Freedom
Technologist Two	In VR chat, people learn about how to interact with their friends who don't speak verbally by subverting the original bodily gestures into usage of expression beyond the original intention of the platform.	subverting, original, intention, platform	play as experimenting with new personal behavior	Game As System	Human Motivation
Technologist Two	Besides mechanics, the player's real-world persona serves as another organic constraint. Going back to D&D, the social aspect of taking on another person, trying to think of how one would think through one's virtual avatar can be a very rewarding process.	social, virtual avatar, real-world, personal	story as rules	Conditions of Player Agency	Constraint vs. Freedom
Technologist Two	According to the technologist, a lot of people's in-game D&D characters end up becoming different facets of their real-life personality. One obviously carries oneself into a game, but also expand beyond the physical realm to the imaginative realm—the theater of the mind, or collective imagining.	Real-life, personality, expand, imaginative, realm	Virtual world allows rules to be made imaginatively	Conditions of Player Agency	Agency in simulated vs. physical reality

Technologist Two	Most of the creatures are results from independent evolutions. Some developed strategies similar to those in real life. Once they're evolved multiple copies, these creatures can be made and simulated together in the same environment.	evolution, strategy, real-life	games as evolution, the learning contributing to rules in reallife	Conditions of Player Agency	Agency in simulated vs. physical reality
Technologist Two	What the technologist seems to be alluding to is that, in a simulation game, even though AIs can be trained to optimize towards specific goals, it will not have the ability to challenge the goals themselves. On the contrary, when real human players play a game, the sometimes question the original goal of the game in its entirety, and device playstyles that's not intended by the original premise of the game.	simulation, AI, training, original, premise	difference between AI simulation and games played by real humans	Future of gaming	Artificial Intelligence

Coded Themes by Origin and Percentage

Theme	Origin	Percentage
Game As System	Research Question	28%
Game As Storytelling	Research Question	19%
Game As Action	Research Question	17%
Conditions of Player Agency	Emergent From Data	23%
Figurative vs. Abstract Narrative	Emergent From Data	8%
Future of Gaming	Emergent From Data	5%
Total		100%

Coded Themes by Participant Percentage

Theme	Artist One	Artist Two	Scientist One	Scientist Two	Technologist One	Technologist Two	Sub-total
Conditions of Player Agency	0%	17%	**28%**	11%	**22%**	**22%**	100%
Figurative vs. Abstract Narrative	17%	**33%**	**33%**	0%	17%	0%	100%
Future of gaming	**50%**	0%	0%	25%	0%	25%	100%
Game As Action	15%	0%	23%	**23%**	15%	**23%**	100%
Game As Storytelling	**27%**	**33%**	0%	13%	**27%**	0%	100%
Game As System	9%	**23%**	**23%**	18%	**23%**	5%	100%

Appendix D

Design of Research Instrument

The design of the research instrument is inspired by open-world simulation game, but it has some unique features that differentiate it from commercial games in the genre. It was designed around a few key principles:

1. Procedurally Generated World: The virtual world is not pre-built or static. Instead, it uses procedural generation to create varied landscapes whenever a new game starts.
2. Object-Based Design: Everything in the virtual world is defined as an object, which players can freely edit, in terms of its visual appearance, behavior, as well as relationship to other objects in the world. This allows for critical design and creativity beyond conventional games, as players can remake creatures, redefine collective behaviors, or alter the virtual environment however they see fit.
3. None-Survival: Different from conventional games in the genre, players do not need to gather resources to survive. The none-survival mechanics create a sense of material abundance, driving player engagement towards expression and experimentation.
4. Sandbox Gameplay: There are no set goals or objectives in the virtual worlds. Participants are free to explore, build, and interact with the world as they see fit. This freedom enhances the player agency and enables a wide variety of play styles.
5. Multiplayer Functionality: Minecraft allows players to share their worlds with others, enabling cooperative building projects, competitive games, and more. This social element can greatly enhance the game's longevity and appeal.

6. Rulemaking interface: The research instrument has been designed to be highly flat, which allows players to add new features, mechanics, and content to the world. This has resulted in critical player engagement that is rare in conventional worldbuilding games.
7. Day/Night Cycle: These cycles introduce dynamic elements into the gameplay, influencing player activities and strategies.
8. Object neutrality: Conventional open-world simulation games are populated with a variety of creatures. Some are friendly, like the animals that can be farmed for resources, while others are hostile and pose a threat to the player. In the research instrument, players are allowed to define a mixture of friendly and hostile behaviors for any given creature, making their individual characteristics more dynamic.

In terms of technical design, the research instrument uses a variety of programming and design tools. The rulemaking interface was made using Javascript, which allows for a high degree of cross-browser compatibility. The game also uses Github to aggregate individual player contributed procedural rules. GitHub is a web-based hosting service for version control repositories. It offers the distributed version control and source code management (SCM) functionality of Git. allows multiple people to work on a project at the same time without overwriting each other's changes. This is achieved through the use of "branches," which let developers isolate their changes from the main project until they are ready to merge them. GitHub provides a platform for developers to work on projects together, no matter where they are located. This technology is essential for achieving a flat, nonhierarchical collaboration environment among all participants of the worldmaking process.