

THE ROLE OF VIDEOGAME GLITCH IN ADULT LEARNING

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ABSTRACT

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This research investigates the responses of three individuals engaging with the Super Mario World (SMW) platform videogame glitches, and how they learned to solve the problem without formal help. This investigation was chosen because it explores connections between media literacy, critical thinking, and play in adults in the context of responding to unexpected technological errors. At the core of this study is the question of how encounters with arbitrary glitches can motivate and elicit critical thinking. Following a case study model, data were collected as the three subjects played SMW and encountered glitches. Questions regarding the (glitchy) game play experience were addressed in the first interview immediately following. The subjects were asked to create a visual essay and keep personal journals, which were gathered after 30 days, and a second interview at that time focused on the overall experience.

Several results emerged from the data. Each of the subjects identified and solved for glitches in a way that suggested critical thinking processes. In addition, they all reflected in various ways on the challenges that glitches presented, making connections to larger issues and their everyday lives. The data also showed the importance of memory in these processes. The results suggest that while subjects approached and solved a technological glitch in SMW game play, they simultaneously acquired, developed, and—at least for the duration of the study—sustained new literacy skills and expanded their proficiency with critical thinking. This holds some potential implications for the value of incorporating glitch experiences both inside and outside

the classroom, suggesting that videogame play—and particularly glitches in play—can be considered valuable opportunities for learners and teachers alike.

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DEDICATION

This dissertation is dedicated to Professor Dr. Judith Burton for her nurturing support and expert guidance.

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Chapter I

INTRODUCTION AND RATIONALE

From the moment I knew of their existence at a young age, I was attracted to videogames of all sorts, and I attribute a good part of my artistic practice and scholarly interests to this early enthusiasm. The first time I came upon a glitch, however, occurred not with a videogame but with a television in the 1980s. Back then, Portuguese television only had two public channels: TV Channel One and TV Channel Two. The wooden button was meant only to tune into one channel at a time. Through cooperative problem-solving with my brothers, we found that if we held the button down partially, we could tune into some *other* channels that should not have existed (sometimes cartoons, sports, sometimes French or Spanish programming, etc.). In that same year, the frame of our television turned black, creating a kind of pinhole effect with the color image visible only in the center. Later still, the black border turned red and the colors faded to sepia. This was a kind of disruption and degradation of the television, but I saw beauty in its unpredictability. Eventually, the television stopped working entirely, but this was my first glimpse into glitches, which has since evolved into a fascination for creative possibilities within the media itself. These were all glitches in the technology—unintentional results due to deterioration, misuse, or just normal usage over time. After that, still in the 1980s, in a computer in my mom's office, I played a videogame for the first time. The workers in the office would take turns playing Pac-Man. I watched them play, and observed how they controlled the Pac-Man character with the arrow keys on the keyboard. When an

adult would leave, I played by myself, mimicking the movements I saw, but only for a few moments until another employee would take over. In retrospect, this was an example of self-learning, and one of the formative experiences that influenced this dissertation.

A few years later, I played Arkanoid on the Spectrum console at my friend's house. But before we could even upload the game, there was a glitch in the code that prevented us from playing. With this game system, uploading took about an hour. Spectrum had a keyboard, and software was stored on and uploaded from tapes that resembled audiocassettes.

When an error in the uploading happened, my friend handed me a heavy book, an official Spectrum publication with codes for finding the problem and solving it. After spending a few minutes comparing and inserting codes, she said it should be fine, and we could upload the game. A mere hour later, the game was uploaded. This was my first experience watching someone problem-solve a videogame glitch. At that moment, I was aware how a videogame glitch could be solved by rewriting the code, and it made me begin to wonder about other videogame glitches. I looked over the Spectrum codebook, and it appeared to be a fascinating foreign language text with numbers and symbols assembled into a book. My friend told me these types of issues were common. I found it curious that if one single comma were misplaced in the coding, the whole game would not function. I saw that my friend would reference the big book from Spectrum quickly and confidently, because she had encountered it before and was familiar with this language and process of debugging.

A couple of years later, I encountered Super Mario World (SMW). SMW is a 1990s platform videogame with 96 levels, played on the Super Nintendo Entertainment System. This particular game notoriously possessed many different types of glitches (Wiki, 2012). For example, through a malfunction in the connection between the console and game cartridge, the game would toggle between black/white and color. I would either shift or reinsert the cartridge, and the game would return to color. Another glitch involved

the main character—Mario—almost disappearing in the monitor, giving Mario temporarily indestructible status and allowing the gamer to continue through the entire level, effortlessly avoiding all obstacles and enemies. I started thinking then about how glitches might facilitate other options in the game play.

Background to the Problem

New technologies such as computer hardware and software, or mobile phones, require new skills, which seem to be in a state of constant adaptation and change to fit these new technologies. Individuals learn new media literacy skills within this ever-changing environment, in which technological errors seem to occur quite often. Such errors, or glitches, can call attention to some of the ways we acquire and develop skills in the realm of new literacies.

This study focuses on the occurrence of glitches in a videogame and asks how individuals may develop and evolve their media literacy skills as a result of encounters with these glitches. It will be argued that videogame glitches inspire a natural form of critical thinking skills that emerge from practices with the videogame media and constitute a type of self-learning vital for media literacies in general. This study investigates how videogame glitches, as distinct from television, internet, or other media glitches, provide challenges to learning that act as a spontaneous catalyst for critical thinking. This critical thinking is elicited naturally, without a facilitator or educational plan, as a result of glitches posing problems to the play itself through direct interaction with the media.

I chose to research videogames because they are embedded in contemporary culture and daily life and are available through mobile phones, the Internet, gaming consoles, and the like. Videogames also frequently generate mistakes, such as jamming and locking of the videogame screen, freezing of game functionality, and other errors.

Through negotiating solutions, it is possible that a player can develop skills such as critical thinking from these frequent glitch encounters.

Previous Research

There is an extensive body of research suggesting that videogames and platform games (both commercial and edutainment) can have learning value when tied to a facilitator, either a teacher or parent. In these studies, the facilitator typically directs the learner through the videogame to analyze a specific skill set or topic, and this same facilitator will analyze the learning outcomes and value the student gained (Adachi & Willoughby, 2013; Andersen & Dalgaard, 2005; Boyle et al., 2016; Brody, 1993; Buckingham & Scanlon, 2002; Calvert, 2005; Cavallari, Hedberg, & Harper, 1992; Connolly et al., 2012; Dempsey, Rasmussen, & Lucassen, 1996; Facer, Furlong, Furlong, & Sutherland, 2003; Freitas, 2005; Forsyth & Lancy, 1987; Gee, 2003, 2004, 2008; Gozli, Bavelier, & Pratt, 2014; Green & Bavelier, 2012; Gunter, 2005; Hainey et al., 2016; Hostetter, 2003; Hoyle, Harris, & Judd, 1991; Hoyles, Noss, & Adamson, 2002; Kafai, 1995; Kendall, 2011; Kirriemuir & McFarlane, 2002; Lantolf, 2000; MacClurg & Chaille 1987; McGrenere, 1996; Okan, 2003; Subrahmanyam & Greenfield, 1994; Uttal et al., 2013).

Of these studies, one pertains to the creativity that glitches can bring (Krapp, 2011). Another study concerns high school students in a classroom setting who work to find glitches in a videogame for the company to fix these glitches (Bruckman & DiSalvo, 2011). Neither of these, however, considers that glitches might be a source of interest in themselves. These studies also did not address which types of skills or practices of thinking the players brought along with them as they approached these glitches, or the kinds of learning glitches might elicit in the absence of a facilitator.

To expand on the literature concerning videogames and learning, and to provide a larger context for understanding learning around glitches, my literature review gives

further emphasis to the intersection of media literacy and play. This is divided into two important movements, one that dictates the skills used or developed with a videogame glitch encounter, and the other which is focused on media literacy (in this case, videogames). Within media literacies, I give emphasis to critical thinking as an important skill, as argued by others (Feuerstein, 1999; Jenkins, 2006; Masterman, 1985). Further, I incorporate the idea of self-directed learning in Knowles (1975), who coined the term Self-Directed Learning (SDL), in which any adult can construct their own goals and learning, and aspects of Freire (1983a, 1983b), who likewise suggested the importance of self-learning.

Glitch Engagement for Learning

Any technological object is prone to problems and imperfections. An error potentially brings conscious awareness to the fact that programming exists behind the graphics or appearance of the game, which the user is not necessarily aware of while the game is running smoothly. With a videogame glitch, the player may be confronted with an apparent inconsistency or instant puzzle, and they may not know if this is part of the game or a programming error. In order to understand the particular problems concerning the relationship between glitches and learning that this study pursued, it is useful to have a general sense of the nature of glitches and some typical features.

When the glitch happens, limitations in the programming become more apparent through a rupture of the intended pattern in how the technology/media should work. The user may or may not identify this as a glitch instead of just part of the game, but if they do, then the next step involves what to do and how: should the glitch be incorporated into play or should the solution be sought and then incorporated into play? As individuals ponder their responses, more and more possibilities and choices open to them for which paths to take. Glitches may be a problem that not everyone approaches uniformly, since

each learner has their own style, and individual variances abound that could provide insight into self-learning in a media literacy context.

John Dewey (1979) defended the need for reflective thinking and pointed out strategies for practicing it, recognizing that while we reflect on a set of things when we think about them, analytical thinking only happens when there is a problem to be solved. It may be possible to analyze the problem of glitch encounters in videogames as problems to be solved that may spur this kind of reflective thinking. For Dewey, the key to freedom is intelligence, and if we become aware of the contingencies of our environment, which control our actions, we can alter those contingencies and thereby change ourselves. The solution of a problematic situation may involve the transformation of both the investigator and the environment (Dewey, 1938, in Garrison, Neubert, & Reich, 2012). Perhaps encountering a glitch may allow the users to find unique solutions to these problems, and along the way be transformed by their videogame playing experiences. In this research, I was interested in observing the processes by which solutions to glitch problems may reveal subtle transformations in reflective thought. Playing videogames and encountering glitches could provide a gateway to developing media literacy skills. Videogame glitches might not only provide tools for subjects to develop specific skills, such as motor skills, memory, problem solving, and critical thinking, but also skills that beget other skills for media literacy self-learning. Media literacy skills could be applied outside of videogames or even to glitches in different devices. In the rapidly changing media landscape, all people need to learn and relearn. It is no longer the norm that a worker can simply maintain the same skills for 60 years and expect to stay in the same job, using that same skill set. We are in an era where it is more common to re-educate ourselves, be it through attaining multiple degrees or through teaching oneself updated skills (Edelman, 2017). Glitches are not only a part of this landscape that are not going to go away, but themselves may require skills to identify and navigate, potentially useful skills that may apply broadly.

Problem Statement

Since the advent of Gutenberg's printing press, the ability to create and respond to media has expanded over the centuries. Within the 21st century, we are now expected to respond to the sustained emergence of new forms of digital technology, such as smartphones, the Internet, tablets, computers, videogames, and the like. This research focuses on an underutilized aspect of media literacy education: videogame glitches, and more specifically, the glitches in Super Mario World (SMW).

With these glitches, or technological errors, people are presented with a novel idea or problem through which they must decide how to proceed. Given my own experience, and supported by the literature review, this study focused on the kinds of skills and thinking that are elicited by engaging with videogame glitches. This research concentrated on the qualities inherent in videogame glitches as a self-directed source for learning.

The videogame glitches in Super Mario World are an underexplored resource, and I propose that glitches in SMW have potential as both a medium and tool to facilitate the development or acquisition of skills used to approach digital technology today, such as critical and inquiry thinking (forms of media literacy), and at the same time inspire self-learning in those that encounter them.

Research Question

- I. What range of skills are called into play and challenged when an individual encounters a glitch while using or playing videogames? Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World (SMW)?

II. *Sub-questions*

- a. Given that meeting the challenge of a glitch is encountered when playing SMW, what kind of skills come into being to solve the perceived problem of the glitch?
- b. Given that an individual confronting an SMW glitch calls into play a range of responses, how do these responses interplay with each other as the individual tries to solve the problem?
- c. Given that an individual meeting the challenge of a glitch when playing SMW arrives at a resolution of the problem, how do critical thinking skills come into being as a consequence of these responses?

Assumptions

Not to be Debated

- I will not debate that adults have a prior capacity to self-direct their learning, if they so choose.
- I will not challenge the idea that media literacies include new media literacies. In my view, media literacies are the larger umbrella of literacy that also contains new media literacies. The presence of digital technology alone, in my view, does not lend itself to distinction apart from the larger category of media literacies.
- I will not challenge the idea that videogames are a type of media that provides engagement with new media literacy skills.
- I will not debate that videogames are motivators.
- I will not challenge the idea that videogames are narratives.
- I will not challenge the idea that videogames are art.

- I will not debate the pre-existing meaning of the word *glitch*, as a technological error.
- I will not debate whether glitches are good or bad, since it depends on circumstances in which the glitches are encountered and the person that encounters them.
- I will not challenge the appropriateness and pre-existing meaning of the word *Edutainment*.
- I will not debate whether self-learning and Do-It-Yourself (DIY) learning are different or the same. On this matter, my approach is that they are different since “D. I. Y. encourages us to reject authority and hierarchy” (Mason, 2008, p. 12). In my view, self-learning is a process that involves play, and through play and experimentation one arrives at a self-derived approach that can complement any learning, including classroom learning and learning in any social setting.

To be Debated

- Given that contemporary media can be thought of as new literacies acquisitions that can be developed, can it be assumed that videogame glitches without guidance are an influence for learning?
- Given that new technologies and media brought us media literacies acquisitions, how do videogames and glitches without guidance provide new skills and media literacies skills to the player?

Study Limitations

The study limitations are divided into four areas: limitations in activities of the study, the population for the study, the type of study and data collection, and the limitations of the literature review.

First, I wanted the subjects in this study to all be exposed to the same videogame. Therefore, I limited the research to the Super Mario World (SMW) videogame because I needed a videogame with a lot of glitches, in both software and hardware errors. In addition, Mario is a videogame character that has had wide-reaching influence among the people I knew growing up. It was a game available in Portugal, and it seemed everyone in my generation played it; I hoped this familiarity would help my subjects feel comfortable to play and explore in their responses to the glitches in SMW. However, this also presents a limitation in the study, in that the data only reflect encounters with this one game. More generally, it should be said that by their nature glitches are unpredictable; one does not know exactly when a glitch will happen or precisely what form it will take. This nature of glitches presents a further limitation: it is impossible to be sure that subjects will encounter glitches or share similar game play experiences. SMW was chosen partly to ensure a relatively high frequency of glitches, but in the end this is difficult to control for.

Second, the study was limited to a data scope collected from three persons: two men and one woman born in Porto, Portugal in 1978. Originally, there were two women, but one dropped out in the beginning of the study. My subjects were of the same age and native city and also spent their formative years in Porto. There they grew up with only two channels of television, landline telephones, and as they reached adulthood, computers, internet, and mobile phones were just beginning to be available. This similarity of subjects reduces outside variables, but also presents the limitation of a relatively homogeneous dataset. Although this small sample size may not provide enough

valid data to generate broad findings, it can provide a foundation from which to inquire into areas that need further examination.

Third, I briefly mention the limitations in the type of study and research methods for data collection. This was an observation and interview study conducted in the Portuguese language that was recorded and then translated and transcribed into English. Data were also gathered from the subjects' personal journals and their visual responses. I asked for these responses from the subjects in order to bridge the gap between the two interviews, which were conducted 30 days apart.

Last, I will briefly mention the limitations of the literature review. The literature review section was limited by the rarity of studies available concerning videogame glitches. I chose to focus on a literature review that could address the glitch encounter phenomenon from different perspectives, and this intersection is the framework for this study: media literacy focusing on critical thinking and self-directed learning and play.

Goals of the Research

What I set out to achieve with this research is to illuminate the role of self-learning that happens in videogames, as well as the skills acquired or methods explored when encountering inconsistencies in videogame programming, and to contribute to an understanding of how students might continuously and independently learn to further their media literacy skills, including critical thinking.

Congruent with that, I would like this research to offer educators a deeper sense of the possibility that videogames and technological errors could be a departure point for self-learning in the classroom. This could take different forms, such as new curriculum or new learning experiences.

My hope is that this research will assist educators in considering ways to incorporate technological errors into their classrooms, giving emphasis to a glitch-

embracing approach to self-learning and that they can continue to encourage students not only to experiment through playing videogames and encountering glitches, but to create a safe and nurturing space for them to develop and improve their critical thinking skills.

Educational Aims and Benefits

The internet, computer games, digital video, mobile phones and other contemporary technologies provide new ways of mediating and representing the world and of communicating. Outside school, children are engaging with these media... If educators wish to use these media in schools, they cannot afford to neglect these experiences: on the contrary, they need to provide students with means of understanding them. (Buckingham, 2008, p. 22)

As schools acquire access to new or relatively new digital technologies, they require new ways to effectively give students tools to learn. Among other challenges, schools are faced with the dizzying ever-changing landscapes of digital technology, in an environment where products and even their means of production are constantly and rapidly evolving. At the same time, these shifting landscapes create new jobs and a need for new skill sets, such as problem-solving within digital technologies (Edelman, 2017).

Given this environment, there is a need to focus on continuing to make education possible, as well as empowering students to access information through self-training. This study intends to benefit future media literacy in digital technology, giving emphasis to a glitch-embracing approach to self-learning that can be brought into the classroom. It also potentially suggests elements that a facilitator might bring to students who already possess a range of relevant skills, and how the facilitator might provide a safe, nurturing place for the student's perspective in self-learning skills using the medium of videogames.

The educational aims of this study are to elucidate processes of self-learning in videogames and the skills acquired with it, to contribute to a way in which students might

continuously and independently learn how to acquire and develop media literacy skills, and to suggest how this can be brought into the classroom.

Organization of the Study

Chapter I has introduced the background to the problem, the history and definition of *glitch*, the research question and opinions around and personal development of the research, and the research question. Chapter I has also presented the parameters, including limitations of the study, assumptions to be debated and not to be debated, and a definition of key terms.

Chapter II explores the theories and discusses previous studies and educational perspectives that inform the research more fully and extensively in a way to compare and contrast each other in the area of media literacy, giving emphasis to critical thinking and self-directed learning both outside and inside the classroom, as well as the importance of play.

Chapter III describes the methodology informing the research, fully explains the study parameters, the participants' background and selection, the methods around the data collection and coding system and analysis, and further development of the research question in this context.

Chapter IV presents the findings of the study as they emerged from the data. Moving from subject to subject, this chapter details each mode of data collection, followed by the overlapping themes of the data across all subjects that were noteworthy in these findings.

Chapter V returns to the research question to discuss the findings as they are informed by the literature in the field. This chapter organizes these data into phases through which to further analyze SMW game play, SMW glitch experience, and real-life connections. Also important in this chapter are the ways that memory, skills, and

self-directed learning are foregrounded across each of these phases, which then recontextualize the research question in light of this analysis.

Chapter VI explores the educational implications germane to this research by discussing how self-directed learning might be harnessed both outside and inside the classroom, with and without a facilitator. I will discuss three approaches that might serve as lessons in the pedagogy of self-directed learning to inspire ways in which teachers can foment self-directed learning in their students.

Chapter VII discusses the overview of the study and implications for further research as regards media literacy and media literacy skills, self-directed learning, videogames, videogame glitches, and potential implications for academic research outside these topics.

Chapter II

REVIEW OF LITERATURE

My interest in glitches emerged out of my early personal experiences with both videogames and non-videogame media. Here I will elaborate on the context of those glitch experiences, attempting to examine, from my own experience, why glitches are important aspects of these media forms, and why they might be relevant to pedagogy. In reflecting on how I found myself using “errors” while teaching coding as opportunities for learning, it became clear that glitches might be a useful way of thinking of opportunities for developing critical media literacy skills in non-facilitated learning environments. Just as coding “errors” provided opportunities to apply critical thinking to specific problems in formal learning, glitches might do the same within a context of non-formal, adult learning motivated by a spirit of play. Super Mario World provides a particularly rich environment for studying glitches in this context due to its lack of a manual and reputation for widespread glitches. Conversely, it seemed possible that what might be learned about how people respond to these glitches in this specific context would also give us insight into how new media literacy skills can be developed. Thus, after discussing the environment of glitches and videogame media, I will look at how media literacy relates to critical thinking in the theory of Marcuse, self-directed learning in Knowles and Freire, and Ranciere for exploring how non-facilitated learning can happen in classroom settings. Play being a significant feature of videogames, I then look at its importance in adult learning in Dewey, Dorsey, Froebel, Rousseau, and others. By

using glitches as the focus for understanding the relationship between play-based, non-facilitated learning, and the problem-solving and critical thinking that is elicited by disruptions in this context, it may allow us to see opportunities for expanding new media literacies.

Early Glitch Encounters

When I was younger, I became intrigued with glitches in a more general way. But as I grew older, I began to dissect the glitches more on these specific terms, and I also began to think about how I could seek out these glitches, or other glitches, or even create the glitches themselves through programming. I viewed the glitches more as a disruption or interruption in the technology, and would try more often to fix the glitches. As I got older, I would still use the same problem-solving techniques, but I saw beauty in the glitch, and ultimately appreciated such usage of glitches, as how Nam June Paik used distortions in his television installation art.

As an adult, I began to look for glitches instead, so I could experience a game within the game. I would also find glitches in videogames specifically to explore hidden levels, or to see what was hiding in the game that one was not meant to play. I craved some experiences in videogames that lay outside of the programmed boundaries of the game, and I wanted to share these glitch experiences with others. I also used glitches to cheat and advance in videogames. I started pushing the limits. I wanted to find the creative side of things. When I was younger, I wanted to solve the problem, but creatively around the age of 15 or 16, I wanted to push these boundaries. It was a symptom of enjoyment of the games. One thing I do now is try to find the boundaries and see where I can push those, or find the hidden potentialities, secret worlds, realms of pure enjoyment, and experimentation within a videogame.

My early glitch experiences were characterized in two broad categories for these purposes – videogame glitches and non-videogame media glitches. The very earliest of my experiences centered around non-videogame encounters with radios, telephones, televisions, cassette players, and other technologies. Later childhood experiences starting with Spectrum videogames began for me around age 10 or 11 and continued through adulthood into the present day.

Television Glitches

I mentioned in Chapter I that my very first glitch encounter was with the television, and I trace my interest now in glitch to these first encounters. As Williams (1992) has noted, viewers of television become entranced by television broadcasts such that the true source behind the flow of information becomes not visible or else forgotten or seemingly natural to the viewer absorbed in the act of passive digestion of a program. When a rift occurs in the technological flow, for example when the broadcast is interrupted, or there is static or other visual delays or technical issues, this can provoke a contemplation of the media itself and foment a search to find the meaning or the source of the disruption. The glitch, in other words, reveals the framework of the technology (Williams, 1992).

In a similar vein, Rosa Menkman (2011) views glitch as a helpful, revealing interference with the predictable technological data protocol. Glitch is a gift to media theory in the sense that it is a disruption with unintended positive effects by virtue of this unpredictability. In this way, I wanted to pursue how revealing technological mechanisms might corroborate with media literacy skills in videogames. But this first television glitch was like a gateway glitch that led me to appreciate other glitch experiences.

Videotape Glitches

Growing up in Portugal, we had Betamax, and VHS was not a competitor in the home movie market. Betamax were basically identical with VHS but with a larger,

½-inch tape format. My experiences with videotaped movies were therefore had exclusively on the Betamax medium.

A typical Betamax glitch stopped the tape from playing, the music would jump and sound would be distorted, or else the image would look scratchy, or its edges were not clean. In my approach, I would rewind the tape, eject it and make sure it did not have a crease or any folds in the magnetic tape itself, and I would blow out the dust. I could reach the magnetic tape by lifting up the plastic covering on the tape's edge. After this treatment, I would reinsert the tape and press play. Usually that worked to solve the problem. If it did not work the first time, I would repeat the process, sometimes manually rewinding the tape also by turning the gears, and visually scanning the tape for any irregularities.

In the worst case scenario for Betamax tapes, the tape would get “eaten,” which is when the magnetic tape would unravel inside the Betamax player, and I would have to extract the tape. This was difficult and often resulted in tape that was overlapping and twisted. Even if I managed to wind the tape back onto the reel, it would often still be twisted. To fix this, I would unwind more of the tape until I could grip enough of it to properly align it, and turn the reel to rewind it into the casing. However, if the tape was “eaten” for a longer period of time, the tape would unravel even further and I would have to perform an operation. I would unscrew the screws on the plastic case and remove the reels, reset the correct alignment of the reels, then reassemble the tape and put the casing back together.

I think my treatment of the Betamax tapes is connected with the idea that children learn to articulate procedures, recognize repetition, and “debug” their own thinking when programs don't run as expected (Papert, 1993). I would basically use a similar approach each time the tape jammed or got eaten.

One reason I learned how to read quickly in Portuguese was that, as a child, I watched a lot of movies on Betamax, which in Portugal were subtitled and kept the audio

track from the original English, French, Spanish, or other languages. But this was not only the case on Betamax. Like other Portuguese children, I was inundated with films and cartoons that I could not fully understand because they were broadcast on television in foreign languages. Because I was fascinated with the films, I had an early interest in learning to read the subtitles to understand the plotlines, characters, and action in the films. I remember the first film in which I was able to read about half of the subtitles, and that was a film featuring secret agent James Bond. Eventually, I watched all the 007 movies, beginning with the versions of 007 starring Sean Connery. I believe that watching movies with subtitles was a motivating factor in my literacy in the Portuguese language, and maybe one reason I am a fast reader today. Reflecting upon this process of learning through technology made me wonder if there were other technologies that also might contribute to literacy, or other literacy skills in the larger sense, such as media literacy.

Audiocassette Glitches

Audiocassettes were similar to Betamax in both glitch symptoms and in their repair, except of course there was no video track, and the cassettes were much smaller. The analog magnetic, however, in this medium was more accessible and did not require lifting off the plastic cover to blow off the dust. This lack of protection also caused issues. There was one major difference in that the magnetic tape would become too loose between reels, or would catch on an object and spill outside the casing. Typically, I would rewind the tape back onto the supply reel by inserting a finger into the spokes, but if the tape had been ejected too far, I needed a more hands-on approach. In these times, I would unscrew the plastic casing and repair the magnetic tape by hand, then replace the casing. The method for repairing the tapes when “eaten” was also basically the same as with Betamax tapes.

The Sony Walkman with AM/FM radio usually did not have any glitches that I can recall, but the Sony Walkman with cassette tape would often “eat” tapes. I also had a boom box with a cassette tape player. When batteries powered the boom box, it seemed more inclined to eat tapes than when the same boom box was operated solely with an electric power cable.

Compact Disc Glitches

As compact disc (CD) music technology emerged later, the glitches around playing the discs would be about “skipping,” when the music being played would sound like it skipped over a few seconds in greater or lesser degrees. For this, I would turn the device off and on again. If it still skipped, I would eject the disc, turn it over to the side the laser read, blow the dust off, and reinsert the disc. Maybe I would blow some dust off the inside of the CD player as well. Then I would turn the device off and back on again, or repeat this process. Usually this solved the issue, but I noticed that certain CDs seemed to keep skipping.

Telephone Glitches

Landline telephone glitches were common for me around age 12—in what was at the time new wireless handheld technology for landline-based telephones, the antennae would pick up other transmissions of strangers’ conversations. I noticed that the volume of the others’ conversation was lower than the conversation I was having, but I could hear their conversation without interruption, in a steady stream. I would experiment to see which side of the house might change the reception of the signal, to see if it would clear up based on my physical positioning in the house, and sometimes this would make their conversation fade more or less. I noticed also that if I turned off the phone, the interruption would stop. With this same wireless telephone technology, sometimes I would pick up bits of Morse code transmissions. I noticed these Morse code transmissions were heard especially when it was foggy, and I suppose it was because I

lived near a lighthouse and what I was picking up were transmissions from boats, which came across similar frequency ranges as that associated with the telephone antennae. My friends would actually visit so they could play with the phone and listen in on strange conversations and Morse code transmissions. We would also play and experiment by taking the phone outside to see what other streams we could hear, because the signals of others were much stronger when further from the signal base. We would talk to the strangers on the phone, knowing they could not respond, and we made a game to see who could create the most outrageous or absurd conversations.

Paul Virilio (2005) comments that a malfunction in technology is not an indication of a mistake, something to be tossed aside or ignored, but rather he emphasizes what he calls its “accidental potential.” When I noticed I could listen to others’ conversations, or when I heard the Morse code transmissions in the handheld wireless telephone, I felt a sense of excitement in discovering this mistake. My impulse, like that of my friends, was to play with the malfunction and to try to realize some of the potential behind it (Virilio, 2005).

Walkie-talkie Glitches

Walkie-talkie glitches were similar to those on the telephone, crossing signals with other conversations and hearing Morse code transmissions. Walkie-talkie transmissions could not be heard clearly and would often cross over with others’ conversations. With this device, this would happen often so that I would turn it off and back on again. Also, the walkie-talkie conversations were very clear, even if they were other people talking. This was distinct from the telephone, which was not as clear.

I approached all glitches more or less the same way, and I had this technique since I was a child. My first approach would be to turn the device off and back on again. The same is true of my approach to videogames, even now as an adult. Like many others, I experienced videogame technologies at a fairly early age, and I think that influenced my

approach to other media later on. The prevalence and influence of videogames in the average household predates home computers and mobile phone technologies by several years (Lenhart, Jones, & MacGill, 2008).

Videogame Glitches

As I mentioned in Chapter I, my first videogame encounter was with the Spectrum system. But there are many more videogames in which I have experienced glitches, for example with Pac-Man. In Pac-Man, the player controls a circular, yellow character called Pac-Man through a maze-like game space composed of smaller white Pac-Dots, which Pac-Man can consume. Enemies are presented in the shape of simple multicolored ghosts, which destroy Pac-Man upon first touch, and the goal of each level is for Pac-Man to consume all of the Pac-Dots in one single maze before being captured by ghosts. I remember a place where I could position the Pac-Man and the ghosts would not be able to “see” the Pac-Man character, and in a similar position I found that I would be immune to the enemy ghosts. This was achieved by hiding Pac-Man in a certain corner just above the headquarters of the ghosts. I shared that glitch with my friends, and we tried to mimic that again. We did a drawing and submitted it to a Portuguese gaming magazine from that time. James Paul Gee (2003) calls a number of activities “metagaming,” referring to activities related to videogames such as sharing tricks and ideas about how to advance, reading and writing about gaming, even tips on cheating in the game. Finding glitches in the game can be a valued characteristic among gamers and others who play those games (Bainbridge & Bainbridge, 2007). The continuation of play after the end of physical game play includes participating in online forums (Krapp, 2011; Steinkuehler & Duncan, 2008), developing ways to cheat (Gee, 2003; Hayes & Gee, 2010; Hayes & King, 2009), as well as even customizing and pursuing cheating through active creation of dedicated online resources for cheating (Kafai & Fields, 2013) to assist gamers in finding their way through the games more efficiently. Through finding the glitches in game play, cheating

sites may assist gamers to perceive where the framework of the game is most vulnerable, and gives strategies to use against that vulnerability and get ahead more quickly or easily. Mia Consalvo (2007) believes that in achieving such a great degree of knowledge of the game, their ability in cheating allows these inside gamers what Consalvo calls a kind of gaming capital.

Arkanoid glitches. I have also experienced glitch encounters in the game Arkanoid. Arkanoid is a 2-D breakout-style game originally released in 1986 for the arcade, in which the game space consists of layers of bricks that need to be “broken-out” one brick at a time in order to pass each level. The player navigates a paddle from the bottom of the screen and uses ricochet to angle the ball, which destroys the bricks on contact. I found a glitch in Arkanoid that allowed me to advance the level automatically without playing it. When the indestructible gold and silver bricks were present on certain more difficult levels, I found a way to make the door open, which is usually closed until the level is defeated. In this case, I was able to open it and slide the player’s paddle easily through if I clicked both right and left buttons quickly and alternately. I was able to do this for only the levels with gold or silver bricks. This was a case of a glitch that I did not want to fix, and that I used to advance levels and shared with my friends as well.

Metroid glitches. Metroid is a 2-D side-view platform game also available for the Super Nintendo Entertainment System (SNES). It consists of navigating a futuristic character in a dark, science fiction-like realm while jumping, avoiding pitfalls and enemies like Mario does in SMW, but with the added action of strategic gunfire defense. I can remember instances in playing Metroid in which the game space halted all movement and became significantly broken apart in the graphics realm. I have also experienced the classic frozen screen glitch in Metroid, and other glitches in which the main character seems to be immobilized in an endless mid-screen jump or fist-forward attack mode, or other graphics-based screen delays involving enemies or characters who have undergone slight graphics alterations while being immobilized.

Bubble-Bobble glitches. Another instance of glitches I have witnessed in videogames is with a platform game called Bubble-Bobble. In this game, two players in cooperation must navigate their dragon characters to inflate and then make bubbles burst, while jumping to and from the bubbles and along platforms to avoid obstacles and manage enemy attacks. In experiences of glitches during game play of Bubble-Bobble, the dragons would often jam and descend uncontrollably, or else become immobile and sometimes even jump to the next level spontaneously. As a game player, I generally do not engage in problem-solving to fix these types of glitches, since they allow me to advance to the next level.

Videogames are “evocative objects” (Turkle, 1984). In a sense, videogames are moving, interactive images that evoke reflections of reality and culture, such that while the water level on SMW, for example, does not contain actual water, it is mere representation. The fate of the videogame is intertwined with their widespread enjoyment by average consumers (Lenhart et al., 2008). I think this is especially the case with the Super Mario Brothers (SMB) game for a couple of reasons. Firstly, the SMB game was free with the purchase of the Nintendo Entertainment System (NES) console, and so SMB experienced almost universal recognition as a popular game. In addition, the Mario character was solidified in my thinking as synonymous with videogames, and since that time I have been fascinated with the Mario games and their educational potential, especially with regard to glitches.

The diversity of glitches in videogames are manifested as sound or visual issues, changes in the shapes of objects, color changes, and unpredictable movement, and all of these come against the game’s own rules or the norms established by the game itself, such as when the walls in SMW would become transparent and permeable (Bainbridge & Bainbridge, 2007; Hind & Bell, 2007).

Super Mario Brothers glitches. Designed for the Nintendo Entertainment System (NES), SMB is the iconic game, which helped to popularize platform games with a left-

to-right scrolling feature. The main character is Mario, and the player is tasked with navigating Mario through the blue skies of the “Mushroom Kingdom” while bumping boxes with his head to send collectible coins and fungi rolling off the upper platforms, avoiding pitfalls and carnivorous plants, and jumping atop turtles and other potentially harmful elements. This Mario game has an array of glitches, including some similarities with Super Mario World, the game I use in my research study. One of these similar glitches that I encountered is that the Mario character has the ability to jump and land on invisible bricks and walk through walls. There were other occasions where Mario or Luigi were able to slide through the bricks in the wall facing the wrong direction. Also with Super Mario Brothers, Mario has a glitch where the turtles, which normally would injure Mario on contact, walk alongside Mario without harming him. There was another glitch I remember where, in the normal case, the character would fall short on a jump and land in the gap between the bricks, and the character would die. But occasionally, I was able to maneuver Mario to seemingly catch an invisible edge of a brick inside the hole and jump out onto safe ground.

Super Mario World glitches. Designed for the Super Nintendo Console (SNES), Super Mario World (SMW) was released in 1990 and closely resembles the platform-style, left-to-right 2-D scrolling game play established in Super Mario Brothers, with the addition of Mario’s companion Yoshi, a dragon who acts as a navigational vehicle and helps Mario eliminate enemies and gain points by eating with his tongue. With SMW, many of the glitches are similar to those with the first Super Mario Brothers, but SMW adds even more. There is the glitch when the enemy character somehow co-exists with Mario like in the first Super Mario Brothers game, where Mario is able to walk alongside the enemy and even right on top of the enemy without being harmed. There is another glitch involving Yoshi the dragon. Normally, Yoshi will pace right to left until Mario lands back in Yoshi’s saddle. But there is a glitch where Yoshi seems paralyzed, stuck in one place instead of always pacing. When this happens, Mario cannot mount the saddle

as usual. The flower, which is an enemy character, normally moves like an elevator up and down from inside the green pipes, and only when it emerges from the pipes does it have the ability to harm Mario. In an odd SMW glitch, this flower sometimes exists outside the tube, still elevating itself as if inside a tube but alongside the tube instead. Whereas the normal flowers harm Mario only when they emerge from the top of the tube, these glitch flowers always have the ability to harm. So, this is a case where the glitch makes the level more difficult.

Why I chose Super Mario World for this study. I chose SMW as the videogame used in my research for two main interrelated reasons. The first reason is because as Shigero Miyamoto (Nintendo, 2010) said at the time when SMW was first issued, console games have no manuals or directions for playing. This limitation is important for my research because without a manual, subjects will have to rely on themselves as a resource for problem-solving glitch encounters and for all their responses and actions during game play. This enables favorable conditions for observing how subjects may enact their own facilities without external guidance. The second reason I have selected SMW for this research is that the game has a multitude of glitches, therefore increasing the chances that my subjects would encounter glitches. A few of the glitches from SMW were used for marketing later in the 1990s by a Portuguese magazine called “the bible for videogames console tricks” (Zimbra, 1999), which catalogued videogames in an A to Z index with all the latest glitches and tricks to defeat levels in various videogames. This calls our attention to the fact that glitches have already been mentioned and become commercialized in a way that was explored in this and other magazines. In the case of SMW, there was an enormous list of glitches published in this magazine. These glitches were given names and categories such as: Walk Through the Floor, Freeze Glitch, Glitchy Graphics from Defeated Enemies, Music Speed, and Discoloured Worlds.

This platform videogame console contained a problem in the co-processor that resulted in the slowdown of some videogames, adding one more glitch to the list, not

disclosed until 10 years later (Snes9x DSP team, 2004). More recently, in celebration of the 25th anniversary of Super Mario Brothers, Nintendo released a video with samples of glitches that the game contained, embracing these technological mistakes (Empresa, 2010).

Emergence of the Word “Glitch”

The existence of mechanical technology brought us the word “glitch,” meaning a mechanical error in the game that was not intended to exist (Bainbridge & Bainbridge, 2007).

In the *American Heritage Dictionary of the English Language* (2001), “glitch” is an English word borrowed from the German word *glitschig*, and its original meaning is “slip,” but in the *Oxford Advanced Learner’s Dictionary* (2005), “glitch” can also be considered “a small problem or fault that stops something working successfully.” However, in the *Oxford Dictionary of Modern Slang* (2008), “glitch” is a “sudden brief irregularity or malfunction (of equipment, etc., esp. orig in a spacecraft), also, something causing this.” The term was first used in the United States by American electronic engineers from the 1950s to refer to the sudden malfunction of an electronic device. The term was reused later to refer to the “chirps” produced in a CD when it is not reproduced correctly, a flaw revealed only in playback. When it slides and reads the tracks in an abnormal way, it generates a “glitch” of a digital nature. Also, in 1962, the term “glitch” appeared as a word beyond technical use and covered a variety of malfunctions, as used by the astronaut John Glenn, the first American to orbit the earth, in his capsule Friendship 7 (*American Heritage Dictionary*, 2001).

While the term “glitch” denotes an error or malfunction, the notion that media in the digital realm should function smoothly without glitches is not only unrealistic, but fails to accurately encapsulate the very nature of digital media itself, which is quite prone to errors and malfunctions (Parikka & Sampson, 2009). Even further, we cannot simply

label these glitches as “bad” or “good,” because that depends on the larger context, which is often quite complex. Instead, glitches provide opportunities to become aware of and wrestle with the implications from these contexts that they bring to the surface.

Research does exist that shows errors or “breakdowns” judged as somehow negative, and how users of digital media see lapses in function as errors. It is interesting to note the value judgment assumed within the classification of errors. The premise of technological error as somehow wrong or undesirable is based upon the idea that there is such a clear line between how media is supposed to work, and what media looks like when it does not work properly (Nunes, 2010; Parikka & Sampson, 2009). While there are many different aspects of glitches that can be examined, for this study we are concerned specifically with their capacity to elicit self-learning and critical thinking, and suspend these other aspects that might judge glitches as either positive or negative.

Videogames and glitches have walked hand in hand since the 1980s with the advent of the arcade game. One of the classic arcade-game glitches comes from Pac-Man. When playing this game, it can produce random numbers, invisible names, or even a complete disappearance of walls (solid walls are intrinsic to the playing of Pac-Man), and during the course of one or eight levels to play, any random error can happen while playing it. Other arcade-game glitches came after Pac-Man, in Donkey Kong, Asteroids, Sinistar, Galaxia, Cyberball, among others. However, we should remember that to fix a glitch in an arcade game is to design an entire motherboard—so these early arcade glitches never had an easy fix, and arguably became part of the games themselves, inseparable and mysteriously beautiful digital errors (Ortiz, 2010).

Krapp (2011), in his book *Noise Channels*, discusses how interest groups of gamers form their own culture of videogame play and use the mistakes or glitches in videogames to create, discuss, and transform their experiences with a variety of gestures, including sharing skills to fast-forward their gaming processes.

Features of Videogame Glitches

The computer as tool and medium is not neutral, but rather informs (or, as Bolter and Grusin, 1998, put it, re-mediates) the work that one does with it, if only by setting possibilities and limits on what can be done (Mahoney, 2005, p. 132). The medium of the videogame is distinct from that of other media and produces distinctive glitches as a result. There is typically a visual element, an audio component, and a highly interactive physical component to videogame play involving movement navigation and functional properties of elements in the game space. This is important to note, because these different media create different challenges, and therefore they call upon particular kinds of strategies. Digital media are interactive, and videogames in particular involve an interaction with the body and the narrative of the videogame. As Marshall McLuhan (McLuhan & Fiore, 1967) noted, the medium is the message. And we could say that “the message” of the glitches experienced in this medium are particular to it. Unlike in media such as radio, television, or even non-videogame digital media, videogame glitches tend to involve challenges to active game play. Thus, videogame glitches highlight challenges to active, play-based problem solving in which the visual space is functionally navigated. This specificity allows us to look at critical thinking within a naturally play-based and active context.

Scholars have made efforts to categorize videogame errors, such as Bainbridge and Bainbridge (2007), who attempted a taxonomy centered on the reason behind why these errors occurred, although they showed that due to imperfect access to the origins of the game programming, their analyses were not comprehensive or foolproof. Companies use videogame error logs for the purpose of fixing these errors, which is why these taxonomies were created (Bainbridge & Bainbridge, 2007; Hind & Bell, 2007). In the context of videogames, a software glitch involving code errors can show itself within game play and may still allow for continued game play, while a hardware glitch, taking place within the technical hardware itself, is more likely to disrupt game play in ways that

cannot be addressed within the game in an organic fashion. These glitches may require the player to address the glitch at the level of hardware, perhaps requiring tools and expertise in hardware systems. Working with hardware glitches, while still eliciting critical thinking, requires more specialized skills than typical players are likely to have. This is one of the reasons I chose to work with SMW, which has a high incidence of software-level glitches that can be engaged with directly during game play, thus not requiring specialized knowledge from the players.

In actual game play, there is a large dynamic quality—incorporating movement, light, image, bodily interaction, sounds, and forms. Hind and Bell (2007) attempted to classify glitches by their intensity in effect on game play. They suggest that intensity ranges from a “graduation from obvious error to subjective opinion.” While this range may be affected by more technical taxonomies, in practice the users approach them as similar, only attempting to assess their impact on their goals. Color-based glitches, such as when the game turns black and white, may or may not affect the ability to navigate, while visual glitches from hardware that disrupt the display of recognizable visual features might be more significant from the player’s perspective. A sound glitch or mistake, discontinuity, or disruption in the audio may throw off play or not provide relevant game cues, while not overtly impeding play. For example, in SMW when the music speeds up, this lets the player know that time is running out to complete the level, but a glitch that cuts out this music soundtrack completely can disorient the player.

At the more intensive end of the spectrum, a movement glitch has to do with the control of physical character. The Mario character, for example, commonly gets stuck in place and cannot move. Many people refer to this as “freezing,” which may involve the entire screen becoming “frozen.” This obviously may have a great deal of effect on game play. Strategies might involve waiting to see if it resolves, restarting the game, or simply “dying” as a result of continued game action.

Often presenting a significant need for problem solving, functional glitches occur when a consistent element of the game is disrupted, or functions differently (e.g., in SMW an enemy character might not cause injury to the character; or the wall, which is normally solid, allows a character to move through it). This could affect gamers in their approach to the game, and they might feel a desire to seek it out again, to use it to advance play, or create excitement about glitches in general. Functional glitches thus might not result in an intensive failure of game play, but instead elicit critical thinking about the nature of the glitch and how it fits or not within game play.

More complex relationships of glitches can also add to the challenges of problem solving. An example of a combined movement and functional glitch would be when the Mario character falls into a hole, but somehow the player can jump out of the hole by grabbing an invisible hold and launching off that hold back into safety. This is functional because a fall into the gap between the bricks at the bottom of the screen is supposed to result in death of the character, and a movement glitch because the action of jumping is supposed to be limited to that from solid ground. But in this glitch, the character does not die and is capable of leaping off of nothing.

Relevance of Videogame Skills to Media Literacy

Super Mario glitches may challenge our ways of thinking in very particular ways, through sound, color, light, movement, function, and complex combinations of the above. Seeing how glitches in this particular medium evoke problem solving and critical thinking around active self-directed play can deepen our understanding of more broadly articulated skills.

Broadly speaking, the videogame medium is situated within a larger context or related but distinct media. People are adapting and learning new technological skills through different media and different approaches every day (Edelman, 2017). This convergence of media formats and mega-interactivity is fully present in the promise of

the simultaneous use of several media devices. In today's ever-shifting era of digital media, the processes of learning and education can happen when we watch television, surf the Internet, or play videogames (Edelman, 2017). Scholars have credited videogames to be one medium that helps in directly improving or developing technological skills, such as navigation skills (Forsyth & Lancy, 1987; McClurg & Chaille, 1987; Subrahmanyam & Greenfield, 1994), spatial skills (Uttal et al., 2013), visual processing, spatial resolution (Green & Bavelier, 2012), hand-eye coordination (Gozli, Bavelier, & Pratt, 2014), trial and error (Prensky, 2007, 2012), problem solving (Adachi & Willoughby, 2013; Kendall, 2011; Prensky, 2012), creativity (Jackson et al., 2012), and critical thinking (Boyle et al., 2016; Connolly et al., 2012; Hainey et al., 2016).

Despite the diverse connections of videogames to cross-medium skills, Connolly et al. (2012) argue a need for research connecting videogames specifically with critical thinking. A number of scholars have pinned down this type of critical inquiry as central to the media literacies skillset (Feuerstein, 1999; Jenkins, 2006; Masterman, 1985). In the following section, I will look at the literature on new literacies, then focus more specifically on media literacy, and to the extent possible on videogames as a form of new media with promise for expanding new media literacies. We can then look at specific skills that are particularly highlighted by the medium of videogames, and that glitches allow us a way to work with: critical thinking skills, self-directed learning, and play.

The Broadening Landscape of Literacy: Media Literacy, Critical Thinking, and Pedagogy

The term "literacy" has gradually acquired a fuller sense, now including the knowledge and skills necessary to produce and understand different types of communication, namely: the ability to understand technology, knowledge of

technological principles, the ability to understand media (such as interpreting visual messages transmitted by film, television, and the Internet), and the ability to comprehend and work with information from mediums, such as computers and its software (Cardoso, 2006).

The concept of literacy is now also broadening to include many areas of science, and research fields are adopting it for their own. This expansion is not homogenous, reflecting not just one type of literacy, but rather a “bundle of literacies” (Firestone, 2008), which are defined by various factors—social, technological, and economic—which together constitute “multiliteracies” (Selber, 2004) or the “new literacies” (Kist, 2005).

Media Literacy and Learning

Contemporary cultures are inundated by multimedia to the point we might say that we now live in a multimedia-oriented environment, one marked by technological change as its essence, by the transformation and adaptation that naturally follows, and by the multiplicity of arenas that interconnect and touch upon each other (Eisenstadt, 2007). Ours is an era of both information and knowledge, supported by the globalization of communications systems and media. The Internet is an example of this global proliferation of knowledge and communication combined with the speed of rapid global cultural flux (Edelman, 2017). It is an environment undergoing accelerated development of information and communication technologies (ICT) and also technological innovations (Castells, 2002). As a result, our contemporary media environments demand specific adaptations to “read” and navigate this complex landscape.

Media literacy is considered more or less synonymous with media education, an accredited field and educational practice (Buckingham, 2008; Fellini, 2010; Gonnet, 1997; Hobbs, 2007; Rivoltella, 2001; Tyner, 1998). The Aspen Media Literacy Leadership Institute (1992) concisely states: media literacy is “the ability to access,

analyze, evaluate and create media in a variety of forms.” According to them, this entails a new approach to education distinguished from that of the 20th century.

The skills required to connect and work with media literacies are only growing, and newer, updated media literacy skills are required to absorb the equally rapid growth of new technologies (Edelman, 2017). In this work, one of the inquiries to expand upon is how the changing landscape of media literacy skills might be influenced by an encounter with videogame errors, inconsistencies, or glitches. Gee (2007) calls this “embodied learning,” using skills with both mind and body, and engaging critical thinking and problem solving.

Reflective thinking and experience. These processes of problem solving around glitches resonates with what John Dewey (1938) calls “problem-solving through reflective thought.” Dewey writes that this type of reflective thought is spurred by an unexpected moment, which occurs when circumstances do not align with expected behaviors. This unexpected occurrence causes a person to re-think both the problem and its potential solutions, and through re-thinking and trial-and-error, a person may approach the problem differently in the present and also use that plan to address similar issues in the future. For Dewey, reflective thinking has a vital function that originates in the confrontation with problematic situations. If we cannot circumvent a problem, we are challenged to face it. What we observe about the situation becomes facts to be understood and engaged with. This is the data for our thinking, which then must be interpreted, explained, and worked with. Ideas, on the other hand, have to do with possible solutions that may then be tested. Data and ideas, observation, and inference are indispensable aspects of reflective activity. Reflective activity involves both thought and action, and both are drawn out by the encounter with the unexpected.

In his book, *How We Think*, Dewey (1959) presents five phases of reflective thinking. The first involves the occurrence of a problem. According to Dewey, every investigation begins with a genuine doubt when encountering a problem: some conflict in

our routine situations. The beginning of reflection begins when we feel the interruption of an activity and we do not know how to continue. This provides a good parallel with the encounter of glitches in videogames. Once players encounter a glitch, they may begin to reflect upon this interruption or anomaly in the programming. The second phase involves the intellectualization or elaboration of the problem. Dewey suggests that a well-formulated question, that is, a well-considered problem, is halfway solved because if we know exactly what the problem is, the solution begins to suggest itself. The problem and the solution emerge, simultaneously. A player, for example, might recognize a glitch as such, and in doing so already situate it within a set of possible solutions to be explored. The third phase involves the hypothesis, and the construction of it comprises the creative use of the imagination to develop possible solutions. It requires careful analysis of the facts to be verified, since formulating a hypothesis is not a routine activity, but requires skill, self-control, and precision. A carefully constructed hypothesis is quite different from conjectures based on emotions or imagination. A player might imagine a way to use the glitch and incorporate it into play, avoid the glitch, or else make the glitch disappear. The fourth phase involves reasoning. The ideas that come to mind are in need of development, and this act of reasoning analyzes the existing conditions, content of the hypothesis, and the capacities and skills to implement a solution. The fifth phase involves checking the hypothesis through action. For Dewey, these phases are sketches of indispensable traits within reflective thinking. There is no necessary sequence in the phases, or even distinction between them. The steps are only distinct within the body of an ongoing investigation or reflection: tact and intellectual sensitivity are crucial to the success of the whole. The extension and development of the third and fourth phases are what distinguish a clearly reflective experience from other experiences. They make the act of thinking an experience. With videogame glitches, this is evidenced when subjects enact their approach to glitch in more than one situation, testing and re-using their solutions, and deciding how they fit within the larger context of play.

Critical thinking and art. Given the complexity of the changing and proliferating media landscape, there is an increasing demand for reflective, reflexive, critical, self-analytic literacy skills (Beck, Giddens, & Lash, 2000). Critical thinking has been abundantly referenced in the scientific literature in this field of research as the most important skill of media literacy in relation to people and media (Feuerstein, 1999; Jenkins, 2006; Masterman, 1985). Henry Jenkins (2006) pinpoints the importance of citizens developing new critical skills: democratic societies need informed, critically media-literate citizens who are able to evaluate and determine the importance of information. The critical spirit is the “basic element” that allows us to develop independent judgments about media and media content (Silverblatt, 2001).

Maxine Greene (2000) suggests that art may change a person, and that person may change the world. When you connect with art, this is an emotional experience that shows you there is another way to engage with and to lead the world. This encounter with art is deepened, what Marcuse (1964) called “maximum acceptance.” An example is when students are taken to museums to have direct contact with works of art, rather than being mediated through the teacher. These powerful experiences with art may change a person (Marcuse, 1964). Both of these thinkers emphasize the power of art as a medium for transforming ourselves, and from there, our worlds.

Once we understand the power of art as a transformational medium, the relationship with critical thinking can be better understood. For Marcuse (1965a, 1965b), it is essential that we teach “abstract conceptual thinking” that deals with big ideas and broadens a person’s point of view while asking the big questions, such as “Why are we here?” It is a vital part of education to be able to ask these philosophical questions, and for Marcuse, art provides that context.

If Marcuse’s approach is extended to consider videogames as a new form of interactive art, the capacity of an individual to have direct aesthetic experiences that elicit critical thinking can be foregrounded, and barriers between artists and non-artists

reduced. Through interactive engagement, the player has a heightened experience of critical engagement with the problems posed within and by the medium. Glitches, rather than interrupting this engagement, may remove us from everyday expectations and engage us further with another world. This deepening of engagement is an unexpected one, where the guidance of the teacher is absent, and art, just as with Marcuse, acts as direct catalyst for the individual. The “democratization of art” puts creativity in the hands of the persons who are not called artists (Marcuse, 1972). A glitch can happen to anyone, artist or not, and may provoke creativity in the lives of those who would otherwise not be considered artists. One consequence of emphasizing the aesthetic power of this new medium for engaging critical thinking in direct (and interactive) experience is that it allows us to look at the learning of critical thinking as a media literacy outside of the typical educational context of teacher-mediated learning.

Self-directed learning. If art is a potent context for experiencing self-directed learning, it highlights the possibility for educational experiences in which the individual takes responsibility for their own learning. Paulo Freire (1983a,b) thought that learning is in fact very much like poetry, or other forms of art, and that learning is undertaking this constant search through creativity, and a constant yearning and quest for knowledge. Like Greene and Marcuse, Freire felt that by modifying themselves, people can produce change in their surroundings. This involves a kind of critical literacy in what he calls “reading the word and reading the world.” And this involves taking ownership of one’s own learning processes. Freire (1997) argues that popular education considers all parties subjects in the process of learning, both teacher and students. In contrast, in an interview at the age of 70 in a newspaper in 1991 (*Revista Giz*, 2012), Freire said that the identity and culture of the learner is more important than that of the educator, and that in order to better reach the learner, their background is significant. The notion of a student as *tabula rasa* is not useful for Freire—in his view, this method does little to work toward the interest of the learner. It is more important, in contrast, to connect to the learner on his or

her own level. The learner then makes meaning within that exchange on the learner's own terms. Freire also believed that the facilitator should not be the dominant presence or the source of all learning (*Revista Giz*, 2012). What is most pertinent for this research is Freire's idea of defeating one's own fears and applying this to self-learning. Freire desired that individuals would raise questions within themselves to overcome their own fears. To this end, Freire wished to give tools to individuals to be able to achieve learning within themselves.

We can see a similar argument in Malcolm Knowles (1975), who is responsible for coining the term "Self-Directed Learning" (SDL). Emphasizing adult education, Knowles suggests that having a sense of direction in learning is a result of having self-directed initiatives in one's own learning. Knowles states that adults have a yearning for independent learning, that they have a natural need that initiates this learning. This suggests the need to reconsider the role of the teacher in learning. For Freire, the facilitator, then, should be more like a poet who nurtures, who even defies the learner at times and yet does not overpower or put undue pressure and quash the learning spirit. From Freire's (1983a,b) viewpoint, the learner should have a great degree of autonomy of what to pursue in learning. What Merriam and Caffarella (1991) emphasize is that one core belief behind many SDL scholars is that the adult learner takes the lead in prioritizing, outlining, executing, evaluating their learning and that this learning can and does occur without outside facilitation. For Jenkins (2006) and Hase and Kenyon (2000), technology can create this environment of natural SDL to happen. These arguments taken together may suggest that technology can provide a natural link for autonomous learning or SDL.

Self-directed learning in the classroom. For Eriksson and Miliander (1991), there is a paradox regarding the most efficient ways to implement student-centered teaching methods. That paradox is a result of the need for class management and control as a means to the end of student engagement. The teacher's role in increasing learner

engagement is further explored with Eriksson (1993), who states that the teacher's role must change to adapt to the influences students bring into the classroom. Taking assessment as an example, Eriksson (2006) recognizes the importance of student involvement directly with this process, and not merely to be assigned to the teacher's role. Eriksson (2006) classifies four types of assessment: self-assessment, peer assessment, teacher assessment, and external assessment. Especially relevant to the context of self-directed learning, Eriksson and Tholin (1997) describe how some teachers have set about assisting learners to actively engage with self-assessment, consciously learning while also exploring how to further their own processes of learning. Jacques Rancière (1987) connects with this idea that the self-learner should be at the center of his or her own learning. In his book, *The Ignorant Schoolmaster: Five Lessons in Intellectual Emancipation*, Rancière gave the example of a nineteenth century French intellectual, Joseph Jacotot (J.J.), who was invited to teach to a group of Flemish (Dutch) speaking students. The problem was how to instruct the students if they did not speak French, and he did not speak Flemish. How could the students learn by themselves and then try to communicate what they learned? J.J. chose the bilingual novel *Télémaque* by François Fénelon (1699). What he found surprising is that without any explanation about the book, or attempt to teach them French, the students were able to learn French for themselves. Based on this experience, he thought it was necessary to invert the usual logic of teacher-student learning.

Instead of explaining how the language works, Rancière's (1987) new method was based on the idea that the will of the learning itself is what truly propels learning for the student. He synthesized three working principles from this: (1) All people are intelligent. (2) Every person has the ability to educate him- or herself. (3) Knowledge is transferable even among the supposedly "ignorant." These three principles emphasize that learning can happen through any person as they continuously research, founded on what they already know. These three principles of Rancière are valuable to this study because they

provide a philosophical backbone to approaching videogame glitches. To the first point, videogame players are often thought of as unintelligent and merely playing games, but from Rancière's perspective we should consider videogame players as no less intelligent than non-players, bringing their own skills and knowledge with them. (And conversely, non-videogame players can bring their own experiences to the task of playing videogames they are not familiar with.) Second, the ability to self-educate (in this case, through videogames) is integral to the premise of this research. And third, knowledge is transferable, even when learners are not aware it is being transferred, as when students are using skills they did not recognize as skills in media. Rancière's philosophical stance vis-à-vis the student conquering his own internal struggles can apply to glitches in videogames; a videogame glitch could be a source of impulse in order to propel the student into self-learning mode. Considering Rancière's elaboration of an equal capacity of intelligence and self-directed learning among all learners, this suggests a prior capacity for self-directed learning. While some researchers might debate this prior capacity (Candy, 1991; Merriam, Caffarella, & Baumgartner, 2007), they all emphasize a more general point of view of confidence in adult learners. This notion that teachers can nurture self-direction in students in the classroom has roots in scholarship supporting the best ways in which educators can foment a learning environment conducive to such learning (Candy, 1991).

When we apply this to videogames, many researchers mention how videogames and platform games (both commercial games and edutainment games) have learning value when tied to a facilitator, either a teacher or parent. This facilitator directs the learner through the videogame to analyze a specific skill set or topic, and this same facilitator will analyze the learning outcomes and value the student gained (Andersen & Dalgaard, 2005; Brody, 1993; Buckingham & Scanlon, 2002; Calvert, 2005; Cavallari et al., 1992; Dempsey et al., 1996; Facer et al., 2003; Freitas, 2005; Gee, 2003, 2004, 2007; Gunter, 2005; Hostetter, 2003; Hoyle et al., 1991; Hoyles et al., 2002; Kafai, 1995;

Kirriemuir & McFarlane, 2002; Lantolf, 2000; McGrenere, 1996; Okan, 2003).

Numerous studies deal with this.

What these studies do not emphasize is self-learning or critical thinking in videogame glitch encounters, and only two studies mention glitches at all. The studies that do mention glitches in videogames are Krapp (2011), who cites glitch as a source for creativity, and Bruckman and DiSalvo (2011), which is focused on subjects finding motivation to pursue technology careers through testing glitches in videogames. These suggest that not only videogames, but glitches within them, may be interesting contexts for self-directed learning.

Videogames may provide their own contexts for self-directed learning, but this might also be transferrable to more traditional educational contexts as well. There is a recent example of an attempt at using non-facilitated learning to create a self-learning space in higher education. “Just Press Play” was a scavenger-hunt type game play initiative funded by Microsoft in collaboration with the Rochester Institute of Technology (RIT) to integrate game-like, playful interactions within the typically traditional realm of orienting freshman students to a new higher education campus (Brinkman, 2012). “Just Press Play” used a narrative approach to assign students tasks both individually and in groups, with whimsical exercises such as performing a dance for a professor in her office, or sharing a piece of rock history trivia in order to score points. The initiative operates on the basis of non-facilitated—and perhaps to a certain extent self-directed—tasks to expand students’ comfort zones. What this example suggests is that there is potential for exploring self-directed learning within more traditional educational spaces through modes of game play. This brings us to the importance of games and play as a support for learning experiences.

Claims for Learning through Play

“In every real man, a child is hidden that wants to play.” (Nietzsche)

Although the word “play” is closely linked to childhood and children, play has always been a significant activity in the lives of men in different times and places (Borba, 2007). According to Borba, the experience of playing crosses different times and places, past, present, and future, being marked at the same time by the continuity and change. This experience is not simply reproduced, but reinvented from what the child has the power to imagine, create, and produce culture. Playing is an important cultural experience not only in the early years of childhood, but throughout the lifespan of any human being (Kramer, 2007).

Play is widely written about in terms of its importance in child development by scholars such as Froebel, Rousseau, Dewey, Vygotsky, Piaget, and more recent scholars such as Killi, Kim, Park, and Baek, DeVane, Squire, and Jenkins, but in the majority of the literature with regard to the importance of play, adults mostly have a role as facilitators while the kids are the only ones at play (Aranha, 2002). But what about when an adult plays a videogame? In that moment of playing and encountering a glitch, something happens that can propel a challenge that is not part of the videogame’s rules. The adult might experience play as something that develops outside the rules and could also help acquire or develop new skills. Videogame glitches might open adults up to realize that the rules of the game have burst into new territory, into the unknown. For adults, the videogame glitch sets up a sense of play that I believe could serve as a trajectory for self-learning in media literacy skills.

Importance of Play

“Play is the beginning of knowledge.” (Dorsey)

When we analyze the trajectory of play within a historical context, we see the introduction of play through Froebel, a German educator (1782-1852) and pioneer for

recognizing the importance of play in child development. We see even earlier, in Comenius (1592-1670), founder of the modern didactics of pedagogy, who thought that teaching must be action-oriented. Also predating Froebel was the philosopher Jean-Jacques Rousseau (1712-1778), who stated that learning is gained through experiences, and we must let the child live, each doing in his or her own due time. Although it was Rousseau's text *The Social Contract* that was heavily influential on democracy and the French Revolution, his ideas about the importance of allowing a child to explore have implications for the notion of play discussed here. Learning through experiences (Rousseau) could occur through videogame glitch experiences as well (Aranha, 2002).

If one plays a videogame and comes upon a glitch, then a series of decisions must be made, but probably those decisions will initially be discovered through exploration of how the glitch functions, and what are its limitations and advantages—in other words, the adult gamer would be prone to play around with the glitch in order to understand it and make further decisions.

Dewey (1859-1952) believed that technology would change education in the 20th century, even if the technology of his time was not the same type of technology we are accustomed to thinking of today. Dewey recognized the transformative potential of technology in education, and long before arriving at videogames and the Internet, he sensed that technology would influence culture a great deal. "Technology is modifying, even revolutionizing conduct and beliefs outside the school" (Dewey & Childs, 1933). I find this shows that Dewey was interested in the ways technology was changing culture outside of the educational system. Dewey defends knowledge as a directed activity that has no end in itself, but is turned into experience. Thus, he believes play activity becomes a decisive factor for the development of the child. For Vygotsky (1896-1934), play is an activity specific to childhood, in which the child recreates reality using symbolic systems. Play is a social activity, with a cultural and social context. He also believed that the toy's influence on a child's development is enormous. It is through play that the child learns to

act in the cognitive sphere. With Piaget (1896-1980), play is essential to contribute to the learning process (Aranha, 2002). The authors Chateau (1987), Leontiev (1988), Roncada and Marquez (1998), and Winnicott (1971) agree that play is an act characteristic of childhood and affirm that childhood does not exist without play. Playing is something free, and due to this aspect, there are no ready modes by which to act or operate. These authors describe the importance of play, its mental and sensory meaning in human life.

Connecting Creativity and Play

“If you want to be creative, stay in part a child, with the creativity and invention that characterizes children before they are deformed by adult society.” (Piaget)

For Vygotsky, there is no game without rules, since the imaginary situation itself already contains rules of conduct. Vygotsky (2001) also maintained that since play is a reproduction of an ideal reality, children choose and reproduce this reality through imitation. Fortuna (2001) defines play as an attitude that is free, creative, unpredictable, capable of absorbing the person who plays, and not centered around productivity. In a way, this kind of aimless experimentation that is not focused on goals could be an approach that a gamer might have when encountering a glitch; the gamer might enjoy the exploration for the sake of exploration in the videogame realm. Eventually, as when a child might first experiment with a musical instrument before his first music lesson, some skills will naturally develop.

Borba (2006) affirms that the imagination, which consists of play and is characterized by a process of humanization, is an important psychological process initiated in childhood. The imagination allows subjects to detach themselves from the constraints imposed by the immediate context and to transform it, which could be interrelated with the creative impulse. Spencer, Freud, and Karl Groos argue that play is a way of unloading superfluous energies, that play is not focused or aimed at a particular

goal and has cathartic functions that allow humans to satisfy desires and develop coping mechanisms.

According to Ferland (2005), to play is to imagine and to create, and it is the place of the fantasies in which the child uses his creative abilities and decides what reality is, transforms it, and adapts it to his desires. The author compares the child's creativity with an "intellectual bricolage," since it composites various elements to create a new idea.

Play as a Tool for Exploring Knowledge

Erikson (1950) suggests that play is an expression of the human capacity to deal with experience, to create model situations, and to master reality by experimentation and planning. Maluf (2003) extends this concept and offers the idea that play is communication and expression, associating thought and action; play is a voluntary, instinctive act and an exploratory activity; it helps children in their physical, mental, emotional, and social development; play is a way of learning to live and not a mere pastime. But if we consider videogames as a form of play for adults the way Maluf thinks of play, as a voluntary and exploratory activity and not just a distraction, then we can begin to wonder what sorts of skills are being developed. Sarmiento (2004) argues that play implies the detachment of these rules, while *playing* presumes rules of conduct, from the outside in. However, Huizinga (1980) defines the game as a voluntary activity exercised within certain limits of time and space, according to rules that are freely consented to, yet obligatory.

For children growing up in the new millennium, the mere presence of a videogame is not alone enough to constitute a novel experience, but has become so common as to be mundane or everyday (Killi, 2005; Kim, Park, & Baek, 2009). DeVane and Squire (2008) advocate viewing videogames as "possibility spaces," or "open work[s] that [allow] the player many potential actions and thus styles of play." Rosas (2006) points to the relevance of playing not as a strategy of learning with a facilitator, but rather as an

important human activity. Media researcher Jenkins (1998) argues that videogames provide a contemporary, much-needed alternative to the adult-supervised, structured spaces of home, schools, and playgrounds, similar to the effect of the outdoors in increased freedom of movement. Ferland (2005) says that “the child plays to play.” Ferland also considers the idea that if a child learns something while playing, it is “by accident,” to the extent that learning is not the first concern when a child is at play. However, play is a source of several discoveries for the child and through play, the child learns rules, social values and customs (p. 42). If children learn by accident through play, then it would seem likely that adults would experience the incidental side effect of learning while playing a game such as SMW.

A glitch also happens by accident. Maybe for adults when they encounter a glitch in a videogame, it is like children learning something by accident, as Rosas (2006) points out. I believe that in adults, skills can be learned by accident in this way through playing with videogame glitches. Seber (1995) says that play can be used as a tool to teach and learn. “Young people are interacting with videogames—and other popular cultural practices—they are learning, and learning in deep ways” (Gee, 2003, p. 219).

As play can be a tool, I think that videogames are the toy and glitch can be a vehicle for learning. Videogames have rules in this fantasy world, but the glitch, arguably, has no rules as imposed by humans because glitches are unintentional and random. Although glitches or what precise skills they may teach cannot be controlled, they can be played with, and through this play, glitches may teach the users skills, especially in the technological realm.

Play in Adults

Numerous studies conducted in the new millennium have observed the many benefits of playing videogames for learning (Clark et al., 2015; Girard, Ecalle, & Magant, 2012; Vogel et al., 2013; Wouters et al., 2013; Young et al., 2012).

Games support happiness ... by giving us more satisfying work or concrete tasks that we can accomplish.... Studies have shown that playing a short game—having something concrete that you can accomplish—actually gives you the motivation, energy and optimism to go back and tackle real work. (McGonigal, 2010)

For Sole (1980), play cannot be considered simply as a hobby or fun but also as “learning for adult life” (p. 13). The child, when playing, is getting to know their own body and their potentialities. Play allows the child to express pleasant and unpleasant situations, and it is when a child is at play that he or she begins to foster positive social relationships. Adults also need play, which serves a function outside of work. As McGonigal (2010) notes, play creates a sense of focus when returning to the work at hand, and in this sense it serves a direct productive function. But if videogame glitch is the element that creates play, even in this aimless exploration and experimentation, skills may still be used and developed and put into greater focus when doing other work. McGonigal elaborates on this point as relates to videogames in the workplace environment. For Chateau (1987), all the activities the child practices during play are of a serious nature, which is similar to that of an adult at work, whereas Smith (2006) considers play to be the opposite of work, an activity carried out by itself and without external limitations and as a relevant characteristic present in the two- to six-year age group. Smith also states that in play, as well as in other activities, conflicts and limitations may occur. Along the same lines of thinking as Smith, Frantz Alexander (cited by Roncada & Marquez, 1998), describes another view on the contrast between play and work, stating that there is a marked difference between the two. Play allows for an expression of actions and thoughts that are not accepted by social rules. At work, the individual expresses actions and behaviors determined by a pre-established model. Glitches in videogames then fit into the category of play as characterized by Frantz Alexander, because it is so unexpected and it exists outside the rules, in this case of the videogame programming.

There have actually been interesting studies that 62 percent of executives at work play games online and they do it to feel more productive. That's because when you're trying to do real-world work it's frustrating; we don't see the results of our actions right away. So games give us that sense of blissful productivity.... Neurochemically we're kind of fired up ... to take on challenges.... Games take us immediately out of a state of paralysis or alienation or depression and they switch on the positive ways of thinking. They trigger the brain to a state in which it's possible to do good work. (McGonigal, 2010, n.p.)

I believe, as McGonigal argues, that games take us out of a state of paralysis that glitches might have the potential to switch on another level of thinking. If, as she says, games online have the ability to create a sense of productivity, then play in the realm of glitch may lend this sense of productivity to the goals that are within the videogame, or even create new goals within the videogame play, thus setting up a kind of play within play situation where perhaps the benefits of play are multiplied. One of the main characteristics of games, according to Dohme (2003), is that players enter the world of play and practice various actions, sometimes with extreme force, but knowing that they have the ability to return to the real world when the game ends.

According to Borba (2006), playing is an important psychological process, a source of development and learning. It involves complex processes of articulation between experience, memory, and imagination, between reality and fantasy. Play is one way of making meaning in the world, and it distances itself from common reality, although reality is still referenced. I believe glitch serves an important function in the process of learning in media literacy in direct ways as well, because it references the methods by which we interact with new media, which itself is subject to errors and glitches, just like videogames are subject to errors.

Machado (2003) argues that play is our first form of culture. Culture is something that belongs to everyone and that makes us share common ideals and goals. Culture is the way people agree to get along, express themselves, how children play, how adults live, work, and make art. Even without playing with what we call "toys," the child plays with

culture. Also in play, the child deals with his inner reality and its free translation of external reality; it is also what the adult does when he is philosophizing, writing and reading poetry, exercising religion. Bruner (1986) describes culture as a forum in which you can create and recreate meanings.

Play in the adult has the power to integrate and make ourselves whole. When we play, we come into contact with our feelings, desires, impulses, and fears, as well as with our abilities and knowledge. Such components of our self, many of them contradictory or downright antagonistic, coexist through play. In addition, we have contacted everything that is not the self, that is, the material world, the environment, others and their feelings, acts and thoughts (Fortuna, 2008).

The internet, computer games, digital video, mobile phones and other contemporary technologies provide new ways of mediating and representing the world and of communicating. Outside school, children are engaging with these media... If educators wish to use these media in schools, they cannot afford to neglect these experiences: on the contrary, they need to provide students with means of understanding them. (Buckingham, 2008, p. 22)

As Buckingham clearly states, we “cannot afford to neglect” the new media experiences, and I emphasize the word “experiences” because within those experiences, users will encounter glitches. And if we are to understand those experiences with media, surely then understanding glitches would necessitate exploring glitches further for the sake of understanding new media. So, exploring videogame glitches might be useful even for coming to a greater comprehension of how media functions and how videogames function.

All these external elements of play—located in the school or in the television media, among other spaces conducive to social and cultural experiences—are reinterpreted by children and articulated by their playful experiences. From there, new play modes are generated. Videogames, for example, are where new ways of playing are generated. Currently, play in our culture is constantly being directed toward the domain of objects. In a way, the play culture has evolved due to the arrival of new toys.

Teresa Sarmiento and Manuela Fao (2005) characterize the toy as an object whose function is to “replace the reality that one does not have” and that regardless of talk about children or adults, leads us to “handle this reality” (p. 189). Within this evolution came electronic games and the videogame—new constructions for play or development of some in the absence of others, and thus new representations (Brougere, 2001).

Videogames and Play

I recently learned something quite interesting about videogames. Many young people have developed incredible hand, eye, and brain coordination in playing these games. The Air Force believes these kids will be our outstanding pilots should they fly our jets. (Ronald Reagan, speech, August 8, 1983)

Reagan, who also spearheaded the proposed “Star Wars” Strategic Defense Initiative anti-missile program in the 1980s, already knew that skills were being developed through videogames. Thus, he knew that there was value in play, and specifically in play with videogames, which may actually propel a career path, in this case as pilots. It would stand to logic that in any career, one needs to prepare for the unexpected, and that it must be possible to train for glitches in technologies such as with the navigation of a high-powered jet.

When we read about play, there is a tendency to talk about the importance of play in child development and how beneficial it is for the formation, social interaction, and skill building happening in children when free play happens without interaction with adults (or else structured play, directed by adults). However, there are far fewer theorists who address those same benefits of play in adults that choose to play using toys, for example, a commercial videogame—and how that can be beneficial in adult self-learning and training adults to continuously learn. No studies were found that mentioned glitch along with that play experience. Play is beneficial and important because these skills can have the same effect for adults as when a child plays, such as increased hand-eye coordination, exploration through trial and error, emotional escape, new knowledge and

creativity in this alternative reality. However, new skills can emerge or develop from this play differently than for a child, such as natural critical thinking, being more related to adult thinking and development of media literacy skills.

Accommodating the intellect. Through videogames and game glitches, a gamer can augment his literacies in the same way that Engelbart (1962) said the computer can “augment his human intellect.” If we adopt his idea that the intellect can be augmented by technology and apply it also to videogames and glitch, the visual interpretation of gamers can be said to be augmenting their intellect through the use of videogames. This initiative was not imposed by any outside forces, and a body of distinct visual knowledge was created using game glitch as a departure. We can see self-visual learning occurring without teacher guidance or direction. Games, therefore, can catalyze a grounded, embodied cognition and a multimodal explanation and experimentation (Goldin-Meadow, 2003; Kosslyn, 2008; Smith, 1979).

The inventor, computer, and internet pioneer Engelbart (1962) talked about the study and development of a computer program and research in relation to “augmenting human intellect” in different arenas and disciplines in a diverse range from mathematics to social life. Now, with videogames, we have an active example of an “augmented intellect,” available for all. Through the medium of a videogame, a gamer can handle an enormous amount of information and develop skills that meet various needs for our 21st century society. Problem-solving in this rich terrain of the videogame world can also provide a “glitch” that will foment the creative arena of the human intellect, giving it a basis to develop different skills to respond visually to a given problem in the world outside of the videogame as well.

What is remarkable about Engelbart’s (1962) research is that many concepts he initiated in the early 1960s are still relevant today in new media. In the sense that augmented intellect plays a role in “increasing the capability of a man to approach a complex problem situation” (p. 86), this augmentation might be investigated as applies to

the way in which videogames augment problem-solving situations in new media. I am interested in how glitches in videogames might increase the capabilities of persons to deal with new media literacy issues.

In a different vein, neuroscientist Antonio Damasio (2003) theorized that all thoughts and decisions have an emotional underpinning. Also, this glitch phenomenon happens with a group of persons that share common interests and some aspects of the Do It Yourself (DIY) learning style, a method that is intrinsically social. For Wheatley (1999), there was the urge and desire of belonging (example being part of a group), and for Fitzgerald et al. (2006), to find ways to belong is part of our identity as well as establishing communities. These may be useful lenses when looking at the reasons behind why the “GET DANN” glitch may have had so many responses, but I will not be examining the emotional or social reasoning as much here for this research. Two results presented themselves vividly in the aforementioned dance glitch phenomenon, which are very common for memes: one, there were the people who first posted the video glitch image, and two, the community that gathered around this glitch and contributed their further visual interpretation and embellishments upon the original dance glitch (thus the imitation, mimesis). The relationships that surround a person and their social environment in which they are part strongly impact what a person learns or knows (situated cognition) (Gee, 2007; Lave & Wenger, 1991).

Glitch play. With each new form of technological production, the representations, transmission, and access to that content has a specific literacy to it (Edelman, 2017). These forms of literacy refer to interpretation of the meaning presented by the media, and this process of interpretation is affected by the way it is presented. New literacies complement and integrate literacy as traditionally understood in that they extend its infrastructure. In this way, new forms of literacy play a key role in the learning process today. Videogames have their own literacies, which are in turn constantly under repair and reproduction in their changing forms and can serve as an important tool, even a

catalyst to acquire media literacies, whether the user is aware of these literacies consciously or not, all the while playing and having fun (Bruckman & DiSalvo, 2011).

In a program called Glitch Game Testers, high school students worked full-time as quality assurance on pre-release videogames, including reports of glitch encounters for the purpose of fixing them before their commercial release. What is interesting to note is that the number of students who stated explicit interest in computing more than doubled after finishing their positions as game testers, demonstrating that glitch can be an inherent motivator for learning (Bruckman et al., 2009). The notion of play has implications in terms of this study and the relations of play with new media literacies. Play is vital and even irreplaceable in the development of any person, as the education and learning theorists Prensky (2005) and Gee (2003) point out quite explicitly. Besides serving as forms of entertainment, videogames can also be facilitators for learning, and even important tools to be used effectively by educators. A gamer while playing videogames is not just doing so mindlessly, but is able to understand, extract, and produce meanings from these games. In accordance with this point of view, the theorist Gunter (2005) added that games are important tools for learning in children and adolescents, since the technological resources are present everywhere and the literacy of technology is of a remarkably high degree of importance in today's societies. When a person plays a game, he/she learns (Cavallari et al., 1992; Dempsey et al., 1996; McGrenere, 1996) and gains knowledge. Videogames may, in their role as self-contained cognitive and social arenas, help resolve personal problems, allowing the player to move within a simulated space by making them access new educational settings. In the game *Second Life*, the gamer can access museums, libraries, and even schools. The videogame, then, could be said to have a generative capacity, and even might provide motivation to a new and essential knowledge or skill set in the ever shifting technological contexts of our time. Opportunities for accidental play and encounters with glitches may provide a gateway into skills the users can explore through the technology.

Adults in a business environment have been shown to feel greater sense of productivity when given the chance to play videogames to reinvigorate their workday (Fortuna, 2008; McGonigal, 2010; Sole, 1980). Play, with no rigid methods, is inextricably linked with childhood. Emulating this sense of childhood play during adult life can create a sense of accomplishment and creativity, which brings joy into the everyday and paradoxically lends itself to a greater focus through a replenishment of energy throughout the monotony of the day's tasks. As Fortuna (2008, 2011) has made clear, play in the adult holds an ability to influence a feeling of wholeness and well-being. The sense of play derived from videogames and other digital media should not be overlooked. But perhaps even more interestingly, glitches themselves—typically considered a frustration simply to be avoided—might serve as a particularly fruitful avenue for play, harnessing their accidental learning potential. Glitches serve as ruptures of expected patterns and thus lend themselves to creating an ambiance of difference, creativity, problem-solving, and play.

Summary

Edelman's (2017) assertion is that media literacy is an important skill that requires constant updating. Videogames have been shown to improve specific media literacy skills, such as hand-eye coordination, spatial skills, visual processing, spatial resolution, trial and error, problem solving, creativity, and perhaps most significantly for this research, critical thinking. Critical thinking has been identified as one of the most important media literacy skills, as well as one skill that scholars have pinpointed as needing more research in relation to videogames. As the domain of new media literacy continues to expand to include more recent technologies, this poses interesting opportunities to think about the relationship between these forms and educational spaces. This study addresses the relationship between questions concerning videogames and their

glitches and a theoretical framework drawing on work around media literacy, critical thinking, self-directed learning, and play.

Chapter III

METHODOLOGY

This study looks at a very specific cultural experience—encounters with glitches by adults playing Super Mario World for the first time—as an opportunity to understand the overlap between several different but related domains: new media literacy, critical thinking, self-directed learning, and play. The assumption is that by looking at the points of overlap and resonance between these areas, through this particular instance, we can learn more about how these elements work together to create learning experiences. Changes in our media landscape call for expanded understandings of media literacy. Drawing on the framework of new media literacy, critical thinking is foregrounded as an essential skill. Critical thinking can be looked at within theoretical frameworks posed by thinkers such as Marcuse and Greene, who propose that it is facilitated by encounters with aesthetic works. Likewise, there is a significant body of research looking at self-directed learning. This study situates itself within this research that argues for the value of self-direction in learning experiences as an important facilitator of critical thinking. Finally, play has been studied from a number of different angles, and I draw on a theoretical approach that understands play to be a productive context for self-directed learning and critical thinking.

I approached this theoretical frame in the same vein as Maxwell (2005): that worldviews set up theoretical frames that provide a “system of concepts, assumptions, expectations, beliefs, and theories that supports and informs” (p. 33). In developing a

study that can look at the possibly complex interrelationships between these diverse domains, focusing on glitch experiences within videogame play allows us to see the broad overlaps while also allowing us to pose several specific questions about the nature of videogame glitches as an unusual challenge of media literacy. The guiding research question is: What are the range of skills called into play and challenged when an individual encounters a glitch while using or playing videogames? Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World? Within this overarching question about what media literacy skills these unusual encounters elicit, I also focus on three specific elements: (1) What kinds of skills come into being to solve these perceived problems; (2) What is the interplay between the different possible responses to glitches; and (3) As players solve the challenge of dealing with glitches, how do critical thinking skills come into being as a result?

These questions are designed to take advantage of glitch experiences existing at the nexus of the theoretical framework described above. More specifically, videogame glitches are particularly suited to looking at the emergence of new media such as videogames, the diverse interactive skills they draw on, and the problematization of experience that elicits critical thinking, within an interactive environment of self-directed play. The design and methodology of my case study aim to draw out specific responses to glitches that will give insight into the research questions.

Research Design and Methodology

Case Study

A number of studies in education (Stake, 1978, 1995), psychology (Bromley, 1986), and sociology (Creswell & Miller, 1997; Yin, 1984) have researched individuals as the unit of analysis and have used the case study method to develop complex and

complete studies about people. Yin (1994) discusses both single and multiple case studies.

I chose case studies to study the glitch phenomenon because I wanted to be able to see how individuals with different experiences respond to glitches in real time. According to Yin (2001), a case study is a method of empirical investigation that encompasses the logic of planning, collecting, and analyzing data. According to Yin (1984), this methodology is based on field work studied in its real context seeking evidence through interviews, observations, documents, and artifacts. For Gil (1995), the case study does not require a rigid script—particularly relevant for studying glitches, which by nature do not lend themselves to scripts. A case study investigates a certain phenomenon, usually contemporary, and which occurs within a real context in life, when the boundaries between the phenomenon and the context in which it is inserted are not clearly defined. A case study is an in-depth analysis of one or more objects (the case) to allow for their ample and detailed knowledge (Berto & Nakano, 2000; Gil, 1995). Its purpose is to deepen knowledge about a problem that is not sufficiently defined (Mattar, 1996), to stimulate understanding, to suggest hypotheses and questions, or to develop a theory, which is why this method is the best fit for my research about glitches. Case study can be classified according to its content and final objective (exploratory, explanatory, or descriptive) or quantity of case study (single case, non-holistic or incorporated, or else multiple cases not categorized as holistic or embedded). The main trend in all types of case studies is that they try to clarify why a decision or a set of decisions were made, how they were implemented, and with what results (Yin, 2001). My own case study was centered around the playing of the Super Mario World (SMW) game for a total of one hour. The reason I chose this game specifically was because it seemed to bring a great deal of enjoyment to players I observed in the past, and thus involved a sense of play; but in addition, I chose Super Mario World because it is known to have several glitches, and the chances that these participants would encounter one of those glitches was high. The

platform videogame used in this case was designed by the Japanese in the 1990s, but marketed for Europe, the United States, and elsewhere, called Super Mario World (SMW), not to be confused with the Super Mario Brothers game. This study provided a unique opportunity to research this dichotomy from the experience and perspectives of adult gamer and scholar, and examine the skills and influences learned and utilized through gaming.

Planning the Case(s)

One of the first tasks in this planning was the choice of the unit(s) of analysis, i.e., the case(s). First, the quantity of case studies had to be determined: either single or multiple cases (Yin, 2001). As a general rule, four to ten cases appears to be sufficient (Eisenhardt, 1989). In my case, I choose four persons, but one dropped out, so I did three case studies. I chose to implement a multiple case study, following “replication logic” (Yin, 2009). Yin refers to multiple case studies as similar to multiple experiments. In my case study, I followed a replication logic for each case so that the replication is of the theoretical type, which produces contrasting results for predictable reasons (Lee & Vandewater, 2006).

Through the selection of the case(s), one must determine the methods and techniques for both data collection and analysis. In this sense, multiple sources of evidence should be used, and so I used structured interview, documentary analysis, and direct observations. Eisenhardt (1989) argues that the use of multiple data sources and iteration with the constructs developed from the literature allow the researcher to achieve a greater constructive validity of the research. Constructive validity consists of the extent to which an observation measures the concept to be measured (Croom, 2005). In addition, the use of several sources of evidence allows triangulation, which comprises an iteration between several sources of evidence to support the constructs and hypotheses in order to

analyze the convergence of sources of evidence (Croom, 2005; Eisenhardt, 1989; Maxwell, 2005; Yin, 2001).

Conducting a Pilot Study

Although it is not a universal practice in case study, I thought it could be helpful to conduct a pilot study before starting to collect data. The purpose of this test was to verify the application procedures based on the protocol, aiming at its improvement, and “to assess the feasibility of steps necessary for the main study” (Van Teijlingen, Rennie, Hundley, & Graham, 2001, p. 291). From this application, it was also possible to verify the quality of the data obtained, in order to identify if they were in need of revision.

For the experimental pilot test, I had to consider the particular set of glitches derived from SMW. I interviewed a 32-year-old female about her experiences after she had played SMW on a console for one hour—30 minutes of level one, and 30 minutes of the “water level.” Afterwards, I asked her to create a visual response to her experience and meet again after 7 days. When she showed me her visual response (drawings and paper sculpture), she answered a few questions (Appendix A).

The aims of this pilot study were to elucidate and add to the dialectic of self-directed learning occurring in videogames and glitches, and the new media literacy skills that come with it. On a personal level, this study illustrated that the field of pedagogy could explore different approaches in the implementation of videogame errors for the development of the intellectual capacities of adults.

Revisions to Data Collection Steps

This pilot study was intended to shed some light on my research methodology for my thesis. I realized from the pilot study that the data to be collected in the future should be from four persons: two men and two females, and should include video documentation of the one-hour they are playing the SMW, passive participant observation, documentation such as notes, sketches of the sound recording, two sets of the interviews,

visual essays, and personal journals. Also, upon reflection after the pilot study, I decided that the subjects should have 30 days to create a visual essay instead of 7 days, because it allowed time to analyze the personal journal and see if there were any indications of critical thinking emerging by playing SMW.

Revisions to Data Collection Guides

During the data collection steps from this pilot study, I learned that I should approach the observation a little differently. What I concluded was that when I observe the subject playing for one hour, I should videotape the screen, which shows the videogame play, and observe the person playing it. In this way, I would not get distracted with too much information and only two hands to record notes. I could then review the video later. For my study, I kept three columns separated and wrote what I observed, what I thought, and how what I observed was connected to my questions, without mixing them up in the same notes, again considering the rigor necessary for case study (Feignin, Orum, & Sjoberg, 1991).

Changes in Sampling

With the pilot study, I realized the need to have more than one subject of the same age, so I could better triangulate my findings. But there was the need of more than one case study to allow us to meet the subjects through in-depth data collection that involves multiple sources (Creswell, 2006), which would allow me to cross-compare data among the three subjects and see the common threads among them.

Changes in Interview Questions

I based my initial approach to my interview questions on the investigations and experiments from my pilot studies and on studies I could locate that addressed adult populations and at the same time referred to a connection with media literacy skills. For the questionnaire and specific protocol, I worked to transform these questions into very

open-ended questions that would not influence the responses of the subjects. In relation to the first interview, I found that based on my pilot study, I would need a few more probes in order to extract more data from the subjects when I did my main research. This made it necessary for the interview protocol to include a few more questions. The questions that were added were fill-in-the-blank sentence types pertaining to topics such as what subjects thought they developed or did not develop, or what they thought they encountered or did not encounter, or experienced in the videogame. Please find this revised interview protocol in Appendix B.

Changes in Approaches to Data Collection and Conduct in the Field

With this Pilot Study, I found that, as mentioned above, some approaches needed to change in the data collection. I also found the need for the subject to have more time in creating their visual essay as well as their own personal journal during the process, so that when I analyzed them I could see if there was any connection with critical thinking. For this reason, I added a personal journal. The subjects' personal journals also shed light on the visual responses that happened after the first interview, and whether they did or did not show if a glitch can be a catalyst for learning or propel critical thinking. In relation to my conduct in the field, I aimed to be friendly yet still neutral, but never judge or cross boundaries and always allow room for the subject to answer in their own time, allowing for periods of silence during the interviews.

SMW Final Case Study

Participants

It is important to relate a few details about the context for this qualitative case study. The four subjects (which became three subjects) were recruited through hard copy flyers, online announcements, and word of mouth. Four informational meetings

explaining the study were held in Porto and also online through e-mails with the persons who showed interest. Afterwards, a follow-up phone meeting was scheduled with the subjects who demonstrated a desire to participate. Throughout all of these stages, subjects were encouraged to ask more questions. I was looking for subjects that were born after the fall of the Salazar dictatorship in Portugal in 1974; and consequently, due to circumstances that were very different than in the United States, their exposure to technologies (based on availability in Portugal) did not necessarily occur at similar moments of development as they might have in the United States. Because of the relatively late appearance of computers in some schools in Portugal, these subjects all had their first exposure to computers in their adolescence. (A similar age group in the United States would most likely have been exposed to computers in early childhood, where by the 1980s, computer technology was already being integrated into school curricula.) The Internet appeared even later in the subjects' lives, either late adolescence or even in adulthood. The Internet was introduced in Portugal in the late 1990s, several years after its start in the United States.

Data were collected in two rounds of separate interviews with each individual, and each first interview was followed by a second interview after a 30-day period. Dates for the interviews also varied between subjects. Data were collected through photographs, personal journals, visual essays, and sound and video recordings. The subjects recruited for the study were two females and two males, each born in 1978 in the same city in Portugal, in order to control for some of the differences in such a small study. One of the female subjects dropped the study at an early stage due to family issues, leaving a total of three subjects.

Procedures

The site where the study was conducted was my home office, also referred to in this research as Albuquerque home office. None of the participants were remunerated,

and they were fully informed of their not being compensated financially before the study began. After I ensured that they understood the parameters and procedures of the research, I asked them to thoroughly read the consent form and take their time to completely read and understand the participant rights. Finally, if the subjects agreed to them, appeared to understand the processes and procedures of the research, and had no further questions, I asked them to sign and date the forms.

Study Procedures of the Participants

I met subjects for a total of two times with a period of approximately 30 days between the two sessions. Subjects participated in interviews during both sessions. The first time, subjects played a videogame for one hour and were interviewed afterwards. While the subjects were playing the game, I never answered any questions or spoke.

During that 30-day period, subjects agreed to create a personal journal based on their experience of playing the videogame, and also created a visual essay. The subjects generally asked me if I had any specific instructions, and I answered that anything they could imagine would be acceptable. My goal was to allow them the most open-ended potential for expression. Subjects then presented the visual essay and personal journal after 30 days and completed the second interview. This method was repeated for all three of the subjects. Informed through “replication logic,” in all steps each subject had the same or as similar treatment as possible (Yin, 2009).

Data Collection

After contacting the subjects, the data were collected using the protocol defined in the planning, keeping in mind the aforementioned “replication logic” (Yin, 2009). In this way, the protocol was more than a mere script with questions, but rather an instrument that improves the reliability and validity in the conduct of a case study, considering all relevant parts (Souza, 2005). Interview skills were considered based on the following factors: ability to ask appropriate questions and interpret responses; to be a good listener

and not bring any kind of prejudice; to be well grounded in the theory for the topic investigated; to be receptive and sensitive to possible contradictory evidence; and to be adaptable and flexible toward new and/or unforeseen situations, considering these as opportunities rather than threats (Yin, 2001). During data collection, I had to try to limit my own effects as a researcher, and always keep in mind that I was a strange element in the analyzed context; in terms of effects as researcher, I needed to eliminate my influence on the respondents (Souza, 2005).

Data sources and data collection. A case study involves intensive data collection and methods of multiple sources, such as interviews, observations, etc. All this is framed in the time and space that they were collected and in a context that is rich and bound by the research setting, for example (Creswell, 2013). Before each of the interviews, I asked my subjects to play a videogame on a console connected to a television while I observed them, and videotaped the television monitor but not the body or face of each individual subject. I took notes, both visual and written, from observations of this activity, as well as photographs.

For data gathering during the first interview, I took notes and recorded the subject's response to questions (in their native Portuguese) on handheld digital audio voice recorder, and later played back the sound and transcribed their responses in Portuguese onto my personal computer, then translated these into English. The computer was password protected at all times, and I was the sole holder of the password.

The second interview took place about 30 days after the first interview. I took notes and recorded the subject's responses to questions (in their native Portuguese) and later transcribed and translated them into English using the same method as with the first interview. The subject gave me their visual essay, which was a response to the videogame, and also a personal journal. The questions I asked during the second interview were centered on their visual essays and journals. Photographs of the journals and essays were also taken for the second interview to support further documentation. I

kept a log for not only observational but theoretical and methodological reasoning and thought processing during the whole of the data collection (Schatzman & Strauss, 1973).

Table 1. Relationship of Data Collection to Research Questions

Questions	Data collected directly in words from Subject	Data collected during the Subjects playing SMW	Data collected in the beginning of the 2 nd interview
I. What are the range of skills called into play and challenged when an individual encounters a glitch while using or playing videogames? Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World (SMW)?	1st and 2nd Interview: one-on-one question-and-answer sessions with the researcher. Interviews average 30–45 minutes per subject. (Sound Recording)	Observations: Video recording and stylized note and drawing taken during the subjects playing SMW for 1h.	Visual Essay and Personal journals: photography of the subjects handwritten account of playing SMW, over time.
2a. Given that meeting the challenge of a glitch is encountered when playing SMW, what kind of skills come into being to solve the perceived problem of the glitch?	1st Interview: one-on-one question-and-answer sessions with the researcher. Interviews average 30–45 minutes per subject. (Sound Recording)	Observations: Video recording and stylized note and drawing taken during the subjects playing SMW for 1h.	
3b. Given that an individual confronting a SMW glitch calls into play a range of responses, how do these responses interplay with each other as the individual tries to solve the problem?	1st and 2nd Interview: one-on-one question-and-answer sessions with the researcher. Interviews average 30–45 minutes per subject. (Sound Recording)	Observations: Video recording and stylized note and drawing taken during the subjects playing SMW for 1h.	

Table 1 (continued)

Questions	Data collected directly in words from Subject	Data collected during the Subjects playing SMW	Data collected in the beginning of the 2nd interview
4c. Given that an individual meeting the challenge of a glitch when playing SMW arrives at a resolution of the problem, how do critical thinking skills come into being as a consequence of these responses?	1st and 2nd Interview: one-on-one question-and-answer sessions with the researcher. Interviews average 30–45 minutes per subject. (Sound Recording)	Observations: Video recording and stylized note and drawing taken during the subjects playing SMW for 1h.	Visual Essay and Personal journals: photography of the subjects handwritten account of playing SMW, over time.

Data collection. The data collected from each of the three persons included interviews, passive participant observation, documentation such as sound and video recordings, written notes and sketches, images and scans of their personal journals, and the visual essays that the three adults were asked to create. The data collected were centered on the one-on-one observation of the videogame activity, followed by two main interviews of the subjects, one of which was myself.

Interviews. Interview data were collected by using one format and their protocols, which included two in-depth interviews conducted at different times and dates, with approximately 30 days difference between the first and the second interviews. The dates and length of the interviews are noted below.

1st Interview

Subject I met at Albuquerque Home office on 2 July, 4pm. The interview lasted 40min.

Subject C met at Albuquerque Home office on 9 July, 5pm. The interview lasted 53min.

Subject S met at Albuquerque Home office on 2 August, 4pm. The interview lasted 43min.

In-depth interview: 1st interview. After the subject played the videogame SMW for one hour on the SNES console, the adult was interviewed in-depth, and on site. This procedure was repeated for each of the subjects individually and separately. In this first in-depth interview, I asked a set of questions that were precise, exact, and inflexible with regard to wording and order of the questions. Also, I made sure to pause after asking each question to allow each subject to respond on their own time, and I did not rush them to get an answer. If the subject did not answer right away, I waited at least a full 60 seconds before asking them if they needed me to rephrase the question, needed more time, or wished to skip and return to the question later. With this in mind, my interview protocol was directed at each subject as such: practice, reflection, and skills, in videogames and media literacies. Examples of prompts included:

- Can you describe your experience in this one hour?
- What was prominent for you?
- How do you use in your day-to-day life what you have learned in playing videogames?
- What caught your attention in the videogame? and in your memory?
- What leads you to say that?
- Did you learn something in this one hour? What did you learn?
- How might you use this one-hour experience in your future as a student, person, or in your daily life?

Second Interview. Subject I met at Albuquerque Home office on 7 August, 4pm. The personal journal she provided was 10 pages in length, and the visual essay was a drawing. The interview lasted 37 min (which included a lot of silence).

Subject C met at Albuquerque Home office on 10 August, 5pm. The personal journal and the visual essay were one, as he merged both into 30 pages. The interview lasted 84 min.

Subject S met at Albuquerque Home office on 31 August, 4pm. The personal journal that he provided was 1 page in length, and the visual essay was a print drawing. The interview lasted 31 min.

I conducted all data gathering in Portuguese and translated into English myself, as I am a Portuguese-born native speaker of Portuguese.

In-depth interview: Second interview. After gathering the visual essay and personal journal, I conducted a second interview with the three subjects. This second interview differed from the first interview because it related to their experience and thinking 30 days after they played the game, and to their personal journal and visual essay. Three equal questionnaires, designed for the purpose of gathering data, were used during the interview. This in-depth interview addressed two main points: media literacy skills and critical thinking.

Examples of prompts for the second interview are:

- What is going on in this visual essay?
- What connections and thinking surfaced while you were working/developing this visual essay?
- How do you connect this drawing with the one-hour experience of playing a videogame?

Observation. As pointed out by Spradley (1980), there are a number of degrees of participation available for any researcher in the field. These range from what Spradley terms non-participation, passive participation, moderate participation, and finally complete participation. At the least involved end, the researcher simply observes from an outside point of view without participating in the activities whatsoever. One step away from that, passive participation is where the researcher observes inside the setting without participation. With moderate participation, the researcher observes within the setting and almost completely participates, but stops just short. Complete participation is where the

researcher observes activities in the setting and totally participates in the activities of the setting.

In this study, I undertook one of these roles. That was passive participation, in which I passively observed subjects in the same room while they played the videogame.

I observed the subjects while they played Super Mario World in two segments of 30 minutes for each of the interviews, and these observations were taken down as notes. This game-playing activity was videotaped by framing the lens on the television set for each individual subject. The subjects themselves were not videotaped, only the television monitor. I took notes, both visual and written, from observations of this activity. I observed and kept detailed notes from my observations as suggested by DeWalt and DeWalt (2002) and Wolcott (2001).

I also drew sketches along with the written notes and sketched the types of glitches the subjects encountered. For example, I drew a visual representation of the glitch when Yoshi became glued to an apple in the case of Subject I. I was careful to report what I saw and not what was inferred, such as pointed out by Bernard (1994). Under no circumstances did subjects' faces appear on the videotape or in photographs.

Passive participation. When I observed three of the subjects (two males, one female), I was a researcher in the field but did not participate. I assumed a spectator role while the subjects were playing the SMW videogame for an hour.

Documentation, archival records, and physical artifacts. Documentary data, such as photographs, sound recordings, videogame recordings, personal journals, and visual essays, were collected during the interviews. Collecting the personal journal of each subject enabled a description of what happened to the subject while playing that one-hour videogame, and also illuminated the way in which literacies, technology, and critical thinking flowed in an activity like this.

Documents. Throughout the study, I collected the subjects' visual essays and journals.

Photographs and videos. Through the study period, I recorded, on video, the subjects playing the videogame Super Mario World, first on level one, then on the “water level,” each for 30 minutes. At no time were the subjects themselves part of the video. I also took photos and scans of subjects’ journals and visual essays.

Notes and memos. I routinely took on-site notes and observations on paper while the subjects were interviewed, and while they played the videogame. As a passive participant, I prepared three columns of notes in order to organize my observations. These three columns were (a) observation, (b) initial thoughts, and (c) how this observation relates to my research questions. This organization helped me connect what I was seeing quickly and effectively, in as rigorous a fashion as possible. These three columns of observational notes were based on research previously done by Feignin et al. (1991). The goal of this organization was to contextualize media literacies development and also critical thinking in relation to videogame glitch. For example, when I observed how the subject positioned himself physically in space, I observed his physical interactions with the videogame—in this case, pertaining to the physical ability to manipulate an instrument such as a video console, a videogame, a glitch, focusing on the change, development, and behavior skills engaged through this interaction.

Preparation and translation of transcripts. I recorded and then listened to the interviews one by one, and upon playback I transcribed them in the original Portuguese onto my secure personal laptop computer. Once I transcribed all three of the subjects’ original interviews in Portuguese, they were translated into English, taking care to remember that the content of what the participant says is more important than the way he says it, remembering Riessman’s (2008) preparation of an interview prepared for thematic narrative analysis. I also gave the subjects the Portuguese and English transcriptions of their own interviews to see if the meaning was correctly transcribed and translated. All subjects agreed that the transcriptions as well as the translations were

accurate. In this way, the interviews were prepared considering Gee (1999, 2006, 2010) and his performative action-oriented discourse analysis.

Confidentiality. These procedures were clearly connected with the IRB process in which this research data gathering only began after I received approval from IRB in 2013. The subjects were not identified by their names on any data collected, and a fictitious name was assigned to protect privacy. The data were stored in a locked file cabinet and password protected computer, in the Albuquerque home office, and were only handled by me, the principal investigator. After the research dissertation was concluded, the audio/videotape was destroyed. Also, all the copies made from the visual essays and personal journals were destroyed.

As the principal investigator, I was the only person allowed to see these records. All data collected through notes, photos, and audio/videotapes were assigned a fictitious name, and the participants' faces were never shown in the data collected. I was the only person who viewed the written, video, and audio taped materials.

I received the consent of all subjects both verbally at the meeting of the initial conversations and through their signature on the informed consent form. The consent form specifically addressed the video recording of the monitor while they were playing the videogame (excluding their face/body) and audiotaping during the two interviews. All subjects were comfortable with giving their consent; they were not pressured in any way to consent and were offered the choice to cancel the proceedings at any time.

This research was considered to be of minimal risk to the participants. The reason is because in terms of participation, they played a non-violent videogame and talked about that experience, then created a visual response. Essentially, the risks associated with this study were no greater than what a person faces every day. As such, the subjects did not exhibit any signs of being distressed while talking about their experience of playing a videogame or during the playing itself. However, during the first interview after playing SMW for 1 hour, Subject I told me she wanted a break because the question was

too hard. In this case, I asked her if she wanted some tea and food and to relax her mind and body and then to see if she wanted to continue the interview. After this break, she said she wanted to continue, and only then we resumed the interview.

In this research there were no direct benefits; however, there were some potential social benefits. While there were no immediate benefits for the participants, I noted at that time that this research might potentially improve and change the field in a scholarly way.

Data Analysis

From the collected data set, the transcription and assembly of a narrative considering all sources of evidence are not enough for an adequate analysis of the data. Thus, some practices can be used, such as coding, which is the first step in data reduction (Souza, 2005). The idea is to mark parts of the narrative (words, sentences, or even paragraphs) with a code that represents categories previously defined. These categories must correspond to theoretical properties, deployed in dimensions associated with a search. The codes are blocks whose purpose is to retrieve the data of the narratives and transcriptions to associate them with what is intended to be investigated, either in the scope of the research question or the constructs developed from the literature. It is important to mention that the codes do not answer the question of research, but serve only as conductive wires for this, from the analysis of the data, described below.

The data analysis of the interview and materials gathering was based on Kvale's (1996) analysis methods: meaning condensation, meaning categorization, meaning interpretation, and generating meaning through ad hoc methods. As Yin (2009) mentions, for "how" and "why" research questions, case studies are the most appropriate method. He emphasizes that connecting the data to the propositions is vital in the final analysis. In terms of findings, it is important to be very clear about the criteria through which the findings are analyzed (Yin, 2009). Theoretical generalization in the social sciences can be

useful in the single case study (Yin, 1984), although some researchers find that steers them away. It is important to mention that the data analysis generally moves from data gathering to management, description, interpretation, and visualization, which Creswell (2006) describes as a spiral.

An analysis based on a case study opens the door to better interpretation of a case (or several cases), under conditions in which the research questions are well defined and articulated theoretically (Nissen, 1998). However, this is a holistic approach looking to the individual as also the broader basis of their settings, giving emphasis in looking to the subject/participant in the study in a particular context and how this context interplays with the subject (Yin, 2009).

Codes based on previous study. One of the challenges in this research was that there are a few scholars who recognize the enormous difficulty in measuring media literacy, and yet, there are those who attempted to create a general approach (Bergsma & Carney, 2008; Hobbs & Frost, 2003; Primack, Gold, Land, & Fine, 2006). For this case, I focused on adult learning studies related to media literacy or overall assessment of media literacy.

For analysis codes, I based myself on research done by Edward Arke and Brian Primack, published in 2009, called “Quantifying Media Literacy: Development, Reliability and Validity of a New Measure.” In their research, they worked with an adult population and quantified media literacy. The target population was a group of college students in an undergraduate class, and the sample size for this research was 34. It is important to note that Arke and Primack talked about the importance of doing studies on college students and adult participants, because as Bergsma and Carney (2008) already mentioned, the majority of the studies in media literacies have involved adolescents, underlining this need also for doing my own research pertaining to adults.

Arke and Primack (2009) analyzed three media: radio, television, and print. The main objectives of this study were, on the one hand, to develop an instrument of

measurement (pilot) that could evaluate media literacy skills and, on the other hand, to bring validation (testing) to its psychometric properties. The authors created a model with five conceptual domains: recognition, purpose, point of view, technique, and review; these matched the skills of media literacy identified by Aufderheide (1993), such as access, analyze, and evaluate; and Bloom's taxonomy (Bloom, Hastings, & Madaus, 1971) in the cognitive domain in relation to learning objectives: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Arke and Primack (2009) also conceived seven measurements to be implemented in five areas: recall, purpose, viewpoint-sender, viewpoint missing, technique, evaluation, and evaluation-inference. The objects for evaluation were: facts; purpose or purpose of the message; sources of information and viewpoints omitted; ways to attract and keep attention; attitudes and feelings after reading, listening, or viewing; and, finally, determining what suggests the information. For the evaluation of critical thinking, they gave all their subjects the California Critical Thinking Skills Test (CCTST). The language of the CCTST refers to critical thinking skills, rather usefully, I think, as core cognitive skills. This language emphasizes the importance of critical thinking skills as central to not only media literacy but many other arenas. Arke and Primack concluded two major notions based on their internal model analysis: one, that media literacy quantification can be achieved, and two, that media literacy and critical thinking measurements are co-related.

The case study method allowed me to meet the subjects through in-depth data collection that involved multiple sources (Creswell, 2006). using case study as a method allowed for cross-comparative data among the three subjects, which exposed the common threads among them. The interviews, observations, personal journals, and visual essays were designed for the purpose of gathering data that were part of this research, in order for results to be subsequently compared. The interview questions were constructed based on Bloom's (Bloom et al., 1971) taxonomy domains of Cognitive (remember, understand,

apply, analyze, evaluate) and Psychomotor (set, guide response, mechanism, complex overt response, adaptation, origination). Upon completion of the interviews, the data were encoded in accordance to a given key based on Aufderheide's (1993) definition of media literacy: decode, analyze, evaluate, and produce. I based my first data codes on this taxonomy and then summarized and distilled them into summarized codes. This I will explain further below.

Data codes and analysis. For the data analysis and treatment of the information, I first structured three stages of openly looking into the data in light of the literature, in order to look into themes and patterns. I did an analysis in search of commonalities and differences through cross-comparison of the subject data:

- 1st stage codes were used to analyze the video, and the conceptual model of Aufderheide's (1993) definition of media literacy and Bloom's (Bloom et al., 1971) taxonomy in education.
- 2nd Stage codes were used to analyze the interviews in order to find patterns in the data; words that capture the essence of what the data carries were merged into groups. This was done by condensing the data from the three interviews and siphoning for key words to draw larger conclusions and summarize the vital clues in the data. I looked for patterns using word frequency counts, and this process helped me understand what the interviewers were saying. The meanings taken away from these patterns made the beginning framework, which is addressed by the third stage coding.
- 3rd Stage codes were used to analyze the interviews in which at this stage, the coding scheme was created to interact precisely with the central research question and sub-questions. This assisted a deeper probe into the data patterns. This third stage was based on a broader look at all the interview data, including an open capture of the emergence of vital data. This stage of coding was informed by not only the interview data but also an examination of the creative

output of the subjects from sources such as their personal journals and their visual essays. Analysis could have been completed within the first case, then cross-referenced with other cases; however, this sample only consisted of three subjects, and because of this I looked at all of the data in all of the cases.

Using these codes, I was looking for connections across the interview data in an open way and in light of the literature, with posterior reference to the personal journals and visual responses and finally connecting with new literacy theory and my research question. These codes were used to converge and confine my data and research to triangulate data that could corroborate, support, and strengthen my findings and conclusions, remembering always that triangulation and corroboration are important in research (Kvale, 1996; Schloss & Smith, 1999).

Final synthesis coding (Tables 2, 3, and 4). In what will be presented as Tables 2, 3, and 4, I have represented the codes to show how the data respond to the broader concerns of my study. Each table represents the data for each individual subject. On the left side of the table is denoted which subject is represented for that table, with three columns each corresponding to these broader concerns distilled from the initial coding of the data. These columns are Decoding, Analysis, and Solution, and should give readers an idea what patterns the data demonstrated in the subjects' encounter with SMW videogame play. In Tables 2-4, these columns are populated with phrases and examples taken from the subjects themselves through their own words and in their own self-reporting. For ambitious readers, Appendix C contains the complete analysis with all the details surrounding the arrangement of stage one, two, and three codings.

In the Decoding column, the data are arranged according to what subjects did and said in their responses to encountering a glitch or obstacle within the game space of SMW for the first time, and these data were taken from the video recordings of when the subjects actually played SMW in two 30-minute sessions, coupled with the interviews and observation data.

In the Analysis column, the arrangement of Tables 2-4 is concerned with how subjects inspected, evaluated, dissected, and interpreted these obstacles and glitches within the game space of SMW. The data in this column were also taken from the video recordings, observations, and interviews (and largely from the second interview), but also combining the data from their visual essays and personal journals in what they wrote, drew, and reflected upon from their SMW game-playing experiences.

In the Solutions column, data are taken from the video recordings, observations, and interviews. This column is populated by the ways in which subjects were moved to respond and made decisions upon these obstacle and glitch encounters.

Conceptual synthesis (Table 5). Collapsing, distilling, and synthesizing the main themes from the specificity of subjects' data in Tables 2-4 was the task set before me in constructing Table 5. My goal was to arrange the data from all the subjects in a way that seemed to provide a clear method of viewing the data in a single sweep and that would lend itself to ease of analysis and extrapolation. In arranging the data, I organized the themes into categories (Decoding, Analysis, and Solution), and each of these categories I further subcategorized according to what seemed to logically follow from the patterns in the data. I subcategorized Decoding into (a) Controller Decoding (which refers to the controller which is connected to the SNES Console), (b) Level Decoding (corresponding to each of the SMW levels and the particularities of each level's game space, visual maps, obstacles, and goals), and (c) Glitch Decoding (initial recognition and engagements with SMW glitches). I subcategorized Analysis into (a) Game play analysis (in which subjects delineate how they viewed and approached game play in SMW, (b) real-life comparisons (subjects thinking around creating parallels with SMW and their real lives), and (c) glitch analysis (comprised of subjects' relationships towards glitch). Finally, I subcategorized the column labeled Solution into (a) Memory-based solutions, (b) glitch response, and (c) self-directed solutions.

The data analysis of the interview and materials gathering was based on Kvale's (1996) analysis methods: meaning condensation, meaning categorization, meaning interpretation, and generating meaning through ad hoc methods. I did a cross-comparative data analysis between the three subjects based on the notion that the method of triangulation is vital for research to be valid (Kvale, 1996; Schloss & Smith 1999), and I approached the gathering of data from this point. I searched for relationships between interview data and the findings, noting the relationship with the personal journals and visual responses, and lastly converging that with the literature review while poised on the central research question. In sum, I combined and contrasted data, research, and literature to enforce, uphold and connect my analyses and conclusions, with the method of triangulation in mind. The overall data analysis moves in what Creswell (2006) describes as a spiral, from data gathering to management, description, interpretation, and visualization.

Limitations of the Study

... how you will use different methods to address a single validity threat (a strategy discussed previously, known as triangulation) ... (Maxwell, 2005, p. 126)

A case study should be based on reliability and validity, the criteria for judging the quality of the research. Reliability aims to demonstrate that the operations of a study (such as procedures for data collection) can be repeated with the same results (Yin, 2001). Quality of research necessitates a consideration of ethics, which is why, for example, I made certain to notify and inform the subjects fully and completely about the process of the research, allowed subjects to opt out at any time, and followed very carefully IRB guidelines in each step of the way (Lincoln, 1995).

To address my research, I used a case study, which can have two advantages when used to test theories such as the one addressed above. The first one is directly related to

the fact that case studies are strong, as they are associated with events considered unique, such as the “black swan” case (Taleb, 2010), which relies heavily on those involved, the context, and the causal factors that cannot be predicted from the recurrence patterns of normalcy and regularity in typical statistical analysis. Since my research was related to new literacies acquisition through videogames and the encounter of glitch, I thought a case study was the best way to approach it.

An analysis based on a case study opens the door to better interpretation of a case (or several cases), under conditions in which the research questions are well defined and articulated theoretically (Nissen, 1998). However, this had a holistic approach looking to the individual as also the broader basis of their settings, giving emphasis in looking at the subject/participant in the study in a particular context and how this context interplays with the subject (Yin, 2009). A case study involves intensive data collection and methods of multiple sources, such as interviews, observations, etc. All this is framed in the time and space they were collected and in a context that is rich and bound by the research setting (Creswell, 2013).

Data were gathered during the observations, two interviews, personal journal, and visual essay. Since I was the instrument, I was trying to be as least biased as possible; however, we are all influenced by our own cultural, historical, and social backgrounds. I had set up the boundaries while maintaining the relationship between myself and the subjects, without crossing boundaries, which means it was not my role to take sides, offer any opinions, or pass judgment.

As regards the study, there were some limitations that should be addressed. It should be said that glitch is unpredictable; one never knows when it will happen or what form it will take. The human limitations of the observation and interviews were that the data were collected from three adults around 30 years of age. It was an observation and interview study conducted in the Portuguese language that was recorded and then translated and transcribed into English. Different participants displayed similar and

different outcomes, because there were external factors that influenced the use of videogames and the encountering of the glitch, such as technology, the limit of time spent playing (two 30-minute segments), plus there was always the question of whether the glitch was found at the beginning or the end of playing time, or if it was even encountered at all.

Other Methodological Considerations

I analyzed the data gathered and interpreted it to help ensure validity in the findings and to promote convergence in the inquiries. In this way, I wanted to look for connections across my interview data and results, with reference to the personal journals and visual responses, and finally connecting the findings with my literature review, with emphasis on my research question. I converged and confined my data and research to triangulate data that could corroborate, support, and strengthen my findings and conclusions, remembering that triangulation and corroboration are important in research (Berg & Lune, 2012; Creswell, 2013; Kvale, 1996; Maxwell, 2005; Rubin & Rubin, 2012; Yin, 2009).

Summary

This research follows a case study model using individual cases as the units for analysis of SMW glitch encounters. The questions from the first interview immediately following game play were related to the game play experience. The questions from the second interview, after 30 days, were about the overall experience as well as reflections upon their visual essay and personal journals. After conducting the study and collecting the data, I arranged the data through the implementation of Aufderheide's (1993) definition of media literacy as well as Bloom's (Bloom et al., 1971) taxonomy in education. Then, I synthesized this data into tables for each subjects (Tables 2, 3, and 4).

Each table was designed to give an accessible view on specific data from the subjects regarding self-reported and observed relationships of their SMW play experiences. They were broken into how they decoded the game and glitch experiences, analyzed these, and the solutions they developed. Table 5 is then a conceptual synthesis of the data in Tables 2-4, examining broad themes present across each of these subjects.

Chapter IV

FINDINGS

Given the study methodology detailed in Chapter III, including the approach to data analysis, I can now report on the findings. I was looking for what the learner/player develops by playing without external guidance, and how encounters with glitches may enhance, develop, or otherwise influence their skills in the context of self-learning. The findings regarding this are drawn from the data gathered during the observation, the two interviews, the personal journals, and the visual essays. After removing the data from the fourth subject who dropped out, the findings code these data points from the remaining three subjects. I begin by detailing the findings for each mode of data collection, subject by subject. In the second section, I review the coding of these data. First, the data for each subject are summarized in three phases: how they decoded game play and glitch experiences, the analysis they made of these, and solutions they arrived at (Tables 2-4). Finally, I look at the overlapping themes of these findings across all of the subjects and summarize these in Table 5, again using the same three phases.

Logistics of the Meetings

1st Meeting

Subject C met at the Albuquerque Home office on July 9, 5 p.m. The interview lasted 53 min.

Subject S met at the Albuquerque Home office on August 2, 4 p.m. The interview lasted 43 min.

Subject I met at the Albuquerque Home office on July 2, 4 p.m. The interview lasted 40 min.

2nd Meeting

Subject C met at the Albuquerque Home office on August 10, 5 p.m. The personal journal and the visual essay were merged into 30 pages. The interview lasted 84 min.

Subject S met at the Albuquerque Home office on August 31, 4 p.m. The personal journal that he provided was 1 page in length, and the visual essay was a print drawing. The interview lasted 31 min.

Subject I met at the Albuquerque Home office on August 7, 4 p.m. The personal journal that she provided was 10 pages in length, and the visual essay was a drawing. The interview lasted 37 min.

Subject C

Subject C was a tennis-playing architect who was in the habit of arriving at the interviews after one of his tennis matches. He did mention off-hand that he was experiencing some issues in his love life, and he expressed interest in discussing this. My response was that if it was on topic and made sense for him to talk about it with relation to the study, it should be fine. However, after this initial talk, he never returned to this subject in conversation. He mentioned that he had some familiarity with the Super Mario character before this study.

Video Data (One Hour Playing the Super Mario World Videogame)

Skills. While observing the videotape of the one hour playing the video, I noticed that he seemed comfortable because of his relaxed posture, and his handling of the

controller was rapid and his movements were quick. He tried to solve several issues when he encountered glitches such as freezing and jamming of Mario and Yoshi on level 1.

Learning. In the beginning, he did not seem to know when the enemies would come to attack, but soon he learned where to go, what to grab, how to kill the enemies, and how to jump onto Yoshi's back to "saddle" Yoshi. He spoke out loud as if talking to the game when he played. He sometimes would sit more straight and twitch his body when enemies were closely attacking Mario. He called out the name of the character on the 3rd time he played the first level, and he also referred to Mario by his name. For example, at one moment he said, "Ah, Yoshi just ran away." In this moment, he said "Run...there...stupid..." and then Mario "died" in the game. When he was on the "water level" and reached the end of the level a few times, he noted that "I played well...cool," and continued winning. Toward the end of the one hour, he was collecting more coins and more lives to gain extra points.

Glitch. After nearly 30 minutes of play, he encountered a glitch in which Mario, Yoshi, and an enemy froze completely and nothing moved in the game. He began pressing buttons on the controller with different combinations until the game started moving again. He did not say anything and continued playing the game.

In the final 30 minutes, he played the "water level." On this level, he discovered a glitch upon his first round of play: Mario disappeared from the monitor. He said at that moment of discovery, "Oh, this way I disappear and no one can nag me." By the 3rd time he played this level, he used the glitch and noted out loud, "same error," and then he discovered the key and tried to figure out what to do with it. By the 5th time, he discovered how to catch Yoshi, and by the 7th time, he reached the end of the level without dying. After this, he started collecting lives by playing from the beginning to the end of the level and collecting coins and mushrooms, and he always gained a total of 7 extra lives by the end of the level. On the 9th time he played, there was a jamming glitch

between the character and the key when he approached it. He tried to figure out how to pick up and move the key on the water level, even as time for the study expired.

1st Interview Data

Background. The first part of the interview was after Subject C played the videogame. The first questions in this interview are related to the subject's previous experience playing games, and Subject C talked about his background as a game player. He mentioned playing a platform game on Spectrum that he connected to "developing skills such as concentration, logic" (I1, Q1). He said that videogames were good influences because we can "develop motor skills ... such as sight, brain, parts of the brain, motor skills, and in the latest games that are more interactive games you can develop it" (I1, Q4). He also spoke about his favorite game, Super Mario Galaxy, in which he said that a person could develop imagination with it (I1, Q6). He said that a game called Prince of Persia influenced him while working on an assignment for his studies in architecture at the University of Architecture (I1, Q3). According to his account, this gave him some expertise when encountering consoles and videogames, even different from those he previously played, since he knew a little of the "language" of them.

Skills. In response to questions about skills development while playing the game, he said that he developed "some," but he could not pinpoint exact skills because it was too early in the experience (I1, Q10). Subject C said that he developed reasoning skills, and other skills related to self-discipline and self-reflection, and that when using a keypad, many skills are activated (I1, Q13-d). He also asked to skip the question (I1, Q13-e) that asks what skill(s) he did not develop while playing the videogame. However, earlier in the interview, he said he used skills he already possessed and compared reusing those familiar skills to riding a bicycle, as they are skills that are possible to recall and reuse (I1, Q10). In relation to using new media literacy skills, he did not know if he used them or not, but he was more inclined to guessing that he did not use them (I1, Q14-2).

Skills in real life. Elaborating on his thinking about how he learned through trial-and-error, Subject C said if a person doesn't learn the first time, then a person will learn in the second or third time. He connected this experience with learning through pain; he said that a person does not take long to comprehend the danger of fire (I1, Q13-h). Later, he reiterated the idea that one cannot learn the same skill twice, but it can be developed. He gave the analogy of learning to walk, learning to drive or ride a bike, skills that can be recalled even after several years' dormancy (I1, Q14-1).

Learning. Subject C also said he used previous skills acquired, such as experiences in other games (I1, Q13-g). Subject C also said he learned not to make the same mistakes in the game. He mentioned this idea of learning in a trial-and-error environment in which repetition happens until the learning is achieved (I1, Q10, Q13-h, Q14-5). This was a theme to which Subject C returned many times. According to his interview, trial-and-error during game play was important because making these errors led to success in the game. He mentioned that not giving up was imperative in the trial-and-error situation, and that one must "sacrifice" and also control one's tendency to be annoyed or irritable when the character dies, or is harmed, or when encountering other difficulties in the game. (I1, Q14-5). He mentioned this many times in this interview.

Glitch. In relation to encountering a glitch, he mentioned that when he found some glitches, the way he approached it was to try to avoid them (I1, Q7). With the "water level" glitch when Mario disappeared in the monitor, his process, he said, was to approach it without feeling annoyed by it, and he only used this glitch once. After that, he avoided the glitch and took what he called a "more honest" stance in the game and completed the game without using this glitch. At the same time, he said he wanted to collect every possible coin, and attributed this need to being what he called a perfectionist (I1, Q14-3). Once he discovered the glitch, he chose to avoid it because he referred to it as the "honest" way. He also pointed out that he didn't know the meaning of glitch *per se* and that there was a difference between the more serious technological errors and less

serious ones. He did not know if there were a lot of glitches in the game or not, or if the game just functioned with them anyway (I1, Q14-9). At one point, he asked me, “By the way, could you tell me if you saw a [glitch]?” (I1, Q12).

Experience. Subject C said that playing the videogame made him feel nostalgic, since the music and graphics reminded him of his childhood (I1, Q9), and he talked about being at a concert recently where the music was composed for Nintendo. The memory of this concert emerged while he was taking part in this research playing SMW, and he was reminded of being a child and growing up in real life (I1, Q9). He also mentioned how the old graphics (low resolution graphics) in games like SMW gave him space to imagine, and fill in the gaps, which is something that does not happen with videogames now because of their high resolution imagery (I1, Q9).

Personal Journal and Visual Essay Data

After the 1st interview, Subject C was asked to create and keep a personal journal, then to create a visual essay. The purpose of asking for these responses was to have a more varied pool of hard data to analyze, in order to apply the coding to the subjects’ processes and differing ways of approach, and to see which skills (if any) they used. I also thought they might enjoy the creative activities, and that this, too, would fuel the data and provide insight. After 31 days, Subject C showed me his personal journal and visual essay. In the project, he superimposed the personal journal and the visual essay together in one.

He explained that there was not a set order to be read, that the pages could be randomly paired or read in any order. His personal journal and visual essay were merged into one piece, comprised of 15 pages printed on both sides. Also, one of the pages was folded in half, into which were other pages printed on A4. Inside were the black/yellow pages first, then black/white pages in the middle. All the pages were placed inside a transparent envelope with vinyl letters stuck on top. These letters were “E, RUN, G, &, a,

LD, FK, N, P, V,” and one decal in the shape of an eye. A price tag also was on the outside of the envelope: “3 Euro” (Appendix A).

2nd Interview Data

Process/experience. In this 2nd interview, Subject C said that the playing of SMW for one hour was enjoyable, comfortable, and fun. It brought him feelings of nostalgia not only to play SMW but also to create the visual essay and personal journal. Subject C combined the visual essay and journal into one single project. As he said, the process was about exploring his past experiences with Nintendo games and various arcade games from the 1990s, which he remembered as well as his time as a student in architecture, through a collage approach utilizing mostly printing technology to achieve his final product. Subject C called attention to the process and the greater importance of the process over the final product. He said that it was hard to summarize his thinking processes as related to playing the videogame, so he came up with the process of transmitting that through a repetitive association of images from old arcade games, such as Mario Cart, Space Invaders, Pac Man, and the experience of different media that were organized as “a set of memories after playing” (I2, Q1). He said his visual essay and personal journal was a place of meeting various disciplines such as music, games, comics, architecture, literature, and video, among others (I2, Q3).

Subject C also connected the moment of playing with the music of the 1990s by the group Aphex Twin. He compared his creation to a tree and how the branches depart from the trunk and get lost in sight (I2, Q2). He also pointed out that he does not like to write, which is why his journal/visual essay is more visual (I2, Q8). For Subject C, the act of playing the game was static, but in the creation of this process, he used the Internet, the printer, the scanner, and the computer to transfer and create his visual essay/journal (I2, Q6). He referred to this as a dynamic act, whereas the playing of SMW he said was “static”:

... the act of playing is a static act, stationary and to create this piece you have to research in the internet, transfer that to a printer and scanner, a computer, continue to search the Net, get a disc and print, which is more dynamic than playing the game. (I2, Q6)

Skills. Subject C stated that “failure” was important for learning. Subject C stated specifically that he used concentration, and he mentioned failure as a way to learn in the game. He said that failure was necessary to learning and improving and overcoming it. He compared the experience of playing SMW for this study with real life. The example he gave was related to concentration while driving or exploring: “I think games are good for those who have problems with concentration” (I2, Q7).

In question 9, (fill-in-the-blank), Subject C stated that he developed and combined media literacy skills related to printing (I2, Q 9-j, 10-2), computer (I2, Q9-g, 10-8), and Internet skills (Q10-2). He also mentioned that he used previous skills related to “music, drawing ... copying” (I2, Q9-h). He also pointed out how he acquired the skill of “overlapping images...” (I2, Q9-e). He learned to improve his printing process (I2, Q10-1). He also learned to “use different ways to express” himself (I2, Q10-5).

Critical thinking. He also said that when creating his journal and visual essay, he used critical thinking with a self-criticism approach (I2, Q10-9), because, as he said, “this association of images requires critical thinking, reflection, some association between them, and that is critical thinking.” He mentioned that both thinking and reflecting had occurred in the process of his personal journal and visual essay: “The final product reflects the process, the process and thinking” (I2, Q1).

Learning. Subject C also said that after playing SMW, he “learned not to make the same mistake through repetition” (I2, Q6); however, he believed that a person needs to fail so then later they can do better (I2, Q7). He also said that he “learned that you can use different ways to express yourself, different forms of printing and process, and this technique was chosen by me” (I2, Q10-5). Subject C related this also with the phrase, “real life”: “I think the idea of never making mistakes is impossible because people have

to fail to learn and do better later. In real life maybe we have to be more open to things...” (I2, Q7).

Glitch. In relation to encountering glitch, Subject C mentioned that during the process of creation of his personal journal and visual essay, he encountered computer, printer, scanner error, stating that “everything stayed in the pages, all the glitches” (I2, Q10-3). For Subject C, the errors he found were his own errors and not errors from technology, but he said they were also useful errors that he could incorporate into his visual essay and personal journal. He compared himself with a glitch, the error in the equation. He said, “I was the glitch,” also “the error is in us” and “I am the glitch” (I2, Q10-11). He also talked about how errors could bring good outcomes and experiences for the future, and how error is related with different paths and options. Subject C said that we make attempts in life and learn from those mistakes, and then change our next attempts to get different results. He approached the SMW videogame “by making mistakes, attempts, one after another in a different way” (I2, Q11).

Summary

For the most part, Subject C explored the idea of error in his visual essay. His responses in the second interview were more focused on the glitch as an idea that he embraced by saying outright, “I am the glitch,” and spoke of errors in general as “useful,” with the ability to expand possibilities. Except for a few hand-written details, his visual essay was comprised of photocopies and collage. He said that because he was an architect, he thought about his mind itself as if it were a house, and he began to think about all his interests in this mind-house. He mentioned that he considered all the areas of his mind to be places where one can live, among other rooms such as music, architecture, literature, and games.

In the first interview, he talked about hardware and software errors. He spoke about these errors as experiences he had had but said he had not considered them very much.

Later, after the 30-day period elapsed, he said during the second interview that he considered himself as a glitch while using the technology. He talked about a printer error that occurred in the making of his visual essay, which he decided to keep, though he did not mention why. He spoke to the importance of making mistakes in the second interview, and how necessary errors or mistakes were for learning. In the first interview, his answer to the same question focused only on the glitches brought about by the technology.

Subject S

Subject S was a student majoring in Biology who wanted to specialize in Marine Biology. Before he played the game, he mentioned that it was the first time he had ever played SMW. As he explained it, he had played Super Mario Brothers in the Nintendo console and only once, years ago. Super Mario Brothers is an older game from the same series.

Video Data (One Hour Playing the Super Mario World Videogame)

Skills. While observing the videotape of the one hour of game play, I watched as Subject S pushed and pulled at the controller and **the** Mario character “died” quite a few times at the beginning of the level play, and he often had difficulty with coordinating the pushing of buttons with the motion of jumping and did not reach the end of the level before Mario “died.” However, this changed as he played and became more familiar with the controller, and he learned to beat the level. Subject S played with baby Yoshi, nudging it with the Mario character, and learned how to get the baby Yoshi to grow up and jump onto its back to ride Yoshi by trying several methods until he succeeded. However, once he discovered this (on the water level) and solved this puzzle, Mario “died.”

Learning. Between the first few times he played (and “died”) and the last, his movements were at first more tentative, experimental, changing to more sure movements in his use of the controller on these two levels explored in SMW. While Subject S was playing the videogame for the first time, when the character Mario died, he swore, “How do you play this? He only jumps,” and, “Fuck, I died, how do we play?” The second time he died he said, “Fuck, don’t know what to do.” The third time he died, he sighed and said, “Don’t know what the controller does! How I am going to play this?” The fourth time Mario died, he sighed, “Really?” After he said this, Mario was hit by an enemy, shrunk and died. He was on level 1. The fifth time Mario died, he said, “Fuck,” while losing Yoshi (Mario’s dragon-horse) in the game. At this time, a glitch happened and Yoshi disappeared from the monitor; he said, “Fuck, now Yoshi disappeared.” The sixth time Mario died, he said, “What is this shit doing here?” while Mario in the game was near a tube, then he died and he said, “Why did I die? Oh ... there is a time limit.” On the seventh time, he said, “Poor thing ... can’t kill it anymore,” when Mario died trying to kill the rugby player enemy. On the eighth pass, he mentioned this was the first time he had ever played this videogame, and he scratched his face three times, and then three more times while playing. That was the first time he beat the level. He completed the level within 20 seconds of the timer’s end. If Mario would not have reached the end within the time limit, Mario would have died.

As with all subjects, Subject S played level 1 for 30 minutes, followed by the water level for 30 minutes. By the time he was playing on the water level, he played the game without dying and received 25 extra lives, which won him a bonus game. He played on this level for 30 minutes and only died once. He found a way to get a grown-up Yoshi and go to the key area in which a glitch occurred and Yoshi got half of his body inside the wall, and he said, “Does this do anything?” He ended the game with 26 extra lives and only lost one life. While playing this videogame level, in the tenth time he mentioned, “This is so boring. Can I go to another level?”

Glitch. On the first level Subject S played, he encountered the same glitch where Yoshi the dragon or horse character disappeared from the monitor. This allowed him (as Mario) to maneuver around all the enemies with this shortcut, while riding the Yoshi dragon. Following this discovery, he never lost any lives and even began collecting lives.

On the water level, there was another glitch with Yoshi eating the apple, where the apple appeared stuck inside one of the tubes, instead of outside or in a different area of the background of the game. From the beginning, he found the glitch where he can disappear from the monitor and pass all the enemies, and also he discovered the glitch where there is a hidden key in the end, which Mario picks up and uses. He learned how to get a grown up Yoshi and go to the key area in which a glitch occurred and Yoshi got half of his body inside the wall, and he said, “Does this do anything?” He was able to avoid the glitch, finishing the game. He reached the end without dying and said, “This is boring. I really don’t like these kinds of little games.” He utilized the disappearing glitch very successfully, using it to avoid most of the enemies on this level, gaining a total of 26 extra lives.

1st Interview Data

Background. I conducted the first part of the interview after Subject S played the SMW videogame for 30 minutes on each level. The first question I asked was about the subject’s previous experience in playing games. Subject S mentioned how videogames helped him with the English language and with solving puzzles (I1, Q6). In relation to the SMW game he played, he thought this was a good thing, but only for children, not for adults like him (I1, Q14-7). He said this several times, and that it was too boring, or too easy.

Skills. As far as skills development while playing the game, Subject S said that he did not learn many skills. According to Subject S, the only skill he developed was getting faster and killing enemies in the game (I1, Q13D). He used the term “skills” in a broad

and general way. He previously mentioned that he used his memory to know when enemies will appear, and also that he developed that memory to advance further in the game, avoid enemies, and through a process of trial-and-error, become more proficient in the game (I1, Q9). Subject S mentioned that he made mistakes in the game because he needed to develop some skills (I1, Q13-h). He stated that SMW was good for learning skills such as the techniques around videogame fighting and battling. He also mentioned that SMW was helpful for “problem-solving.” Subject S reiterated his opinion that these were children’s skills, and not for adults like him.

Skills in real life. Subject S mentioned more than once that the game was “basic” and could not contribute to skills in his real life (I1, Q13-f). He said that he could not connect the experience of being proficient in this game with helping him in real life because he used only basic, simple reasoning in the game, and it was not elaborate or complex enough to use in real life (I1, Q10, 11).

Learning. In relation to playing SMW for one hour, Subject S mentioned that he learned how to use the game controller during the game and also how to play the game; however, he said it did not take him long to learn and to be proficient. He stated that he had to try different things, such as the “buttons on the controller ... techniques to be faster, kill enemies” and learn through his errors in order to use the controller, find what needed to be done in the game, and through this trial-and-error process, he gained experience (I1, Q11). In question 13, fill-in-the-blank, Subject S mentioned his boredom and sense of repetition in playing the game. For the True and False / Why section, Subject S said that he developed skills learned while playing what he called “foreign games,” such as helping him to “better understand English ... and help me resolve puzzles” (I1, Q3) on consoles and computers, but not from the Internet (I1, Q1, 2, 3, 14-4).

Glitch. When he was asked if he had ever encountered a glitch in a videogame, Subject S pointed out that he had found some glitches before, such as in the game Fallout,

the character's legs disappear and the head turns upside down. Also he mentioned the game *Crysis*, where the character walked through walls. He was upset when that happened, and that it was a mistake that should not happen (I1, Q7). He said, raising his voice a little, that glitches should not happen because someone programmed the videogame incorrectly. In relation to encountering a glitch during his playing *SMW* for this research, he referred to the glitch where Mario disappeared from the screen. Subject S said that he definitely used the glitch to quickly accomplish Mario's tasks and complete the level (I1, Q12). He once again mentioned that he took advantage of the glitch in order to give himself an edge that would allow him to win faster (I1, Q13-d). He said that using a glitch meant to take advantage of something, either a person or situation, and that people who use a glitch lack ethics, and are ethically "wrong" (I1, Q14-3).

Experience. Subject S spoke multiple times about how the game was "basic," a child's game, and that he was an adult. In Question 8, he said that he was not stimulated by the game play in *SMW* during the two 30-minute segments. He mentioned an impatience with the redundancy of the game, and that he felt he was too mature to play a game meant for much younger players.

Personal Journal and Visual Essay Data

After the first interview, I asked Subject S to create and keep a personal journal and to create a visual essay. After 29 days passed, he showed me his personal journal and visual essay, comprised of a 1-page written journal and a 1-page visual essay drawing. This 1-page journal was handwritten. His visual essay was a color drawing of a person playing the videogame on the water level in which Mario used a shortcut to reach the end of the game. There was an arrow pointing from the left side of the television screen that reached out and around the television, then pointed to a position at the right end of the television. There were several readable words like "shortcut," "start," "finish," "Mario," "so easy." A controller was visible in the person's hands and a monitor in which the

game character Mario goes outside the monitor. This drawing was done using color markers, and in the monitor were skeletons of three fish and a star. The drawing was concentrated on the upper left-hand side of the paper (Appendix A).

2nd Interview Data

Process/experience. In this interview, Subject S said that the experience of playing SMW for one hour inspired him to use drawing in his visual essay because “we can express our ability to observe something and transfer it to a drawing.” He said his drawing was a reflection of what happened to him in the game (I2, Q8). Subject S said that through drawing, an artist can create an expression readily understandable for all people (I2, Q10-7). On the fill-in-the-blank portion, Subject S said that he did not improve his painting skills, and specifically mentioned how he developed his drawing skills. He stated that he developed the ability to transfer his very specific experience of playing the videogame into a drawing on paper. He developed the “ability to portray something that happened in the game and to transfer it into a paper in a drawing, and the image has everything to do with the game” (I2, Q9-d). He mentioned that this ability to transfer his experience into a drawing was through the skills of reflecting and analyzing (I2, Q9-e, 9-I, 9-J).

Skills. Subject S said that he developed previously acquired skills, also that he discovered a glitch and used it. He said he learned some gaming skills pertaining to this particular videogame (I2, Q5, 6, 7). In the fill-in-the-blank part of the interview, in the first question (I2, Q9-A), Subject S stuttered and said that “I did not learn....” Then there was a silence of 30 seconds, after which he said, “I did not improve my drawing skills.” He said he learned to transfer his thinking onto paper (I2, Q10-4, 9-d). He said that he used previously acquired skills of drawing, and in Question 10-2, he said he developed drawing skills and also reflective capacities. Subject S asked to skip one of the questions, 9-k, pertaining to what he did not develop in his personal journal. In this question, he let

out a long, sustained vocal note, picked up his personal journal comprised of one page and then said, “I did not develop my intelligence,” and “don’t know,” and then after some silence, he asked to skip the question. I honored his desire to skip the question.

Critical thinking. Subject S said that he had “reflected on the role of videogames in training people” (I2, Q2). He also mentioned again that he developed reflective capacities (I2, Q10-2) and also “the ability to reflect on what happened in the game” (Q10-4). He spoke about how he developed thinking through analyzing his experience of playing SMW for one hour in a way that he reflected and criticized what happened through the personal journal and visual essay (I2, Q9-I, 9-J,10-9, 10).

Learning. Subject S also stated after playing SMW that he learned how to respond and react to the challenges and adversaries specific to SMW in that videogame world, and also reinforced “other basic techniques” that he had previously acquired. He also spoke to glitch as having a learning component, and specifically used the word “learn.”

I learned that this glitch allows the player easily to get to the end of the game, and that was it. I learned this useful technique of this game, that I could kill several enemies using other enemies like a stone, and through that to kill the others. I learned to kill stronger enemies. (I2, Q6)

He also mentioned that he learned to connect the videogame with real life, for example, he drew an analogy between the glitch in SMW that helped him beat the level quickly and real life. He said that, like this glitch, in our real lives it is more convenient to “choose the easier way out” (I2, Q10-1). Further along in the interview, he said that he learned nothing new, but that he developed new skills (I2, Q10-5). At the end of the interview, he said again that he learned to reflect and think critically about what happened in the videogame (I2, Q10-10).

Glitch. Subject S mentioned that the most interesting moment of playing the videogame was the glitch on the water level. He stated that a game can help people in real life. The example he gave was related with game skills he called “reaction-response” that he can use in reality, like when driving a car (I2, Q1). In the true-false/why section,

Subject S observed that he found parallels in the game with real-life experiences, and also mentioned how he took advantage of the glitch, once again comparing the glitch situation to real life: “I took advantage of the glitch ... option” (I2, Q10-1). Subject S described his drawing as pertaining to the water glitch and stated how funny it was, laughing about it out loud. He then mentioned that it was a “ridiculous situation” in the game, and how it was “effortless” to take the shortcut and reach the end of the level (I2, Q3, 4, 5). He also said that if he found another glitch in a different game, he would use it to reach the end of the game without playing it the more challenging way (I2, Q7).

Summary

Subject S began with some difficulty in using the controller, but he quickly gained the ability to pass the level, and not only that, he began to collect extra lives. He encountered several glitches along the way and used them, including the glitch where Mario disappears above the monitor but game play continues with Mario gaining total immunity to enemy attacks while in the space above. Subject S also encountered the key glitch and used this as well. He did say that he was aware of his SMW playing skills improving during play.

He referred to SMW as a children’s game and also referred multiple times to the use of glitches as a negative. He made clear that he felt using glitches was like cheating in real life, and that they should not appear in any videogame. Subject S said that the water level glitch was the most interesting part of playing.

Subject S created a one-page personal journal as well as a one-page visual essay. In the journal, he mentioned that the game served little to help him in a real-life context. But he did write that there are “some games that allow us to develop our thinking,” just that SMW was not one of them. In his interview, he expressed his thought that some media skills were used in the playing of SMW, and also in the second interview that he

developed thinking and reflective capacities in the transfer of the experience into a drawing.

In his visual essay, Subject S's drawing refers to the shortcut on the water level in which he used a glitch to advance in the game. Subject S made repeated statements about his opinion of glitches. He felt that using glitches was a kind of unfair shortcut, and equated this with real life. Subject S did, however, use the glitch to advance in the game.

Subject I

Subject I was a first-year fashion design student in a recently opened private school. Her background, she explained, was design in communication and graphic arts. She explained that she had changed her employment frequently, and had worked as a clerk in a shopping mall photography shop. She told me that she loved that job, but after a year, they moved her to another shopping mall, where her coworkers were unprofessional and customers had a lot of complaints. She had quit because some photos had been damaged as a result of her coworkers, and as she explained, she could not take the stress. She had been a student a couple of years prior at a different school, where she took a one-year professional design course with an internship. She said the classes were good but the internship did not go well. She said those in charge of the internship did not want her to do anything, and she complained to the school. For this, she received an incomplete grade. In contrast, she was happy with her current fashion course; however, she pointed out there was a lot of work and assignments and that she was not used to the pace. She also said she was inexperienced in playing videogames in general. She said she had no familiarity with this game, SMW, and had not played videogames on consoles before.

Video Data (One Hour Playing the Super Mario World Videogame)

Skills. While observing the videotape of the one hour playing the video, I noticed that Subject I began with difficulty finding the right buttons to correspond to Mario's movements, as she pointed out in the beginning, "How do I play this? or use the controller commands?" While she was playing on the first level, she "died" a total of 20 times. Toward the end of the 30 minutes, she was able to reach the end of the level for the first time.

During the second half (on the water level), she "died" a total of 33 times. During these 30 minutes, her Mario character "died" instantly upon landing in the game until her ninth try. Gradually, she improved to keep Mario alive long enough to explore the level more between the tenth time and the twenty-third time, when she reached the end of the level. On the twenty-third time, she finished the level for the first time. She then finished the level three more times. The next time she was able to complete the level was the thirty-seventh time.

Learning. In the beginning of each level of game play, I observed how she pressed many keys on the controller that corresponded to Mario character jumping and other actions, while exclaiming out loud how difficult it was. From the fourth to eleventh times she was playing on the water level, she exclaimed sentences such as, "It's hard ... I'm going to die ... where is he?" On the twelfth time, she died, and she asked me, "What should I do?" I did not answer, just as I did not answer or interact verbally with any other subjects during game play. On the fourteenth time she played the game and died, she said, "I bet I'm the dumbest person you have had until now." Again, I did not respond. On the fifteenth time she played the game and died, she said, "Don't understand why I cannot do it." She won for the first time on the twenty-third try. On the twenty-fourth time she played and died in the game, she swore, "Oh, why? They always eat me...."

Glitch. Subject I noticed the freezing glitch on the first level (Mario becomes immobile) and mentioned that she was unable to move the Mario character. "Oh, I can't

move it,” she said. “What do I do? I will wait for it to disappear.” Soon after, the freezing glitch stopped and she continued playing. However, she did not say that she recognized a different glitch, which is where Yoshi pushes the apple with his tongue out of reach. I also observed that she did not react when the apple slid onto a hidden layer in the game space, and she continued to play without comment. But on the twenty-seventh time, when Mario died, she asked, “Oh ... what if I go back inside the tube? Can it be?... Or if I go down, can it be?... there is nothing!” On the last time she played and won, the thirty-seventh time, she swore several times, saying, “The key takes me nowhere! What about now? Fuck ... shit ... look at this shit.” On this thirty-seventh time, she found the key and tried to put it in the key hole but missed, and lost it into the abyss. During the water level, Subject I did use the glitch where Mario disappeared above the screen, and finally advanced in the game navigating Mario through the end of the level. She had completed the one-hour time limit for playing the videogame. When she got up, her posture was less straight than before, and she stated that she felt disappointed in her performance.

1st Interview Data

Background. For the first part of the interview, which was about the gamer’s background, Subject I talked about her background playing Warcraft. She said that she did not learn anything playing the Warcraft game. She said all of this while laughing (I1, Q1), and also when mentioning her current favorite game, Bejewel, which she played on the Facebook website. Bejewel is a pattern-recognition game that is not stressful for her (I1, Q5). She mentioned that she only learned “visual patterns” when playing Bejewel (I1, Q6).

In relation to the notion of whether videogames are good or bad, she said that videogames like SIMS (a sandbox-type character simulation game) are good because they give a strategic point of view, and shooting games are bad because of their violence (I1, Q4). She called attention to how fun and frustrating and irritating her experience was

during the one hour playing of the game. There was a mixture between the relaxation she felt when she won the game and the irritation when she lost (I1, Q8).

Skills. Throughout this one hour playing of SMW for this research, Subject I also mentioned that she did not have the hand-eye coordination needed to play and win. She remarked that she tried to experiment with different key combinations in the command controller so she could “try to discover a way to pass this level, to solve it” (I1, Q8). On the thirteenth question (fill-in-the-blank), Subject I said that she developed and acquired “motor skills” (I1, Q13-b-d), and at the same time made a sexual gesture with her right hand while saying the phrase, “motor skills.” She then expressed in a lighthearted way how funny it was that her gesture would be on the record in this research. She also remarked that she used her memory, that she memorized when “animals” (enemies) appeared (I1, Q13-f). She also talked about using keyboards and joysticks, which are used in other programs and computers (I1, Q14-2). In addition, she said she developed motor skills, manual dexterity, problem-solving (I1, Q14-4), and Internet and computer skills (I1, Q14-8). She also thought that in playing videogames, we need computer skills, and gave the example of how her mother did not have the skills to use the Internet (I1, Q14-8). She also used her “previous skills to avoid problems” (I1, Q13-g).

Skills in real life. Subject I stated the opinion that she improved coordination in her right and left hand. The example she gave was that “Mario would jump ... more in the game” (I1, Q10). She said she could use this in real life, for example, in playing drums or piano, activities that also require “hand-eye coordination” (I1, Q11). She also thought that she developed “motor skills” and “problem-solving” (I1, Q14-4), and she said that in the future, she could use the “manual dexterity or visual memory” developed (I1, Q14-6). She also compared this experience of playing a videogame with, in real life, going to see a psychiatrist because “I have to continue my path walking straight ahead” (I1, Q10). Another example she gave was about learning mathematics while playing SMW. She

stated that SMW could be useful for the built-in exercises in math calculations. She gave the specific example of counting fish or counting the scoring in SMW. (I1, Q14-7).

Learning. Subject I said that, despite her frustration in learning the command controller, she gradually took more risks with the Mario character and approached the playing in different ways. She mentioned that she varied her approach in an attempt to “solve problems.” She gave the specific example of maneuvering Mario down deep in the water to pick up the key (I1, Q14-1). She also used memory to remember when to jump and when and how to avoid the enemies (I1, Q9). She pinpointed that using her “previous skills to avoid problems” was also important to play the game (I1, Q13-g). On question 14 (true/false and why), Subject I said that she learned to “take more risks and try to solve problems in different ways” (I1, Q14-1). She mentioned “motor skills” and “problem-solving” by those names.

Glitch. Subject I said that she had difficulty determining what was a glitch and what was not. She explained that when Mario disappeared above the screen, she wondered if this were a glitch or an “intentional” part of the program (I1, Q14-4). She did notice and acknowledge at least one technological error: “There were errors with the Dragon [Yoshi]. When the dragon appeared, Mario froze, in the first and second game. When the dragon is born, [hatches from the egg] whatever you call it. That was the only one that I was aware of” (I1, Q14-9). Subject I also mentioned that another time, she encountered some glitches online with an Internet connection, and she solved the problem by avoiding them (I1, Q7). She also mentioned the freezing glitch of the characters Mario and Yoshi on both levels (I1, Q12).

On the thirteenth question (fill-in-the-blank), Subject I referred to her own human playing error as a glitch. She said that when she approached what she called the glitch at the moment she was controlling the Mario character, she dropped the key into the abyss. However, this occurrence was not a result of a glitch or technological error; what she describes as a glitch that she encountered was in fact her own playing error (I1, Q13-h).

Experience. Subject I paid a lot of mind to the music when playing the videogame SMW. She said that the music gave her clues in how to play the game, and the more she listened to the music, the better she became at tactics such as avoiding enemies, collecting points, and knowing when Mario was weakening (I1, Q9). For Subject I, the music was the key to her gaining better control over the Mario character and understanding how to win at the levels.

Personal Journal and Visual Essay Data

After the first interview, I asked Subject I to create and keep a personal journal and a visual essay. Twenty-six days later, she showed me her personal journal and visual essay, which were separate objects. Subject I was the only subject who actually brought me the notebook and used it as a journal. Her personal journal was comprised of ten pages of drawings without text, and her visual essay was comprised of a one-page printed line drawing. The visual essay was a black-and-white line printing of geometric free shapes, set in a juxtaposition of lines and shapes. She explained that she took all the lines from her journal and juxtaposed them on this one visual essay using tracing paper (Appendix A).

2nd Interview Data

Process/experience. Subject I stated that the personal journal and visual essay were both interesting and difficult, and that she would do more if she had time. She said the difficulty was in trying to put into words what she learned, especially with how the game related to music, and facing that difficulty of expression and her low level of technical ability at the beginning of game play. She mentioned that she would like to color code the visual essay in a way to explore it more fully (I2, Q4). In question 5, she said she wanted to color the visual essay to signify the experience of passing the levels of the game, and the musical moments. This was exciting for her, she said, because she was proud of how much she improved her performance of the Mario character during the two

30-minute sessions of SMW game play. For her the experience of creating a visual essay was also enjoyable (I2, Q10-7), and this process she believed she could use in upcoming projects (I2, Q10-6).

Skills. In relation to skills development, Subject I stated that she used her memory and reflections in the game to create what she called “childish drawings” because they were not perfect for her and she hoped the drawings were not “going to be judged or criticized” (I2, Q1). She vividly remembered the music and tried to mimic the graphics in the game and the design as closely as possible to what she remembered and their relation to the music in moments of the game (I2, Q2). In Question 9 of the fill-in-the-blank section, Subject I stated that she developed and experimented with skills of different methods of drawing and using decals (I2, Q9-d). She also mentioned that she used other skills previously acquired in the university, such as experimenting with new materials (I2, Q9-h), and that she could use this experience of “tracing paper and decals” in real life (I2, Q9-g). She later pointed out that she could use the idea of the personal journal in the future for other projects to develop skills such as creativity or drawing (I2, Q10-6). In Question 10, a True-False/Why question, Subject I said she used techniques previously acquired (I2, Q10-1), but then afterwards she stated that she did not develop any skills and that she already had them before and used them, such as “the printer, scanner, how to copy, data and turn the pages” (I2, Q10-4, 10-8).

Critical thinking. Subject I stated that she believed the personal journal caused her to reflect upon what happened during the course of playing SMW for this research. She said that keeping this journal helped her collect and organize her thoughts, and also see how those thoughts looked on paper. Subject I noted that this made her collect her thinking twice (I2, Q10-10). For Subject I, among the kinds of thinking she mentioned was that she was self-criticizing. She mentioned her self-criticism in SMW game play and also in the visual essay and personal journal activities:

Of course I'm criticizing, and during the process of creating them after drawing back and forth also, I am criticizing. So, I thought what could I have done differently in the process of drawing them.... I never related the drawings with the experience of real life because I believe that this had to be only related to the game, right? I explored the game more. (I2, Q10-9)

Learning. Subject I said that after playing SMW, she learned motor skills, music, and—related to the soundtrack of SMW—she learned tricks or tactics that helped her in passing the levels in SMW, or learned how to attune herself more keenly into learning the tricks of the game, all of which might help her pass levels and gain points more quickly in the future. She stated that she believed she used none of these skills in real life (I2, Q6). Later, during the same interview, she said that she learned nothing new (I2, Q10-1, 10-4, 10-5).

Glitch. When it came to her own visual essay, Subject I referred to her unintentional printing errors of a Post-It note slogan as something that was “wrong,” and that she would not use it as part of her final product. The same applied to other printing errors, whether it was technological error or human-derived error, and she referred to these as a “mistake” or “wrong.”

In relation to encountering a technological error, she spoke in a flustered or hurried way: “I already answered before what I found in the game” (I2, Q10-11). She connected glitch with her real-life experience and the glitch encounter while she created the visual essay. She explained how she encountered and solved the errors:

In the creation ... in the beginning in the first attempt there was a mistake. The copy was pale, and I could not see any of the lines. When I came back the second time and I put the sheet over another scanner, so all that was printed on the same page. Yes, there was a technological error. There were some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it in the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1st page

[tracing paper], to cover the page and not be transparent. This sheet had a “Post It” slogan written on it “to use for scanning with tracing paper.” I put the part of the “Post It” on the wrong side and printed it. I’m not going to bring a drawing with a Post It saying “to use ... with tracing paper ... So, this was another glitch, but a mistake on my part. (I2, Q10-11)

Summary

This was the first time Subject I had played a console game and therefore the first time she had played SMW. Subject I mentioned during the interview that she was frustrated with her lack of ability, but she felt that she improved and eventually gained much better control of the Mario character and of game play. Subject I noted that, although she dealt with this technical frustration as an adult, if she had been a child she would have acted more physical and immature in coping with this frustration. As a researcher, I made sure to check in with her to see if she was still okay with continuing the study, and she indicated each time that she was fine. During the interview, there were moments she paused, but I allowed her all the time she needed to answer and never rushed or pressured her into answering any questions.

Subject I said that she had improved certain skills. She mentioned skills with moving her hands and that this could also be used in real life, especially with musical instruments. She mentioned that “trial-and-error” was what she was doing in pressing different key combinations in attempt to better gain control over the Mario character, although she was irritated with her lack of success in that department. She also said she used “manual dexterity,” memory, and “problem-solving” skills. Subject I said she was particularly attuned to the music in the game, and made the analogy of playing the drums or the guitar as related with manual dexterity in the game. She said that she memorized enemy movements based on the music.

With the visual essay, Subject I referred to an error she made in the printing process as a mistake, and said that she did not want to bring her finished visual essay with that printed because it was “wrong” and printed on the “wrong side” (a technical note

from the “Post-It”). Subject I said that in videogames, as with real life, one must always continue in a forward direction.

Analysis Coding

For the purposes of this chapter, I will not include the full extent of the coding as applies to the data but have included it in Appendix C. The reason for this is because while useful in revealing great detail, I found it much more readable to show the data as presented in Tables 2, 3, and 4, which is a distilled and synthesized version of how subjects responded to the glitches in playing SMW.

Final Synthesis Coding

In what follows, I have synthesized the codes to show how the data respond to the larger analytical categories of my research, simplified here and presented under Tables 2, 3, and 4 (Decoding, Analysis, and Solution). Each table contains a chart for each subject. Along the top are three columns labeled Decoding, Analysis, and Solution. These tables were constructed in order to illustrate at a glance what the data showed in how subjects responded to the videogame SMW. At times, the subjects elaborated on terms they used (such as “motor skills,” etc.), and at other times they did not.

Table 2

Relationship of Subject C with the Codes

Decoding (encountering an obstacle or glitch)	Analysis (of obstacles and glitches)	Solution (responses to an obstacle or glitch)
<p>-Said in the beginning of the game, he didn't know where the glitch is coming from, and then found it (I1 Q7).</p> <p>-Said he discovered that Mario could disappear the screen (a kind of a glitch) but he isn't sure. Said glitches aren't obvious (I1 Q12).</p> <p>-Said he thought Mario should disappear off screen when found this glitch (I1 Q14-3).</p> <p>-Said not sure what a glitch is, and it can be unnoticed, but it can be discovered also (I1 Q14-9).</p> <p>-Said we need to concentrate, repeat things while playing if we want to do them well (I2 Q7).</p>	<p>-Said that videogames "...help develop motor skills...such as sight, brain, part of the brains, motor skills..." (I1 Q4), also "...imagination..." (I1 Q6), and "... perception and reasoning skills in games, self-reflection and self-control..." (I1 Q13-d).</p> <p>-Said he learned to avoid mistakes when playing SMW, compared with trial-and-error that led to end the game. Persistence and repetition necessary in process until one succeeds (I1 Q4-5).</p> <p>-Said he did not know if in the water level when catching a key, if encountered glitch or not, but after thinking about it, said it cannot be a glitch (I1 Q12).</p> <p>-Said it's too easy to use glitches and they can come in graphic ways or visual ways (I1 Q12).</p> <p>-Said he did not learn the 1st or the 2nd time to play the game, but learned 3rd time and compared the learning to when a person touches fire and gets burned (I1 Q13-H).</p> <p>-Said when playing a game he dealt well with controlling irritation and emotion and never threw the controller into the air (I1 Q14-5).</p> <p>-Said the experience of playing SMW compelled him to think about what he did in a psychological way (I1 Q14-6).</p>	<p>-Said to finish the level Mario needs to eat all items, catch all items to get max score and reach end of level (I1 Q14-3).</p> <p>-Said he failed several times in one place in the game and learned not to make that mistake in the same place. Learned not to go to that place in SMW (I1 Q14-5).</p> <p>-Said the process and final product (visual essay, journal) were summarized together because the process is just as important as final product. He said that repetition, overlapping, different images from books and daily objects were used with the computer, internet scanner and printer. (I2 Q1)</p> <p>-Explained that he assigned deadlines and constraints to create the visual essay and journal, since he said he was not provided rigid direction. It was the first time he did this type of activity, and decided to connect this 1h experience playing with SMW with his day-to-day experience. (I2 Q1)</p> <p>-Said that he could make glitch just like the machine, and believed this could bring good results and experiences in the future. He used these glitches in his visual essay, journal (I2 Q2).</p>

Table 2 (continued)

Decoding (encountering an obstacle or glitch)	Analysis (of obstacles and glitches)	Solution (responses to an obstacle or glitch)
	<p>-Said that the starting point was SMW and the association of his life, a set of memories and remembrances. (I2 Q4) He emphasized that the product reflects the process and thinking, and that the process and technology is equally important when creating the visual essay, journal (I2 Q1).</p> <p>-Said all persons have to fail to learn better in SMW, and in real life. Said that concentration learned while paying SMW can be used in driving and exploring (I2 Q7).</p> <p>- "...ability to express my creative process using a printer..." (I2 Q9-I).</p> <p>-Said that creating a visual essay, journal with associating images "requires critical thinking, reflection, some associations between them, and that is critical thinking." (I2 Q10-9)</p> <p>-Said he considered himself the glitch, not the technology, that he was the printing glitch failure. Said "the error is in us," and "I am the glitch." (I2 Q11)</p>	<p>-Said he embraced the glitch, did not throw anything in the garbage, and that all was used in his visual essay, journal. (I2 Q3)</p> <p>-Explained how he used the error while printing and printed again on top of images, said it reminded him of the ability to replay the game when the level reset (I2 Q10-3).</p> <p>-Said he tried to avoid the glitch choosing an alternative path (I1 Q7).</p> <p>-Said he could choose several paths and made mistakes, attempts, a process of repeating that brought variations and changes like ink blurs to reach the end of his visual essay and journal (I2 Q11).</p> <p>-Said when Mario disappeared, it was a kind of glitch. He did not touch the enemies and he used this to finish the game (I1 Q12).</p>

Table 3

Relationship of Subject S with the Codes

Decoding (encountering an obstacle or glitch)	Analysis (of obstacles and glitches)	Solution (responses to an obstacle or glitch)
<p>-Said he learned that glitch allowed to easily reach end of videogame. (I2 Q6)</p> <p>-Said from time to time a glitch could appear. (I1 Q7)</p> <p>-Said it was easy to learn how to use game controller experiencing each button for what it was. He tried and failed and tried again to kill enemies, learned to jump, grab objects, kill multiple enemies at once, move faster. Found a new character and how to control it – Yoshi. (I1 Q9)</p> <p>-Said he learned basic reasoning while playing SMW such as what the game controller button do, how to kill enemies. (I1 Q11)</p> <p>-Said he noticed in the water level neither he nor the enemy can see Mario (I1 Q12)</p> <p>-Said he took a time to learn how to kill rugby enemy. (I1 Q13-e)</p> <p>-Said he learned enemies could not reach him or kill him on water level if Mario disappeared from the screen (glitch). (I1, Q14-3)</p> <p>-Said he was quick with “response-reaction” while playing a videogame. (I2 Q1)</p> <p>-Said he “...experienced a glitch that consisted of Mario disappearing from the screen and quickly arrived to the end of the game...” (I2 Q10-11)</p>	<p>-Said videogames help improve his English (I1 Q3) and resolve puzzles. (I1 Q3, I1 Q5, I1 Q6)</p> <p>-Said glitch on water level of SMW was because videogame producer created a flaw in the coding. Compared that with the advantages of using the glitch and his opinion about them. Connected this with real life, that persons take advantage of others: “...people choose the easiest method to achieve their objectives. Ethics.” (I1, Q14-3)</p> <p>-Said videogames are good for children because “...they learn mechanism of fighting, defending, problem-solving...” (I1 Q14-7)</p> <p>-Said he reflected on SMW, thinks it’s a positive experience because one is reflecting on it. However, said it’s negative because this activity takes away from human connections, unlike playing cards. (I2 Q1)</p> <p>-Said error on the water level where Mario disappeared from the screen allowed him to not kill enemies, reach the end easily. Paralleled this with real life experience and giving two options: the hard and easy way. Reflected on the positive and negative of these two options. (I2 Q1)</p>	<p>-Said when encountered a “bug” (glitch) he left the game and joined back in the game to see if the glitch disappeared (I1 Q7)</p> <p>-Said “...learning through trial-and-error, gaining experience...” while playing SMW. Gave the example when Mario could not catch items, so next time he played that level he made Mario ride Yoshi and caught the items. (I1 Q9)</p> <p>-Said he used is memory to remember situations in the game to help him reach the end. (I1 Q9)</p> <p>-Said on the water level he quickly finished the level because he noticed that no enemies could hurt Mario, as he disappeared off screen (I1 Q 12).</p> <p>-Said he learned how to reach the end of SMW on the water level using the glitch. (I1, Q12, I1 Q 13-d, I2 Q1, I2 Q5, I2 Q6, I2 Q10-1)</p> <p>-Said he did not know how to rotate very well in SMW, so he killed the rugby enemy with several jumps on top of him. (I1 Q13-e)</p> <p>-Said that when discovering an error in SMW or other games, he uses them (I1, Q14-3; I2 Q7, I2 Q10-6).</p> <p>-Mentioned that any person can use the glitch or choose to ignore it. (I1, Q14-3)</p>

Table 3 (continued)

Decoding (encountering an obstacle or glitch)	Analysis (of obstacles and glitches)	Solution (responses to an obstacle or glitch)
	<p>-Said in the visual essay and journal he summarized all impressions of SMW and how they can help a person "...in real life, it helps the response-reaction skills, which is the reflex to react quickly in situations in real life." (I2 Q1)</p> <p>-Said he "...reflected on the role of videogames in training people." (I2 Q2)</p> <p>-Said he learned to "... find something in the game and transcribe it." (I2 Q9)</p> <p>-Related to visual essay and journal, said that he "developed reflective and critical capacities that I possess..." (I2 Q9-j) since he "... reflected and criticized what happened in the videogame, and in what I had experienced." (I2 Q10-10)</p> <p>-Said he learned to create parallels between videogames and real life (I2 Q10-1).</p> <p>-Said that "...developed my thinking..." while writing and drawing his visual essay and journal. (I2 Q10-9)</p>	

Table 4

Relationship of Subject I with the Codes

Decoding (encountering an obstacle or glitch)	Analysis (of obstacles and glitches)	Solution (responses to an obstacle or glitch)
<p>-Said the music made her realize when “the doll” (Mario) was invincible or lost power because the music changed. (I1 Q9)</p> <p>-Said she would press the wrong keys on the game controller. (I1 Q9)</p> <p>-Said that when “doll” (Mario) would disappear from the screen on the water level, did not know if it was a glitch or not. (I1 Q14-4)</p> <p>-Said she was trying to “dominate the game controller” and see how it works while was playing SMW. (I2 Q2)</p>	<p>-Said hand coordination used in playing SMW can also be used as playing the drums or piano. (I1 Q11)</p> <p>-Said she learned on a visual level when playing videogames, seeing visual patterns. (I1 Q6)</p> <p>-Said playing SMW is taking the “straight path” and she compared it and the glitch with going to a counselor/therapist. (I1 Q10)</p> <p>-Said she “...learned to take more risks when I Play, and try to solve problems in different ways, and to explore various possibilities.” (I1 Q14-1)</p> <p>-Said that she may need what she experienced in SMW in the future, like “manual dexterity or visual memory.” (I1 Q 14-6)</p> <p>-Said we can learn mathematics while playing SMW, when we count fish that he (Mario) eats or points gained. (I1 Q14-7)</p> <p>-Said after a few days passed, details of SMW in her memories which came to her mind were “frames” and “layouts” of the game with the 2-D “doll” (Mario). (I2 Q1)</p> <p>-Said she reflected in her journal and her drawings were childish. (I2 Q1)</p>	<p>-Said when a “bug” (glitch) happens in the game, she chooses to leave or wait for it to function again. (I1 Q7)</p> <p>-Said she used the music and had a problem with the keys in the game controller. Said she had an unnerving feeling when playing a part of the SMW that was problematic. However, she was able to get beyond it and reach the end. (I1 Q9)</p> <p>-Said when Mario disappears on the top screen she needed to be attentive that he would not descend and get caught by enemies. (I1 Q13-c)</p> <p>-Said she need to be persistent to learn run or how to jump in the correct place or to memorize when enemies appear. (I1 Q13-f)</p> <p>-Said she memorized part of SMW so when the animals (enemies) appear Mario would run or jump them. (I1 Q13-f)</p> <p>-Said she used previous skills to avoid problems. (I1 Q13-g)</p> <p>-Said while playing SMW she explored various scenery. (I1 Q14-1)</p> <p>-Said on the first level she played SMW she only noticed one type of freeze glitch, like a pattern in the game. (I1 Q14-3)</p>

Table 4 (continued)

Decoding (encountering an obstacle or glitch)	Analysis (of obstacles and glitches)	Solution (responses to an obstacle or glitch)
	<p>-Said she remembered the music, how it was connected with what happened to the “doll” (Mario) (I2 Q2)</p> <p>-Said she would like to paint the visual essay and explore more interesting forms. (I2 Q4)</p> <p>-aid her visual essay is a reminder of her playing the SMW. (I2 Q3)</p> <p>-Said her visual essay could be better and she criticized the process of creating it. Also related it with experience of real life. (I2 Q10-9)</p> <p>-Said she “...developed skills of experimenting with decals and different methods of drawings...” (I2 Q9-d), also “...developed the part of manual dexterity and problem-solving,” (I1, Q14-4), motor skills (I1 Q13-c, I1 Q13-d, I1 Q14-4) and “manual dexterity or visual memory. (I1, Q14-6)</p> <p>-Said that her hand-eye coordination was a problem because sometimes “the doll” (Mario) would not move (I1 Q10).</p> <p>-Said she can use experience of journal in future to develop other skills at the drawing level, like creativity. (I2 Q10-6)</p> <p>- Said her journal could be an escape from her worries and it could “..help you to reflect things.” (I2 Q10-10)</p> <p>-Said the machine she used to create the visual essay was scanner and printer (I2 Q 10-8) did errors that she did not use, or put in garbage.</p> <p>-Said she made mistakes and finished saying that this was her glitch, and “a mistake on my part.” Applied the word “glitch” to own actions. (I2 Q11)</p>	<p>-Said playing SMW was challenging but she tried to overcome in the same way that she dealt with the experience of creating a journal and visual essay. (I2 Q5)</p>

Decoding (When First Encountering an Obstacle or Glitch)

Video, observation data. All three subjects experimented with the buttons of the controller and observed how to navigate Mario in the videogame. All three subjects mentioned in the first interview that they used their memory to recognize when and how to avoid enemies. All three subjects used the controller to move the Mario character, and each time they “died,” they avoided the enemy on the next level and took a different route in the game, then clicked on a different box and won a different icon to reach the end. All three subjects mentioned that they had not played that videogame previously; however, all three showed during game play that they moved Mario toward the end of the game. They all reached the end of the first and second levels without anyone telling them where or how.

The subjects displayed their decoding processes out loud at the beginning of game play. Here are a few examples: Subject I mentioned at the beginning, “How do I play this? or use the controller commands?” For Subject S, the first time, when the character Mario died, he swore, “How do you play this? He only jumps,” and, “I died, how do we play?” The second time he died, he said, “Fuck, don't know what to do.” The third time he “died,” he sighed and said, “Don't know what the controller does! How I am going to play this?”

Interviews. Subject S (I1 Q9) and Subject I (I1 Q9, I2 Q2) both said they tried and learned how to use the game controller. Subject S (I1 Q9) mentioned that he experimented with each button on the controller, failing and then succeeding as he learned how to kill enemies. Subject I said she would press the wrong keys on the controller trying to reach the end of SMW. While Subject C (I2 Q7) did not mention the game controller in his interview, he did say that people need to concentrate and repeat things in order to do them well.

All three subjects stated they saw Mario disappear from the screen on the water level (SC I1 Q12, I1 Q14-3; SS, I1 Q14-3, I2 Q10-11; SI, I1 Q14-4.) All subjects

mentioned the word “glitch” when speaking about Mario’s disappearance in SMW (SS I2 Q10-11; SI, I1 Q14-4; SC I1 Q12). Subject C (I1 Q12) and Subject I (I1 Q14-4) said they did not know if Mario’s disappearance was a “glitch” or not; however, Subject S (I2 Q10-11) said that it was a glitch. Subject I (I1 Q14-4) said that she was never sure if she encountered a glitch or not, but she said she noticed one type of “freeze” glitch in SWM (I1 Q14-3). Subject S (I1-Q7) did not mention if glitches were hard to identify, but he did mention that occasionally a glitch could appear, while Subject C (I1 Q12; I1 Q14-9) said that glitches are not easy to notice and “the people who discover a glitch say, ‘Ah want to see? OK ... yes.’ Today, I did notice many mistakes” (I1 14-Q9).

Analysis (of Obstacles and Glitches)

Video, observation data. All subjects while playing looked very attentively at the screen and made movements with their body while playing. Subject C was the first (according to the video data timeline) to become more relaxed in posture, followed by Subject S, while Subject I had more relaxed posture only at the end of the one hour of game play. During the first interview, Subject I mentioned that the music was something important to her, and she listened for audio cues from the soundtrack to avoid enemies and to discern if the Mario character was becoming weak. Subject C (water level) said: “Oh, this way I disappear and no one can nag me.” Subjects S (1st level) mentioned: “Why did I die? Oh ... there is a time limit.” On the seventh time, he said, “Poor thing ... can’t kill it anymore,” when Mario died trying to kill the rugby player enemy. On the water level: “Does this do anything?” Subject I (1st level) said: “It’s hard ... I’m going to die ... where is he?” On the twelfth game, she died and she asked me, “What should I do?” Further along in the game, she said, “I bet I’m the dumbest person you have had until now.” Later, she asked, “Oh ... what if I go back inside the tube? Can it be?... Or if I go down, can it be?... there is nothing!”

Visual essay, personal journal, and second interview. Related to use of tools, Subject C said, “I am the glitch.” Subject I compared herself with the error, saying she was concerned about the message that her error with the Post-It note would send. Subject S talked about how glitch was a shortcut (which he said should not be used), analyzing the usage of the water glitch as something “wrong.” Subject S referred to the glitch as a “shortcut,” and as something he repeatedly said should not exist because it was a programming error or mistake. He said this with trembling voice and raised volume. In his interviews, Subject S said the water glitch was harmful, but did not shield himself from the content, because he admittedly used the glitch. Subject C used the water glitch only once, then followed the game without using the glitch. Subject C said he wanted to play the way it was intended to be, according to what he said.

Interviews. Subject S (I1 Q14-7) and Subject I (I1, Q14-4; I1 Q14-7; I1 Q14-1) mentioned that trying to solve problems and avoiding mistakes in different ways was developed playing SMW, while Subject C said that success in getting to the end of the game took a process of persistence and repetition (I1 Q4-5).

Subjects C and S said they developed “motor skills” (SC I1 Q4; SI I1 Q13-c, I1 Q13-d, I1 Q14-4). Subject C said what he meant was “motor skills such as sight, brain, parts of the brain; motor skills ...” (I1 Q4), while Subject I mentioned “manual dexterity or visual memory (I1, Q14-6). Subject S said he developed “response-reaction skills” that can be used in real life (I2 Q1).

All three subjects connected their experience of playing SMW with real life (SS I2 Q10-1; CC, I1 Q13-H, I2 Q7; SS I2 Q1, I1, Q14-3). Subject I said playing SMW is taking a straight path, and she compared that with seeing a psychiatrist (I1 Q10). Subject C said all persons have to fail to learn better in SMW and in real life and that concentration learned while playing SMW can be used in driving and exploring (I2 Q7). Subject C also said he did not learn the first time or the second time (how to play SMW), but he learned the third time. He said that learning was like when one touches fire and gets burned (I1

Q13-H). In contrast, Subject S also connected playing SMW and encountering a glitch with real life. Subject S said errors in the game (like when Mario disappeared) allowed him to reach the end easily, and he parallels this with real-life experience and having two options—the hard and easy way, and contrasted their pros and cons (I2 Q1). Subject S said the glitch on the water level was from the producer’s coding mistake. He compared gaining an edge using glitch with taking real-life advantage of others: “... people choose the easiest method to achieve their objectives. Ethics” (I1, Q14-3).

Subject C (I2 Q1) and Subject I (I2 Q1, I2 Q2) said they started using their memories and experiences around SMW to create the visual essay and personal journal. Subject S said he used his memory of the SMW glitch in the visual essay and journal (I2 Q1, I2 Q2, I2 Q5).

All subjects mentioned development of reflection and thinking critically when they were creating their visual response and personal journal (SI I2 Q1, I2 Q10-10, I2 Q10-9; SS I2 Q1, I2 Q2, I2 Q9-j, I2 Q10-10; SC I2 Q10-9). Subject I said that her journal could be an escape from her worries and it could “help you to reflect on things” (I2 Q10-10). Subject S “reflected on the role of videogames in training people” (I2 Q2).

Subject C and Subject I said that they used the computer, printer, and scanner for their visual essay (SC I2 Q11; SI I2 Q 10-8) and that errors happened (SI I2 Q11, SC I2 Q11). Subject C said that the technology did make errors, but he said that the glitch happens with machines and other times with him, and in this case it was his error: “...I am the glitch” (I2 Q11). Subject C said that the process of glitches was used in his visual essay and journal. While Subject C mentioned mistakes in the technology and in herself, she mentioned in the end “this was other glitch but a mistake on my part” (I2 Q11). Subject I (I2 Q11) also said that she did not use the mistakes, but she did not put them in the garbage either. In contrast, Subject S did not mention printer and scanner glitches while making his visual essay and journal (I2 Q10-9). Subject S said the glitch from the water level was a theme in his (I2 Q1, I2 Q2, I2 Q5).

Solutions (Responses to an Obstacle or Glitch)

Video, observation data. All of the subjects showed while playing that they found the glitch on the water level, and all subjects applied that knowledge during the game to avoid the enemies. Subject C showed while he was playing the game and also in his first interview that he chose to use that information in a different way, such as avoiding it and not using it again to reach the end of the game. All the subjects learned how to use the command and navigate the game, thus reaching the end of the game. One possible measurement with regard to subject mechanism is the following data: Subject C “lost” 4 lives, Subject S “lost” 9 lives, and Subject I had 53 “deaths.” Also, Subject C started going backward instead of forward in the videogame to catch Yoshi or more coins to gain more points instead of finishing the game early.

Visual essay, personal journal, and second interview. Subject C and Subject I both said they used the computer, researched, used the scanner and printer. Subject S did not mention the use of any multimedia tools.

Interviews. Subject C (I1 Q14-5) mentioned that in going to one place in the game, he made mistakes and learned not to repeat that. Subject I (I1 Q13-f; I1 Q13-f) and Subject S (I1 Q9) used memory to help them avoid situations and reach the end. Subject S said it was about “learning through trial and error, gaining experience” while playing SMW. One example he gave is when Mario could not catch some items, so the next time he played that level, he tried riding Yoshi, and he was able to catch the items (I1 Q9). Subject I said playing SMW was challenging, but she tried to overcome it in the same way she dealt with the experience of creating a personal journal and visual essay. She did not elaborate on this statement (I2 Q5). Subject C said he created his own deadlines and constraints, since, as he said, he was not provided with rigid directions. He decided on his own to connect this one-hour experience playing with SMW with his day-to-day experience (I2 Q1).

Subjects S (I1 Q7) and I (I1 Q7) said that when a “bug” (glitch) happens, they leave the game, then jump back in later to see if the glitch disappeared. Subject I gave the example, “I could not do anything with this glitch, nor could I solve it (I1 Q14-3). Subject C said he tried to avoid the glitch by choosing an alternative path (I1 Q7). Subject I said she used previous skills to avoid problems (I1 Q13-g) and explored various scenery (I1 Q14-1).

Subject S mentioned that any person can use a glitch (I1, Q14-3; I2 Q7, I2 Q10-6) or choose to ignore it (I1, Q14-3). All three subjects said they used the Mario disappearance glitch on the water level to advance in the game (SC I1 Q12; SI I1 Q13-c; SS I1, Q12, I1 Q 13-d, I2 Q1, I2 Q5, I2 Q6, I2 Q10-1). Subject C said that he could make a glitch happen just as the machine does, and he believed this could bring good results and experiences in the future. He said he used glitches in his visual essay and journal (I2 Q2).

Conceptual Synthesis

What I found based on these three subjects were data that I arranged as a conceptual synthesis (Table 5). In synthesizing the coding, I have identified the most salient features of the three subjects’ thinking around the three categories in the synthesis coding of Table 5. The columns were arranged according to three categories and three subcategories: decoding (controller decoding, level decoding, glitch decoding), analysis (game play, real-life comparisons, glitch), and solution (memory-based, glitch-response, self-directed), which I explore in more detail below. It should be noted that the subjects played each level, one after the other, for precisely 30 minutes each.

Table 5

Conceptual Synthesis of Coded Data

Decoding	Analysis	Solution
<p>Controller Decoding -All controller buttons were experimented with for navigation, jumping, running purposes, failed and succeeded killing enemies.</p> <p>Level Decoding -Different routes or paths were taken after “dying” in game to avoid enemies, clicked upon new boxes and new icons to reach end of level.</p> <p>Glitch Decoding -When encountering many SMW videogame glitches, it was difficult to identify or label the event as either a glitch or not a glitch. -Mario disappeared from screen was recognized as a glitch.</p>	<p>Game Play Analysis -Game playing tests our patience, irritability. Getting to end of SMW is process of persistence and repetition. Solving problems and avoiding mistakes can be approached in many ways. Music gives cues to avoid enemies, obstacles and know Mario’s strength. Memory must be used for obstacle and enemy avoidance.</p> <p>Real Life Comparisons -Failure important in real life to do better in future. -Connected experience of SMW glitch to real life: therapy, and taking advantage of other people. Real life skills can be obtained through playing videogames: bicycle riding, Math and English skills, puzzle-solving, motor skills, cognitive abilities, trial-and-error, concentration, manual dexterity, thinking critically, reflection, visual memory.</p> <p>Glitch Analysis -Attitudes towards glitch ranged from glitch as very useful to glitch as something, which should not exist. Glitch also perceived as something, which can happen within human beings. A technological glitch can be used for many purposes, such as a shortcut, to help finish the game, repurposed for art or journaling, and does not have to be discarded. -Connected experience of SMW glitch to thinking critically, reflection, visual memory - Connected experience of SMW glitch to real life: therapy or taking advantage of other people.</p>	<p>Memory-Based -Avoided enemies by memorizing obstacles to reach end of level. Did not repeat previous mistakes (because they were remembered and avoided.)</p> <p>Glitch Response -Confronted with glitch, attempted one of two solutions: 1. avoided glitch; 2. used/embraced the glitch. -Glitch on water level was used by all subjects to navigate toward end of 2nd level more easily.</p> <p>Self-directed Learning Solutions -Created self-imposed deadlines and constraints to make visual essay and journal. -Reached end of 1st and 2nd level without any verbal or written instruction in game playing.</p>

Notes. For more information, please visit Appendix C for complete interviews or previous coding, since this is a synthesis of coding.

Decoding

As I examined the data of Tables 2-4, I noticed that I could separate and analyze these data of the SMW playing experience into certain elements of the game that required decoding; in other words, the subjects were not decoding the whole game all at once, but they were dealing with three elements in order to teach themselves how to play SMW. These three elements of decoding were game controller decoding (coordinating buttons and joystick), SMW level decoding (“level one” and the “water level”), and SMW glitch decoding.

Controller decoding. The three subjects described their attempts to understand the game controller for the SNES console in the interview data and in the video data, where I recorded what they said as they actually played SMW in two 30-minute intervals. Their processing of the responses and reactions of the Mario character to the controller buttons were their first concern in learning how to play SMW. This involved trying and sampling different buttons with the controller to test the maneuvering or navigating of the Mario character throughout SMW, and how to use the controller to kill enemies and avoid dangerous bits of the game. All of the three subjects exhibited playing around with the controller in the video data, but these initial attempts at the controller are illustrated in this quotation from Interview 2 with Subject I: “I remember the game screen as the doll [Mario] ran from one side to the other, trying to hit, while I was trying to dominate the game controller to see how it works, as the doll [Mario] goes forward and backward” (SI, I2 Q2).

Level decoding. Next, I noticed (from both video data and interview data) that the subjects were concerned with how to defeat the level, and their thinking around this I labeled as level decoding. Level decoding, as I define it for Table 5, involved how to

navigate throughout the level, how to avoid enemies, where to go, and what to do in order to reach the end of the level. In my personal experience playing these same two levels of SMW, I memorized and created a visual image of the territory and spaces in and around the game, and memorized which areas and which paths to take or avoid in each level. Subject C, who is an architect, mentioned that he creates floorplans in his head and follows this kind of visual mapping of the game as he plays (SC I2 Q1).

Glitch decoding. The column decoding the glitch was about how subjects processed the finding, labeling, and initial responses to glitch. The first process in decoding for a player is whether what they are seeing is part of the game or an unintentional glitch. Many glitches, as indicated in the table, were not easily identifiable as glitches by the subjects.

Part of the reason I wanted subjects to repeat the same level for 30 minutes was to observe the subjects' responses to glitches. In that way, when they played the level again, the glitch that appeared in the first round of play might not reappear, then at that moment the subjects would likely recognize the first appearance as a glitch. There were some visual glitches in SMW that subjects did not actually notice. I know this through my observation data when I was watching them play SMW. For example, while Subject I was playing SMW, there was a visual glitch in which Yoshi could not eat the apple because the glitch put the apple out of reach. Subject I did not mention that glitch in any of the interviews.

As shown in Tables 2-4, the subjects ranged from being uncertain that what they saw was a glitch, to certain that they did, or certain they did not notice the glitch. Some glitches were recognizable by all, like when Mario disappeared on the water level. In that case, every subject referred to this event as a glitch, even if some hesitated at first. With the freezing glitch, for example, Subject I was certain that the immobility of the Mario character was a glitch, and she referred to it as a glitch: "The glitches were in the first and

second levels of the game, as I had previously said. When the dragon [Yoshi] appears, the doll super Mario was frozen” (SI, I1 Q14-3).

As suggested by the data in these three subjects, this labeling as glitch or not glitch is part of the decoding process. As shown in Table 5, all three subjects recognized Mario’s disappearance from the screen on the water level in SMW as a glitch.

Analysis

In light of the data from Subjects C, I, and S, the analysis column of Table 5 is a condensation of data in which subjects showed they were reflective about their SMW playing experience, made comparisons between SMW and real life, and spoke about their own analysis and thought processes around their approach to the specific glitches in SMW and their views on technological glitches.

Game play analysis. Game play analysis is about how subjects analyzed their approach to playing the game SMW. Subject C, for example, mentioned that he maintained good control over his irritability factor (he mentioned repressing the desire to throw the controller), so he was analyzing how his mood was affected by playing the game and his performance (or what he called his “perfectionism”) in the game. Other subjects also commented about their own moods and behaviors, such as Subject I, who said she was irritated with the music and her own performance. Taken with the interviews and video data, this could suggest that these three subjects were aware of their outward behavior while playing the game.

Subject C talked about solving problems and avoiding mistakes through trying and making mistakes in the level, as taken from the interviews, for example, when Subject C said, “I almost did not learn at first, so I learned the second time. If not the second time, I learned the third time” (SC I1-Q13-H).

Real-life comparisons. Real-life comparisons were made by subjects in many different ways: comparisons of SMW playing skills with skill-sets in real life were

common among subjects in their interviews, including English skills, puzzle-solving skills, mathematics, and many other skills listed in the synthesis chart (Table 5). The idea of failing and then trying again came up more than once with subjects, and also the use of memory and memorization, both in the sentimental sense of “having memories” or nostalgia, and of the sense of “memorizing,” as with rote memorization. The two male subjects (C and S) mentioned driving as a comparable real-life skill, and the female subject (Subject I) mentioned that playing SMW and glitch were like seeing a psychiatrist: “...it’s like going to the shrink, because I have to continue my path walking straight ahead” (SI I1 Q10).

For the purpose of this study, I do not go further to address gender differences or gender-related analyses of these data. It would be interesting with a larger population to study the effects of gender on this type of research (however, my sample number here is too small), but that is not my focus here.

Glitch analysis. Subjects were varied as to when they thought encounters were glitches or not, and some subjects said they noticed glitches while others did not. The subjects thought about glitches as useful: “more positive ... reach the end easily” (SS I2 Q1); or not useful: “I could not do anything with this glitch...” (SI I1 Q14-3). Subject S was the only subject who said the glitch should not be used, while at the same time, he could not resist using it in the playing of SMW: “I discovered errors in other games, and as with this game, when I encounter them, I use them” (SS I2 Q10-6). Subject C found using glitches to be convenient, as with “It’s too easy to use a glitch...” (SC I1 Q12).

All subjects said that technological glitches are useful in some way, especially in making the visual essays and personal journals: “These glitches, these errors of being out of ink can bring good results...” (SC I2 Q11). At the same time, all subjects mentioned that under certain circumstances (but not all), glitches in technology shouldn’t exist. Two out of the three subjects applied the word “glitch” to themselves and their own mistakes, and referred to themselves as a glitch: “I am the glitch” (SC I2 Q11).

Solution

Taken from the data of the subjects, the column labeled “solution” from Table 5 breaks down the data into memory-based solutions, glitch responses, and self-directed solutions. I noticed patterns in the data, which pointed toward mention of memorization numerous times in the interviews. Responses to the glitches (Table 5) I have characterized as two broad possibilities—subjects either avoided the glitch or used the glitch when encountering them in SMW game play.

Memory-based solutions. All three subjects mentioned that they had to memorize parts of the game, recognizing patterns that then translated to solutions once they memorized the location of enemies, for example, or memorized the controller buttons in order to complete the level: “memorize when some of the animals [enemies] appear and run or jump...” (SI I1 Q13-f).

Glitch response. For this section of the chart, I wanted to synthesize the responses to glitch in the simplest way possible, so that much of the data that were gathered could be characterized as being one of two reactions to the glitches: either avoiding the glitch, or using/embracing the glitch. For example, when Subject I said that she “waited” to see if the freeze glitch would clear up, I call that avoidance: “I had to wait, so I waited” (SI I1-Q14-3). Had she mentioned that she thought about the timing of the glitch strategically to advance the game, it would be categorized as “use.” In a typical reaction of using the glitch: “I used the glitch for my benefit to arrive faster at the end of the game” (SS I1-Q12), I count as avoidance of the glitch also when subjects shut down a videogame and restarted it to see if the glitch disappeared: “...when a bug happens, I chose to close the window...” (I1 Q7). Another example of avoidance was with Subject C was when choosing not to use the convenient glitch on the water level: “I needed to be more honest and complete all the game...” (SC I1 14-3).

One of the most critical parts of the data was that all subjects used the disappearance of Mario on the water level to advance. In one sense, this glitch is

unavoidable because Mario is simply placed above the screen area, but subjects still had the choice to continue playing or wait to see if the glitch disappeared. All subjects, in fact, chose to use this glitch to advance. The exception was Subject C, who made a conscious choice not to use this glitch every time, as mentioned above. Subject S was the only subject who continually said how it was not a good idea to use the glitch:

“...[people] should play the game by itself and not use the glitch. But as I said, there are people who use tricks to pass levels, which is stupid” (SS I1 Q14-3). At the same time, Subject S, in fact, used the glitch to play SMW: “I took advantage of the glitch ... to beat the level faster” (SS I1-Q13-d).

Subjects S and C kept the glitches they used in the visual essays and did not discard them. I think there is a third subcategory: beyond just using the glitch is embracing the glitch, which comes from total acceptance. One accepts that the technology contains mistakes as they contain mistakes themselves. Subject I kept the error but did not bring it into the visual essay, while Subject C kept the glitch in his visual essay and journal. In contrast, Subject S did not use technology (in his visual essay/journal) so had no opportunity to use technological glitches; however, he chose the glitch itself as his main theme.

Self-directed solutions. I noted in my observations that all subjects reached the end of each level without any instructions. Subject C also mentions that he created self-imposed guidelines: “I created some constraints, like deadlines for myself, such as for the B/W photocopies...” (SC I2 Q1).

Summary

The themes that emerged in this analysis can be categorized as follows. In decoding game play and glitches, the subjects needed to be able to make sense of the controller for navigation and functions, orient to the level structure as a frame for understanding different routes, and recognition of glitches when they occurred. Within

this context, subjects then had to analyze these experiences. Three themes emerged. First, they developed strategies for game play, often involving recall of game elements and their relationships, as well as self-regulation. Second, the subjects made connections to real life, and skills that might transfer. Third, they discussed their assessment of the nature of glitches. In the final phase of looking at solutions, three themes also emerged: the reliance on memory for problem-solving, different solutions to glitches when they occur, and self-directed solutions. These will all be discussed in further detail in Chapter V.

Chapter V

DISCUSSION

This chapter will discuss the themes that emerged from the analysis of the interview and data observation, including a conceptual synthesis of the data from the three subjects around playing SMW. In observing and analyzing the data, several notable patterns emerged around the experience of glitches that will be used to organize the following. The first is the recognition of three distinct phases in the experience: (1) normal game play, in which the subjects learn the parameters of the game and refine their play; (2) the experience of glitches, in which glitches are identified, and the impulse to solve them leads to critical thinking and strategies for their incorporation; and (3) real life, in which subjects reflected on their experiences over a longer period of time, making connections to their everyday lives and engaging in creative reflection.

In addition to these distinct phases, the data also suggested the importance of memory in these processes, a network of skill bases that the subjects drew on in different ways, and an ongoing process of self-direction and learning. I will therefore use these three elements to look at each phase (Tables 6-8). This will provide a synthesis of the relationships between memory, embodied and thinking skills, and self-directed learning across each phase.

This synthesis will then provide a foundation for looking at the data in relationship to the guiding research questions. Research questions 2-4 each center around the skills that emerge in relationship to glitches. Question 2 provides a baseline for understanding

the background skills that players bring to playing a new game, and the pattern recognizing skills that allows them to orient to, and establishes a sense of, what constitutes “normal play.” Question 3 looks at the problem-solving and critical thinking skills that emerge when players experience a rupture or “glitch” in these patterns. And question 4 looks at the deeper critical and creative inquiry that follows from these glitch experiences over time. Finally, I will conclude with my primary research question 1, which attempts to summarize the full range of skills that are called into play by glitches, as well as examining the specific media literacy skills that videogame play draws on and supports.

Game Play

In this first section, I will discuss the relationships that emerged from the subjects’ discussion of the game play itself. In particular, it was expected that, during game play, subjects would engage with skills related to media literacy, such as critical thinking and inquiry. In addition to this, however, the data suggested two other areas that I will include for analysis: memory and connections to “real life.”

Table 6

Relationship of Game Play with Memory, Skills, and Self-learning Data

Memory	Skills Base	Self-directed Learning
<ul style="list-style-type: none"> -Videogames stimulate, develop sight, different areas of the brain, memory. -Memorized controller buttons and their effects through repetition. -Developed basic reasoning while playing SMW. -Frames and layouts of SMW remained in memory. 	<p>Embodied Skills</p> <ul style="list-style-type: none"> -Developed skills experimenting with controller buttons. -Hand-eye coordination was a problem due to lack of control over Mario’s movement. -Used quick response-reaction skill. 	<ul style="list-style-type: none"> -Videogames teach mechanisms that can be applied by children, for example self-defense or problem-solving. -Did not learn 1st or 2nd time to play the game, but learned 3rd time. -Learned on a visual level when playing videogames.

Table 6 (continued)

Memory	Skills Base	Self-directed Learning
<p>-Persistence needed to memorize when enemies appear so Mario would run or jump over enemies.</p> <p>-Memorized rugby player's moves to defeat him.</p> <p>-Remembered music, connection with Mario</p> <p>-Can use visual memory from SMW in future.</p> <p>-Visual essay is reminder of playing SMW.</p>	<p>-Developed manual dexterity, problem solving, motor skills, visual memory.</p> <p>-Tried to solve problems in different ways, explore various possibilities.</p> <p>-Learned to take more risks when playing SMW.</p> <p>-Explored various scenery playing SMW.</p> <p>Thinking Skills</p> <p>-Videogames "train" people (critical thinking).</p> <p>-Experience of playing SMW compelled to think about own actions in a psychological way.</p> <p>-Used imagination, sight, perception, reasoning skills, self-reflection, self-control.</p> <p>-Used previous skills to avoid problems.</p> <p>-Dealt well with controlling irritation and emotions.</p> <p>-Reflected on SMW, thought SMW a positive experience because one reflects upon it (critical thinking).</p> <p>-Self-reflection and criticism on self-performance and SMW experience.</p> <p>-Reflected that journal and drawings were childish (critical thinking).</p> <p>-Viewed visual essay critically and process of creating it (critical thinking).</p> <p>-Can use SMW skills in future.</p>	<p>-Identified visual patterns in SMW to help navigate.</p> <p>-Learned to avoid mistakes when playing SMW, compared with trial-and-error that led to end the game.</p> <p>-Could choose several paths and make mistakes, attempts, in process of repeating which brought variations and successes.</p> <p>-Failed several times in one place in SMW, learned not to make same mistake.</p> <p>-Learned through trial-and-error, gaining experience while playing SMW.</p> <p>-Experimented and repeated movements with keys, mastered controller to reach end of game was same approach in visual essay and journal.</p> <p>-Used music and soundtrack to navigate SMW play.</p> <p>-Did not know how to rotate well in SMW, so killed rugby enemy with several jumps.</p> <p>-Learned to finish level Mario needs to eat all items, catch all items to get max score and reach end of level.</p> <p>-Was able to overcome feelings of fear/doubt because wanted to reach the end of level in SMW.</p>

Notes. For more information regarding the sentences, please visit Appendix C, for the interviews or the previous coding, since this is a synthesis of the overall codes.

Game Play—Memory

Although we could consider it a part of critical thinking, memory emerged as a significant focus in its own right. Due to the time frame of actual game play (1 hour total), the subjects' reflections on memory related to game play would largely fall into the category of short-term working memory. In order to utilize both embodied and thinking skills, the subjects found it necessary to keep track of essential elements in the game play, such as which buttons do what and where enemies are likely to appear in the game space.

The data on the relationship between game play and memory are summarized in Table 6. For example, subjects memorized how the rugby player enemy moved in order to plan a way to move around him from a safe distance and use that sense of distance to mount effective attacks. This entailed learning and recalling where the rugby player showed up within the game space, the bounds within which his apparently random movements stay, the kinds of moves he makes, and the timing of potential strategies.

This example also highlights a related aspect of visual-spatial memory in game play. Subjects reported constructing mental maps of the game space, allowing them to situate what they were currently seeing within a larger sense of the level they were navigating, allowing them to draw on this in future play, and exploring variations upon which paths to take.

One study about fast-paced action videogames shows enhanced processing of visual memory and faster reaction times in persons who habitually play action videogames (Bavelier & Green, 2007). While these findings refer to fast-paced action videogames, their study does not explicitly extend to other types of videogames. Although SMW is not a fast-paced action videogame, and my study chose to focus on shorter term engagements with glitches, there nonetheless appeared to be a reliance upon and development of visual memory skills in my three subjects. It is possible that platform games like SMW may also lend an increase in visual recall in gamers who regularly play platform games.

The foregrounding of memory by the subjects as an important component of game play suggests that it is a critical dimension for the skill development that I will discuss next. Their reflections suggest that it was an integral component of how they learned to navigate, make sense of, and predict what they would encounter in the game space. This will serve later as a backdrop for thinking about the relationship between memory and the glitches they encounter, as well as memories that may extend beyond the scope of game play, into real life.

Game Play—Skills Base

Game play can be considered a form of structured challenge in which a series of carefully constructed problems are posed to the user to solve. The consistent structure of the game, coupled with the variability of options and possible solutions, presents a useful context for understanding how users actively draw on media literacy skills to problem-solve. These problems are embedded within the overarching logic of the game itself and collectively constitute the agreed upon “task” of play. Games thus serve as a platform for continued exploration and refinement of the skills that will allow for solving these challenges. Each kind of game will present its own unique problems and viable solutions, and part of playing the game entails getting familiar with the overall parameters specific to that game. But certain general skills are common across different games, and this study is particularly interested in the overlap between these general videogame skills and those related to media literacy, particularly critical thinking skills. Videogames also provide an additional element for study that is often not as foregrounded, which is active physical engagement.

I will thus look at skills related to game play divided into two large categories: Embodied Skills and Thinking Skills (Table 6). In actual game play, these are often closely linked. What I call Embodied Skills are skills such as hand-eye coordination, manual dexterity, and motor skills. Thinking Skills refer to skills such as problem-

solving, reflection, and critical thinking. The relationship between game play and these skill bases is important for this research because it provides the background context for comparing how the subjects responded differently to glitches, or problems that exceed the constructed and regulated challenges of the game logic.

Embodied skills. Embodied skills often play a large role in videogame play, and this is the case for SMW, predominantly requiring the use of a controller to navigate through visual game space. In addition to memory and the mapping of the space of game play, observation of—and self-reflection by—the players also suggests the development of embodied memory and refinement of manual skills. In decoding the controller and navigating the specific layouts of the levels (Table 2-5), the three subjects used motor skills, hand-eye coordination, and manual dexterity to learn how to overcome problems and find solutions to killing enemies, and progress in the game space (Table 6).

All three subjects reported on the challenge of learning to control a virtual character for the first time through manipulating a hand controller. Subject I demonstrated significant challenges in this regard, but with experimentation, all three subjects showed significant improvement in the ability to manually manipulate the controller to navigate the game space. Examining what my subjects referred to as “visual memory” suggests that there is a connection between what subjects learned through physically playing SMW and visual-spatial learning. In using the controller to explore SMW scenery and jump over enemies and obstacles, subjects engaged with visual learning in connection with control over the Mario character, as they were navigating the visual-spatial arena within the game.

There are several studies that focus on the link between computer games and visual-spatial skill performance (Forsyth & Lancy, 1987; McClurg & Chaille, 1987; Subrahmanyam & Greenfield, 1994) and videogame data in adults that demonstrate that visual-spatial skills were improved through playing videogames (Pepin & Dorval, 1986). While Pepin and Dorval (1986) exposed players to their game on multiple occasions and

used a computer game that was deemed specifically valid for testing visual-spatial skills, I found similarly that my three subjects demonstrated and reported on improved visual-spatial skills in even one sitting. This suggests that visual spatial skill learning is engaged across diverse videogames as an underlying component of game play. As players learn to problem-solve the game space, it is likely they are also learning to coordinate visual-spatial and gestural components with more and more refinement as a function of the challenge of play itself. As players reflect on their experience of playing the game, this embodied dimension of coordinating regular gestures with navigating and acting in the visual space is highlighted.

Thinking skills. As the three subjects worked through SMW, each engaged in different kinds of reflective and analytical thinking and thought critically about their one hour of SMW play. What I find fascinating is not only that they engaged in analytical thinking about their performance of playing the videogame; they also considered their own self-perceptions and reflected upon their own self-control during game play. They employed a variety of self-reflective inquiries into their process of working. For example, Subject I talked about her ability to control her frustration, and that although she felt the impulse to throw the game controller into mid-air, she did not. Subject C spoke to his self-control of emotions like irritation while he was first learning how to move the Mario character and to avoid or kill the turtle shell enemies, and felt that he did better at this than if he were a child.

While critical thinking specific to problem-solving the tasks presented in the game resulted in improved game play, allowing them to build on these skills in subsequent iterations, the subjects' own reflections suggest that an important component of this skill set is recognizing and working with their own emotions. In particular, regulating and expressing self-control when irritated or frustrated and being able to reflect on their own expectations and self-perception were foregrounded. This suggests that it might be

important not to arbitrarily separate out critical thinking skills from self-perception and facility with emotions.

In connection with the larger picture of media literacy, scholars such as Cyndy Scheibe and Faith Rogow (2011) have argued that skills such as reflection and inquiry are critical to our understanding of media literacy education. For example, Scheibe and Rogow emphasized the importance of inquiry, stating, “Media literacy education requires active inquiry and critical thinking about the messages we receive and create” (p. 37). While Schiebe and Rogow are discussing facilitated curriculum in teaching media literacies and not videogames, the importance of inquiry and critical thinking is also reflected in the responses of my three subjects. They not only reflected on the need for reflection and critical thinking in game play without a facilitator, but were able to reflect on their own self-perception and include managing their own emotions as important elements in problem-solving. This suggests the value of considering critical thinking as an integral component of self-directed game play, as well as being part of a larger context of self-reflection and regulation that involves the thinker’s own emotional responses.

By looking at the skill bases involved in game play, we can see that there is a complex set of interrelated elements to be improved and coordinated in order to solve the embedded challenges of the game. Players must learn to coordinate memories of gesture, rules, and game space, with the embodied skills of manual dexterity and visual-spatial navigation. And they have to not only apply critical thinking skills to decipher and solve the game problems, but also notice, reflect upon, and regulate their own emotional reactions. This skill base appears to be at play as an integrated process that is needed to respond to the specific challenges of game play. Later I will compare this with the context of glitches that disrupt this game space, and with the larger context of real life.

Game Play—Self-directed Learning

An important factor of this study is that the subjects' problem-solving and game play are not facilitated by anyone else. The subjects are given time to play the game on their own, and to reflect on that experience afterward. This is a common experience with videogames: the players orient themselves to the rules of the game space and discover how best to play as they proceed (although there are also many exceptions to this as well). And so, in addition to improvements in specific embodied and critical thinking skills, the subjects in this study also reflected on the self-directed nature of their learning, and how they went about it (Table 6).

From their first efforts to make sense of the controller buttons and navigation, the subjects initiated their own learning around game play (as shown through interview data and Tables 2-5). They reported learning by trial and error, but also by attempting to avoid mistakes. Sometimes they would fail repeatedly in the same spot before learning to avoid the same mistake. They reported needing more than one or two attempts to understand and learn particular problems, and would both repeat and experiment with different movements and strategies, learning through the activity itself.

Without a facilitator or overt extrinsic reward, one question is what motivated them to keep learning and attempting to play the game as they faced multiple failures. Although there were variations in how they expressed it, all three subjects mentioned numerous times that they wanted to reach the end of the level, which suggests this became a motivator for their own learning. Subject I, for example, managed to overcome her frustration and fears to reach the end of both of the levels presented in this study of SMW. She achieved this, I should emphasize, through a great deal of effort, as shown through the number of times she “died” (which was more than the other two subjects). Subjects learned after trying and failing several times on their own and at their own pace to achieve their own goals of completing the level. While I cannot be certain of their yearning for specific skills or knowledge, I did observe that they wanted to complete the

two levels presented in their SMW play. We can surmise that the level structure of many games, posed as a problem to solve, serves as a frame for the trial-and-error experimentation that leads to solutions.

However, during the interview, my three subjects also talked about creating their own goals and objectives when they were playing SMW, which implies self-directed learning and goal setting.

In my observations, I noticed that while completing the level, they were engaging in a variety of tasks that nobody imposed upon them and even complicated finishing the level. When Subject C decided he should collect all of the coins and gain the maximum amount of possible points in playing SMW, he was enacting this from his own initiative. Likewise—suggesting that skills are not specific to game play—when he said that he created his own outline by which to approach his visual essay and personal journal, and with his own calendar of deadlines, he was following his own directive, just as when he was collecting all the coins. In the first interview, he spoke of this as a change of plan that he himself invented and decided to do. Subject C reflected that changing his goals was a good example of how an adult learner can find his or her own direction and sense of purpose in learning. These self-directed actions show a process of self-directed learning in which the learner was not only managing his own goals but also aware of this and able to reflect on it.

Knowles (1975) has stated that self-directed learning (SDL) is that learning which is initiated and managed by the learner. Knowles further stated that adults have a yearning for independent learning, that they have a natural need that initiates this learning. Technology has advanced this notion further and naturally includes a broader group of persons who are self-directed learners along with it, implying that SDL may be naturally occurring (Hase & Kenyon, 2000; Jenkins, 2006). But SDL might not only apply to adults, as Lee (2014), speaking from his own experience in being a self-learner, self-learned programming beginning at age 10 through research with a computer and the

Internet, learning at his own pace and choosing the projects he wanted. Knowles (1975) and Lee (2014) both discuss how learners choose or do not choose a facilitator for self-learning and how self-learners can customize their own needs. In my study, I observed how subjects showed both initiative and management of their learning as they engaged with SMW videogame play.

While there might be extrinsic factors to videogame play, as well as more facilitated or collaborative peer experiences, this study suggests that videogames can provide a structure for self-motivated exploration and learning, both through goals implied by the game space itself (e.g., completion of levels, or solving challenges on the way to such goals) and through creating opportunities for players to select and pursue goals of their own devising (e.g., getting all the coins). By creating opportunities for repeated trial-and-error experimentation, they may create the conditions for the skill development discussed earlier, as well as providing a context and platform for persevering through and problem-solving glitches when they occur, and extrapolating to real life, both of which will be discussed in the following sections.

Glitch

Glitches present a second order challenge: they appear to break or restructure the rules and constraints of normal game play. The problem is no longer posed just within the game, but of the game itself. If, in looking at thinking skills during regular game play, we found it already expanded beyond solving specific conceptual problems to incorporate self-reflection and self-regulation, with glitches we might expect to see differences as well. And as with regular game play, the subjects' reflections will also highlight the role of memory, self-learning, and ramifications for real life.

Table 7

Relationship of Glitch Analysis with Memory, Skills, and Self-learning Data

Memory	Skills Base	Self-directed Learning
<p>-Did not know if event was glitch, compared with memories of other glitches.</p> <p>-Learned through memory of previous encounters how to avoid the glitch.</p> <p>-Remembered how to solve glitch to repeat same actions.</p> <p>-Used memory of using glitch in SMW game to finish level.</p> <p>-Acknowledged using of glitch in memory of previous rounds, decided not to use.</p> <p>-Played SMW on first level and noticed one freeze glitch, like a pattern.</p> <p>-Remembered Mario disappearance glitch as most interesting part of SMW.</p> <p>-Reminded how in SMW experience, level repeats itself when using printer errors for visual essay.</p>	<p>Embodied Skills</p> <p>-Learned how to reach end of SMW on water level using glitch. (referred to learning in SMW)</p> <p>-Created intentional glitches also used real glitches for essay and journal.</p> <p>-Scanner and printer made errors, did not discard in visual essay.</p> <p>Thinking Skills</p> <p>-Glitch on water level of SMW was because videogame producer created a flaw in coding (inquiry, reflection skills).</p> <p>-The error is made by humans, we make glitches. (inquiry, reflection skills).</p> <p>-Glitches are convenient.</p> <p>-Using glitch is cheating, unfair. It is too easy to use glitches. (ethics)</p> <p>-Reflected on the pros and cons of having two paths, a difficult but more honest and less difficult but less honest. (ethics)</p> <p>-Likened SMW glitch with how people use unfair advantages. (ethics)</p> <p>-Compared SMW and glitch with going to a counselor/therapist.</p> <p>-Process is just as important as product or result.</p>	<p>-Identify a glitch. Tried to avoid glitch. Chose an alternative path to avoid glitch.</p> <p>-When glitch happened, chose to restart game.</p> <p>-Chose to wait for glitch to disappear to continue.</p> <p>-Any person can use glitch or choose to ignore it.</p> <p>-Embraced glitch to avoid enemies and finish game.</p> <p>-Glitch could bring good results and experiences in future.</p> <p>-Needed to be attentive when Mario disappears on top screen so Mario would not fall, caught by enemies.</p> <p>-Uses errors every time in SMW or other games.</p> <p>-Used glitches in visual essay and journal.</p> <p>-Used error while printing in real life, and printed again on top of images.</p> <p>-Embraced glitch, did not throw anything in garbage, and all was used in visual essay, journal.</p> <p>-Considered self as glitch, not technology.</p> <p>-Considered self as printing glitch failure.</p>

Table 7 (continued)

Memory	Skills Base	Self-directed Learning
	<ul style="list-style-type: none"> -Identified the glitch as human or machine error. People make glitch just like machines can make glitch. (inquiry, reflection skills). -Word glitch applied to own actions. -Glitches are divided into graphic types or visual types. (reflection skills). -There are difficult paths and more easy paths, and using glitch is the easy path 	

Notes. For more information regarding the sentences, please visit Appendix C, for the interviews or the previous coding, since this is a synthesis of the overall codes.

Glitch—Memory

Just as memory emerged as an unexpectedly prominent dimension of game play, it also seems to serve an interesting role in the experience of glitches. Indeed, it seems as if glitches are only recognizable as such in contrast to a memory of what normal, non-glitch game play suggests should be happening. Glitches intervene in the relationship between memory and expectation. As a result, we might expect them to draw on memory in a different way than normal game play.

Each of my three subjects encountered glitches during their game play (Table 7), and in doing so they engaged in a process of recognizing, decoding, and solving the glitches. My subjects needed to have a working memory of the layouts, common obstacles, enemy interactions, and sounds in order to notice a rupture in the game play pattern and identify the glitches in SMW. From my observation, the more subjects became familiar with the patterns, the more likely they would recognize the glitches as they appeared. For example, there was a glitch that I noticed during Subject I's playing of SMW that she did not mention in her interviews; therefore, I surmise she did not

recognize it as a glitch. I had never seen this glitch (Yoshi's tongue pushes apples into an unreachable visual layer rather than eating them) before in all my experience playing SMW, and I suspect it is only my broader set of memories of the game that allowed me to recognize it as a glitch in the first place. The relationship between memory and glitch analysis matters because my subjects needed to recognize the glitch first in order for them to approach a solution to the glitch. Glitches in SMW were identified through a break in the usual pattern of the game, or through comparison with subjects' memories of other glitches, and therefore tied to memories of their playing experience. Another example of the subjects using their memory is when they noticed that Mario disappears from the screen; they knew it was an irregularity compared with previous memories of Mario as situated in the SMW layout. This Disappearing Mario Glitch is a common glitch, and the subjects came to recognize it.

In the context of media literacy in the classroom, Scheibe and Rogow (2011) suggest that the mechanics of memory are linked with approaching a problem and then modifying approaches to those problems. While their study does not apply directly to videogames, it speaks to the way in which memory can be used to modify engagements in a media literacy context. Indeed, if memory allowed the subjects to identify glitches in contrast with normal game play, they also were able to recall the glitches themselves and collect memories of their features and possible strategies for dealing with them. All three subjects, for example, agreed that the Disappearing Mario Glitch was one of the most fascinating parts of the playing experience.

Beyond that, subjects recalled glitch solutions and reapplied them within the game. All three of them, at least once, took advantage of the Disappearing Mario Glitch to help them navigate toward the end of the level. Subject C noticed and used the Disappearing Mario Glitch but chose not to use it in subsequent encounters, as he adjusted his approach. Subject I learned to adjust her approach by predicting its arrival based on past experience, and then used the glitch to help her finish the level. For both Subject C and

Subject I, the approach in which they employed, avoided, or solved SMW glitches was informed and heightened by their SMW game play memory.

Through this experience with glitches, we can see that the important role that memory played in game play also serves to be able to discern the difference between game play that is consistent with itself, and game play in which the logic of the game space is being broken or otherwise altered. Memory of this, in turn, allowed for exploring, decoding, and strategizing around this new level of problem, which then, in turn, provided opportunities to engage with or avoid glitches, thus folding them back into an expanded sense of game play.

Glitch—Skills Base

As glitches occur during game play, they challenge the skill base that the users have been developing in order to solve game play. Now they must attempt to understand problems that don't seem to make sense within the rules of the game they are coming to understand. This relationship between glitch analysis and skills base is important because it will inform my research questions, which are centered on the kinds of skills that are involved in perceiving, responding to, and solving the perceived problem of the glitch. As was the case in the previous section (and Table 6), the skills base here is divided into Embodied Skills first, followed by Thinking Skills (Table 7).

Embodied skills. The glitch encounters my three subjects mentioned were approached with the same embodied skills as those used in SMW game play: hand-eye coordination, manual dexterity, trial-and-error, visual memory, spatial-visual, problem-solving. However, the way they solved the glitches implies more in-depth thinking (see Thinking Skills, below). When they encountered glitches, they would use the same embodied strategies they deployed in regular game play to attempt to approach, feel out, and understand the nature of the glitch. For example, Subject I tried moving the controller buttons around to navigate Mario when Mario was immobilized in the “freeze” glitch.

Subject C said he was able to recognize a glitch when Mario moved to a different room (unseen, above the top of the screen) and became untouchable by enemies. As an architect, Subject C thought in terms of visual floor plans and applied this to SMW. In order to identify and solve glitches, my three subjects were using these and other spatial skills (see Appendix C), such as hand-eye coordination, motor skills, and trial-and-error.

What I was most interested to see in the data were the ways in which glitches heightened a sense of immediate interruption of their game play in the unexpected encounters with glitches. For example, when I was observing Subject I playing, she encountered a glitch, and in that moment she stopped playing. She then asked me if that was a glitch, which I did not answer. Then, after a while she resumed approaching the glitch. This pause implies that she was confronted with a thinking problem, and the embodied game play skills mentioned in Table 6 were interrupted, so that she could decide how to make sense of it.

Thinking skills. Discussion of the thinking skills involved in regular game play highlighted not just problem-solving within the game space but also included self-reflection and self-regulation. Discussion of glitches tended to center around the nature of glitches, questions of how they would influence the experience, and judgments about the appropriateness of engaging with them. My three subjects mentioned that they engaged in a decision-making process about whether or not they should use the glitches, and they analyzed the positive and negative aspects of them. Subjects C and S went so far as to analyze the glitches in moral terms. Subject S said that using a glitch is like cheating and should not be used, and in his visual essay drew the Mario character situated outside a television screen, with an arrow pointing to the word “shortcut.” During his interview, Subject S said that using the glitch was wrong, just as taking real-life shortcuts is wrong. On the other hand, Subject C said that glitches could be used to good effect, citing his visual essay response in which he creatively used the glitches as part of his artistic response. Subject C and Subject I identified the glitch as being of either human error or

machine error, suggesting that not just machines make glitches, but that people can also make glitches. In a different light, Subject I connected her glitch encounter with real-life solutions, such as the way she would avoid problems in real life; when she saw the glitch, she also thought of avoiding problems in the game. All subjects also said that glitches were too convenient, suggesting that one has a choice and must consider critically whether or not to use a glitch. Subject C questioned his use of the Disappearing Mario Glitch and said he wanted to play without the glitch because it was more “honest.” Regardless of the subjects’ opinions of glitches, these SMW encounters with glitches included an impulse to critically engage with and reflect upon the meaning of glitch.

Krapp (2011) states that glitches in videogames are a potential resource for creativity. Likewise, we see this in my study, for example, in the creative use of glitches in their visual essays. Beyond this, the subjects also suggested other skills that come to play when a glitch is encountered, recognized, and accompanied by the impulse to solve it. I was also curious about how subjects thought of human glitches and thought that they themselves were somehow “glitches” in creating errors, as when Subject C was confronted with glitches from the technology he was using and his own glitches and said, “I am the glitch.” The subjects expressed an engagement with many perspectives on glitches, and many more inquiries seemed to come about from their experience with glitches, such as the ethics of glitch, or the process of using or discarding human-made glitches or computer-made glitches in their artistic processes.

With the addition of the experiences of glitches, the embodied and thinking skills that were evident in regular game play took on an expanded role. Glitches heightened the immediacy of existing embodied skills, while reflections on thinking skills expanded to pose questions about the nature and causes of glitches (e.g., are they human or technical?), how to situate them within game play or not (e.g., are they interesting or meaningful options?), and even reflection on their ethics (e.g., is it fair to use them?). Ultimately, their considerations of glitches also resulted in critical reflection about the

role of glitches in SMW and real life, and concerns over what their use of glitches said about their own behavior.

Glitch—Self-directed Learning

When my subjects encountered glitches, they made their own decisions on how to respond, without any external guidance, and these self-directed actions led to enacting and developing self-learning in response to these glitches. The relationship between glitch analysis and self-directed learning matters because of the ways in which glitches in SMW draw subjects into modes of critical thinking and reflection (Table 7).

Several layers of self-directed learning can be seen in the subjects' responses to glitches. At the immediate level, they strategize and develop their own learning as a function of game play. Subject I, for example, applied problem-solving when encountering glitches by trying different approaches like waiting, pressing controller buttons, or else avoiding the glitches. Another layer involved critical thinking about how to reformulate their learning and goals in light of the glitches. As discussed in the previous section, the three subjects divided the glitches into those to be used or to be avoided. All three subjects used the Disappearing Mario Glitch to further their game play goal of completing the level. Only Subject C chose not to use it once, and this decision was self-directed. As he said, he wanted to play more "honestly." A third layer also presented itself in the data, suggesting self-directed learning that extrapolated the glitch experience outside of game play entirely, incorporating the idea of glitches as a creative and productive opportunity. When speaking about his visual essay and journal, Subject C mentioned how he used all the technological mistakes and what he called his own glitch, which came from printing errors. These glitches were visually incorporated into the creative process.

Adults who engage in self-directed learning (SDL) show their own sense of direction in initiating and managing their learning, according to Knowles (1975).

Videogame players use glitches in videogames to achieve their own goals (Krapp, 2011). In my study, there exists an overlap between videogame glitches and self-directed learning. When glitches occurred, my subjects showed an impulse to engage with self-directed learning and outcomes. Working with glitches on their own involved learning, such as using visual memory to repeat approaches to a glitch, using glitches creatively in the visual essays, reflecting critically about the purpose or morality of glitches, and changes in outcomes (such as establishing new goals in the game, finishing the level, developing a sequence of solutions to glitches). This overlap between glitches and self-directed learning is unlikely to be specific to videogames. Critical thinking and self-directed learning are instead likely to be underlying skills that are applied across diverse situations. What glitches highlight, however, is a particular set of conditions that seem to elicit these: a context in which discrepancies are perceivable against the backdrop of routine operation, a problem not solvable merely at that routine level, and an intrinsic motivation to solve it based on the goals of videogame play. Jenkins (2006) underline this with the use of technology and emphasize this as a motivator for natural SDL.

These data were particularly interesting in thinking about self-directed learning due to the condition of not having a facilitator. What is seen is that the subjects have a robust set of responses involving taking responsibility for their own learning, including managing their own approaches, setting their own goals, and managing the complexity and interest of their own initiative. My three subjects show their own initiative and learning paths, they show that glitch encounters and the impulse to solve these glitch encounters led them to critically examine their engagements and the larger meaning of glitch for each of them.

Real Life

In the context of real life, the subjects reflected on their experiences over time and made connections to their everyday lives. The subjects spoke of real-life connections through their use of memory and engagements with creative and social reflection. They connected their self-directed learning in SMW in ways to approach and reflect further upon their real lives. I will begin discussion of this phase by exploring the relationships of real life with memory, followed by skills base and finally self-directed learning.

Table 8

Relationship of Real Life Data with Memory, Skills, and Self-learning Data

Memory	Skills Base	Self-directed Learning
<ul style="list-style-type: none"> -Reminded of how other games were place of refuge for a friend. -Reminded of other arcade games and music. -SMW triggered nostalgia for real life events and music from the 1990's. -Memory of SMW can be used for driving, motor skills for bicycles and vehicles. -Reminded of people who take advantage of others through comparison with SMW glitch. -Related visual essay with real life through memories. 	<p>Embodied Skills</p> <ul style="list-style-type: none"> -Videogames help response-reaction skills, reflex to react quickly in situations in real life. -Hand coordination used in playing SMW can also be used as playing the drums or piano. -Concentration learned while playing SMW can be used in driving and exploring in real life. -Repetition, overlapping, different images from books and daily objects were used with the computer, internet scanner and printer. <p>Thinking Skills</p> <ul style="list-style-type: none"> -Videogames help improve English and resolve puzzles. -Videogames are good for children because they learn problem solving. 	<ul style="list-style-type: none"> -Persistence and repetition necessary in process until one succeeds in the game and real life. -All persons have to fail to learn better in SMW, and in real life. -Playing SMW is like real life in that we cannot go backwards. -Learned to create parallels between SMW, other videogames and real life. -In parallel with real life situations, we always have two options: hard and easy way. Reflected on positive and negative of having two real life options, hard way and easy way. -Compared SMW and glitch with going to a counselor/therapist. -Compared SMW learning to first experiences with fire. -Learned to find something in the game and transcribe it.

Table 8 (continued)

Memory	Skills Base	Self-directed Learning
	<ul style="list-style-type: none"> -Learned mathematics while playing SMW, when we count fish that he (Mario) eats or points gained. -Compared ethics of using glitch with real life cheating or taking advantage of people. -Journal could be an escape from worries and it could help reflecting on things and real life situations. -Can use experience of journal in future to develop other skills at the drawing level, like creativity. 	<ul style="list-style-type: none"> -Assigned self-imposed deadlines and constraints for visual essay and journal, just as in real work.

Notes. For more information regarding the sentences, please visit Appendix C, for the interviews or the previous coding, since this is a synthesis of the overall codes.

Real Life—Memory

When my subjects talked about playing SMW, they connected themes in the game and skills with real-life situations and real-life skills. Again, memory and remembering came up as an important theme allowing them to connect game play with real life. Sometimes this was in the context of being able to transpose skills from one to the other; other times it seemed to be a kind of inadvertent side effect. This effect of memory to connect game play to other life contexts is relevant to thinking about the status and value of videogames. Connecting SMW to real life via memory suggests that videogames, which are not considered “serious,” can also be useful outside of the videogame arena, and that commercial videogame skills and experiences have potential legitimacy and usefulness in the world outside videogames.

All three subjects from my study mentioned remembering the past through playing and talking about SMW. Perhaps as a result of the choice of an “older” game such as SMW, subjects were reminded of moments from their real life brought about through

playing it. For example, Subject I was reminded of moments in the 1990s through listening to the music in SMW. Subject C was reminded of music he used to listen to in the 1990s, such as Aphex Twin, which was electronic music that first emerged in the 1990s and which Subject C associated with the SMW videogame.

My subjects also mentioned the use of memory and the repetition of memory in how they applied it to real-world skills, such as navigating a car or a bicycle. When navigating through streets, one can recall and use videogame-related skills for navigating and negotiating space. For example, Subject I said that through concentration in playing SMW, she began to anticipate when enemies would appear, and she could potentially use this in real-world driving to anticipate when a car might cause an accident.

The capacity to remember skills across different contexts might be particularly useful. A study designed around helping senior citizens used a three-dimensional virtual driving simulation, making use of multi-tasking by also identifying signs at the same time. This videogame was created specifically to help them in real life with memory and attention span (Anguera et al., 2013), but commercial off-the-shelf (COS) platform videogames might also assist with these outcomes. My subjects were making these real-life connections on their own and reflecting on developing and improving these skills in the real world.

Memory emerged as a way to connect game play with other experiences in the real world, from nostalgia for a particular style and time period, to a capacity to feel the relationship of certain skills across different contexts, and perhaps transfer them as well.

Real Life—Skills Base

Memory may be an important connector for relating experiences in game play (and glitches) with prior experience, as well as anticipating future uses for the skills developed during play. As they reflected on their experience playing, my subjects made connections between the skills they were using in SMW with their daily routines. They expected to

see transference of skills across these domains. Again, I find discussion of these skills falls into two broad categories that were related to real life.

Embodied skills. All three subjects in my case study mentioned that videogames are connected and can help improve real-life skills, such as driving or riding a bicycle (Subjects S and C), or in the case of Subject I, playing musical instruments like drums or piano, connected with the performance of spatial skills. Subject S, for example, also said that he thought videogames were useful for children in that videogames could teach self-defense skills because of the hand-eye coordination used in videogames.

One study examines the possibility of transferring the skills of videogames, for example, hand-eye coordination, to surgical contexts such as laparoscopic, gastrointestinal endoscopic, and robotic surgery (Lynch, Aughwane, & Hammond, 2010). My subjects, likewise, were making the connections between the skills used in the videogame and the related skills used in real life. In addition, it is interesting to note that they were making these connections without a facilitator.

Thinking skills. All three subjects mentioned thinking critically, criticizing and thinking about SMW and the glitches. They emphasized that glitches provoked an impulse to problem-solve, and their responses showed a process of critical thinking, in which they reflected on many different elements that appeared to go beyond the specific technical challenge, and in particular, connections to ethical questions, to real life. For example, Subject S mentioned that he was reminded of ethical issues in real life, and that the Disappearing Mario Glitch reminded him of people who cheat in real-life situations. Subject C emphasized in his visual essay that the process is as important as the outcome, both in SMW play and in real life.

More pragmatically oriented, but also using examples of how they were looking for connections to thinking in daily life, they mentioned that videogames can help with learning or improving English (many games have an audio component or subtitles in

English and orient themselves through English), and Subject I suggested that counting fish in SMW could help children with their math skills.

Subjects thus reflected on their own, over a broad range of embodied and thinking skills, not just in relationship to the game play itself, but as applied to everyday life.

Real Life—Self-directed Learning

One of the most interesting things to emerge out of this study is that left to reflect on their own about their experience, subjects reflected a great deal about their own self-directed process and in particular about its relationships with their everyday life. My subjects made many parallel connections between SMW, the glitches, and real life. That these connections were made and reflected upon without a facilitator suggests that there is something in the experience of thinking about games, and particularly glitch experiences, that prompts not only self-directed learning but also the broadening of problem-solving to incorporate critical reflection on life experiences.

All three subjects mentioned the transference of learning and development skills into real life, such as driving a car (Subject C and S) or solving a puzzle (Subject S), which suggests that what was learned and developed while playing the SMW and encountering a glitch could be transposed and used in real life. Subject I mentioned how she approached and dealt with reaching the end of the game, which was the same blueprint she used to approach reaching the end of the visual essay and journal. Although she was not more specific than this, she implied that she repeated the same blueprint approach and applied it to real life. She also implied that SMW was more affordable than therapy and taught the same lesson, which is that with SMW as with life, we cannot go in a backwards direction.

Subject C said that the process is equally as important as the outcome. By process and outcome, he was referring to his choice not to use the glitch and thus to play more honestly (process) in completing the level (outcome), but he was also talking about using

the printing errors (as process) to incorporate into his visual essay (the outcome). He also mentioned the importance of failure to try and succeed again in both SMW and real life.

More generally, subjects connected their self-directed learning in SMW and real life to general themes. Some of these include the importance of failing in order to succeed, the need for persistence and repetition, and an emphasis on process being equally important to outcome. Subjects themselves noticed the way in which their self-directed learning connected with their lives, and it is this that they continually demonstrated through the interviews.

How This Informs My Research Questions

Thus far in this chapter, I have discussed the data of how the subjects responded to game play, glitch analysis, and real-life connections. In this second half of the chapter, I will address the research question and sub-questions and examine the ways in which this data responded to these questions. I will start with the sub-questions and conclude with my main question.

Research Sub-question 2a

Given that meeting the challenge of a glitch is encountered when playing SMW, what kind of skills come into being to solve the perceived problem of the glitch?

We are confronted with glitches in technology quite often, not just in videogames but in other technologies as well. If we can recognize and work with relevant skills, we may be better able to problem-solve when they arise. But conversely, we may also gain a better understanding of the usefulness of glitches in developing broader skills.

Before we can even talk about the skills that are elicited by glitches, we first must be able to recognize the glitches. They need to be able to be identified (and decoded) as glitches. This, in turn, requires being able to identify the normal pattern of the

videogame, and its rupture (see also Tables 2-4, Chapter IV Analysis, Solution). As Clark (1989) and Gee (1992) argue, thinking is largely about storing records of lived experiences and building detailed patterns of their interrelations. Glitch identification requires recognizing these patterns and noting a discrepancy.

Building patterns of SMW. My subjects mentioned having difficulties knowing if what they saw was a glitch or not, and only once they decided it was a glitch would they decide what to do with it. I refer to this process as recognition and decoding of the glitches. Instead of viewing glitches as errors to be corrected, glitches were incorporated as part of the study and part of the playing of SMW. Subjects built up their visual memories with patterns of normal SMW play and noticed when a glitch interrupted these normal patterns of SMW play.

One common example is the Disappearing Mario Glitch. All three subjects recognized this glitch as being a glitch, and referred to this event as such (see Table 5), which suggests that Mario's consistent visual presence in the game was central to the patterns the subjects built of their own experiences of the game. Mario is consistently situated at the center of action on screen, and so when that important segment of the screen is removed, it must appear to be a kind of anomaly in the established pattern. Only then can the subjects begin to problem-solve what the glitch means and how to respond to it.

General background skill sets. In order to develop a working set of patterns for the game play in the first place, players must draw on existing skills and background knowledge in order to proceed with play. This includes assumptions about game space, controllers, game logic, and so on. Each player will bring his or her own set of experiences both with videogames, and with problem-solving in general. Because it was a new game for my subjects, they would need to rectify their past experiences and skills with the specific experience of SMW. While we cannot know all of these subjects' background skill sets, they often self-reported on them, recognizing them as important.

The architect, Subject C, for example, mentioned skills he used as an architect with layouts, drafting floor plans, and architectural software such as CAD. Subject I, on the other hand, noted that she knew how to work with a computer and the Internet and that helped her decode SMW, while her mother (because she does not have Internet/computer skills) would not be able to use the SNES console. In addition to these specific skill sets, subjects seemed to draw on a number of general background skills, including, for example, manual dexterity, a general familiarity with how videogame controllers work, and a working sense of trial and error. Even more broadly, I noticed that subjects brought skills of play and experimentation in approaching technology issues, for example, experimenting (playing) with the controller to decode and learn the buttons.

These general and specific skill sets that each player brings to a new game become the basis for experimentation that will allow them to then develop a sense of the working patterns of this particular game. This, in turn, eventually allows them to notice anomalies, and identify them as glitches or not. This represents the first step in working with glitches.

Research Sub-question 3b

Given that an individual confronting an SMW glitch calls into play a range of responses, how do these responses interplay with each other as the individual tries to solve the problem?

In considering what skills are at play when glitches occur, it seems helpful to order the responses I have observed in a sequential fashion. First, the recognition of the normal pattern of the SMW level is established as a baseline in order to recognize the glitch (an anomaly in the normal pattern). Players are drawing on their background skills to navigate and develop their sense of normal game play. Next, when the glitch occurs, subjects have an impulse to inquire whether or not this is a glitch. Once the glitch is identified as glitch, they turn toward finding a solution through trial-and-error and problem-solving, in a process resembling “learning by doing,” such as Dewey believed

(Kozulin, 1984, p. 131). Dewey (1938) writes that part of the problem-solving process is that the learner experiences reflective thought catalyzed by an unforeseen incongruity of events. When things do not go as planned, the learner must reconfigure the problem, re-analyze, and re-think a new solution with trial-and-error.

In a similar fashion, when videogame players are problem-solving a glitch, critical thinking begins to happen, which leads into reflection and connections with real-life situations and real-life skills. Here, I will focus on the problem-solving that happens around the identified glitch.

During the course of normal game play, the three subjects mentioned encountering obstacles, and coming up with solutions or approaches to them. Glitches represent another form of problem, in which they recognize that something is off with the perceived normal patterns of the game. As discussed previously, the subjects, in their decoding of the glitch, made decisions as to whether they were dealing with something intentionally part of the game or accidental. I noticed that subjects responded with initial surprise or irritation when a glitch occurred. If they decided it was a glitch, subjects would play with the controller, attempting to make sense of it (see the decoding sections of Tables 2-4 in Chapter IV, in which subjects used skills such as trial-and-error, visual memory, memory skills, and repetition to problem-solve the glitches).

Once they understand the working nature of the glitch, the next phase of problem-solving involves deciding how they will respond to this glitch, incorporating it into game play or not. This next level of problem-solving involves more than just understanding how the glitch functioned within game play. Subjects would instead begin to assess the negative or positive value of the glitch. For example, they would consider whether it made the game too easy or not, or whether it was a useful way to complete a level. But they would also use critical thinking to assess the meaning of the glitch, and how it would reflect on them or make them feel to take advantage of it. Subject S, for example, said that the glitch should not exist, or that using the glitch was the same as taking “the easy

way out” or cheating in real life. Conversely, all three subjects said that glitches in some way contributed to creativity. Subject C also said glitches can be used to achieve a positive effect.

When the subjects attempt to solve the problem that a glitch presents, they appear to go through a similar problem-solving process that involves critical thinking, even if they reach their own individual solutions. After recognizing and being interrupted by the glitch, they draw on the skills they have to understand how it works, and then they decide whether or not to use or avoid the glitch as they return to regular game play. In the process, however, they open their thinking onto larger questions, such as ethics, which we will carry over into the connections they make to real life, and their ongoing creative reflections, which I will discuss next.

Research Sub-question 4c

Given that an individual meeting the challenge of a glitch when playing SMW arrives at a resolution of the problem, how do critical thinking skills come into being as a consequence of these responses?

Critical thinking skills come to the forefront in two related areas of this study.

(1) Glitches pose challenges during game play that force the players to critically re-assess the nature of the problem they are working on and immediately develop working strategies for responding. (2) During the following 30 days, the subjects have time to critically reflect on their glitch experiences, thinking through what they mean and how to incorporate them, this time without the pressures of game play.

In the first phase, we see problem-solving that begins to reach into the realm of critical thinking. Train (2003) defines critical thinking engagements as thinking that imposes criteria in one’s thought, or reflective judgments upon experiences. After many small problem-solving actions in the SMW, my subjects began to develop a set of solutions or a repetitive process that was successful in the past, and try to apply this sequence of thinking toward another situation. When they encounter a glitch, they seem

to be attempting to rectify it as quickly as possible in order to bring it back into the realm of normal game play. But this requires that they critically reflect on their choices in doing so, and the implications are not just for game play, but for their own sense of self. The goals of play themselves must be reassessed at a critical level, even if these issues are not easily rectified.

For example, Subject S was very specific in inferring a parallel of the glitch to a person taking advantage of others. Subject S brought up this moral ethical issue several times in the interview and addressed it in his visual essay as well. The ethical issue was centered around the idea that for Subject S, glitches were wrong and a programming error that should not have happened. He said that people who take advantage of others or who take shortcuts in real life are also wrong. Despite this, he in fact utilized the glitch to help advance in the game. So interestingly, his problem-solving action to reach the end of the levels in SMW was to utilize the glitch, but in his interviews he claimed thinking that concluded that to use glitch is generally wrong due to his “ethics” (Table 7).

Prompted by my request for journals and visual essay drawings, subjects reflected on their experiences of the SMW game play encounters. In looking at their reflections after 30 days, we can see that further critical thinking comes about through reflections on the ethics of using glitches, the positives and negatives of glitches, how humans also create glitches, reflections on their own behaviors and thinking, and how glitches can be used in artwork. Subject I said that in real life, her first instinct is to avoid a problem, and this was her first instinct also when approaching a glitch in SMW. At the same time, Subject I in fact did not avoid using the glitch. During the interview, she said something surprising with relation to her own mistakes in the visual essay. She referred to her own human errors as glitches (and to the computer and scanner mistakes as errors or mistakes but not as glitches). When she described the process of the mistakes, she criticized her own process and drew attention to how critical she was being about her own process. In the second interview, she mentioned regret about not having enough color in the visual

essay, and again criticized her own performance of the visual essay. She spoke critically of her artwork in this way quite a lot, and was critical even of her own thoughts and criticisms about her artwork. This suggests not only a sustained and relatively negative self-criticism, but also the complexity of ongoing critical thinking, attempting to make sense of the process.

This extended and complex process of critical reflection and creative engagement highlights the ongoing influence of glitch experiences on the subjects. The initial glitches present challenges that are not easily problem-solved away. They seem to require a more complex and even un-solvable or paradoxical set of responses and reflections. In the immediate term, this results in critical thinking, which results in a decision about whether to incorporate a glitch or not, and in the long term, complex reflections are found about the nature and implications of glitches, with many connections made to real life.

Research Question 1

What are the range of skills called into play and challenged when an individual encounters a glitch while using or playing videogames?

After my three subjects encountered glitches during SMW play, interview and observational data were then categorized (Tables 6, 7, and 8) according to the emerging themes of memory, skills (embodied & thinking), and self-directed learning. By comparing these themes across regular game play, glitches, and real-life connections, the specific effects of glitches on skills can be more clearly seen. In addition to specific skills, the broader inclusion of memory and self-directed learning suggested by the data allows us to see a greater possible range of skills that glitches call into play. The following categories, with just one example of each, are indicative of the range found in the data.

Memory. SMW glitch encounters elicited memories of other glitches, memorization of glitch solutions and approaches, and reminders and recollections of

using glitches (visual memory) to repeat the same actions. For example, Subject S reported using the memory of a glitch to finish a level.

Embodied skills. Dexterity with controller, reaction time, hand-eye coordination, spatial-visual orientation and navigational skills, all developed with game play, and encounters with glitches often disrupted this facility, resulting in increased concentration, and different order problem-solving. For example, Subject I reported that to prevent Mario falling during the Disappearing Mario Glitch, she had to focus her concentration.

Thinking skills. Glitches prompted critical thinking beyond the problem-solving required of normal game play. First, there was a recognition of the glitch, reflections on its purpose, and judgments about how to respond to it. Subjects considered the glitch a programming error (reflection on the origins of glitch); convenient, too easy, or cheating (reflection on uses of glitch, ethics of glitch); made by both people and machines (reflection on own actions as part of glitch or human glitch). They thought about how glitches were good/bad (reflection on positives and negatives of glitch) and were able to control their emotional responses and reflect on their behavior.

Self-directed learning. While subjects already self-selected and modified their own goals during normal game play, the encounter with glitches further required them to modify their thinking to include the nature of the game itself, their own sense of what was fair and interesting, and strategize about how to incorporate this back into game play. For example, Subject C reported shifting his goal to playing without taking advantage of the Disappearing Mario Glitch, finding strategies for avoiding it, such as taking an alternative path. This self-directed inquiry was further embraced in their visual essays.

Transposed to real life, Subjects reported on significant connections to their real life, both in terms of nostalgia for other times, with the expectation that experiences of the game would be relevant to real-world skills such as driving, as well as reminders that the ethical questions that emerge around glitches also apply to real-life interpersonal situations. It could be surmised that this ability to transfer critical thinking across

different domains is another skill in and of itself. For example, Subject C reflected that he could use glitches in his own artwork for good effect. Subject S reported that the glitches reminded him of people in real life who take advantage of others.

This study gave me an opportunity to see how subjects approach glitches without a facilitator, and how critical thinking might be engaged as a result of the drive to solve glitches. The transposition of glitch experiences to real life is suggestive of a prior capacity for self-directed learning, using experiences from one area to inform other areas without the need for explicit facilitation. While some researchers might debate this prior capacity (Candy, 1991; Merriam et al., 2007), this is one of the fundamental assumptions of this study—in agreement with Rancière’s elaboration of an equal capacity of intelligence and self-directed learning among all learners—and is thus not debated here. The diversity of skills that seem to have been elicited by glitches and how the glitches changed the nature and scope of the skill set (e.g., disrupting embodied skill patterns, eliciting ethical questions, and prompting connections to real life) suggest that there is an elaborate set of interrelated skills that are brought to the forefront by glitches in a way that is distinct from normal game play. Particularly surprising was the extent to which critical thinking skills across many levels were engaged.

While my findings suggest that subjects encountered crossover with thinking around moral issues spurred by glitch encounters, and with skills in real-life contexts, it is important to recognize that with realistic day-to-day experiences, people may or may not behave or operate in the same way that they imagine or they claim they would. A study of US prisoners by Lawrence Kohlberg (1971) makes a precautionary point. Kohlberg found that prisoners in his study demonstrated a level 4 on his 1-6 scale of moral development (6 being the highest), but revisiting these same prisoners one year later outside the prison, they demonstrated a significantly lower moral sense, coinciding more with the pre-conventional morality of 3- or 4-year-olds. Therefore, it is good to remember that while my findings show through interviews that subjects found and stated connections to moral

code in daily life as well as other skill-based connections, what they may actually demonstrate could be more variable (Kohlberg, 1971).

Research Sub-question 1a

Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World (SMW)?

Many people encounter technology as a regular dimension of daily life—although some not voluntarily, and other factors may limit access to technology, such as country of origin, lack of economic resources, gender biases, or other biases and barriers. Media literacy skills can allow us to analyze, inquire, and think critically about these technologies. Conversely, the skills we learn in these technological media might apply across media. In this study, I have been focusing on critical thinking as a key media literacy skill (Feuerstein, 1999; Jenkins, 2006; Masterman, 1985). Due to the nature of the study, we can examine this skill in relationship to videogames (and its potential transfer to other domains) independent of a facilitator and based on prior capacities and life experiences. This allows us to see how critical thinking, as a media literacy skill, is taken up within a self-directed context.

One limitation of the study is its relatively short duration, taking place over just two sessions, 30 days apart, including a visual essay and personal journal. In addition, I used a limited sample size of only three subjects engaged in one game-playing session, so the question of which skills are sustained has to be addressed through their own reflections and recollections, both in journaling and during the interviews. However, this provides interesting insight into the subjects' own self-perceptions of what stays with them, which is particularly relevant due to the expanded context of critical thinking that emerges in the data. Likewise, due to the relatively short duration of actual game play (1 hour), it suggests that if the subjects recall its effects 30 days later, there is noticeable skill learning occurring.

The interview findings suggest that they engaged in a great deal of critical thinking during that period. The results are particularly interesting in that they discuss not just aspects of critical thinking utilized during game play, or to problem-solve glitches, but are able to generalize to broader critical thinking and connect it to other aspects of their lives. Subjects over these second interviews mentioned that they themselves were the glitch, that other humans can be glitches, and reflected about the positives and negatives of glitches. This would seem to indicate a sustained level of critical reflection over that 30-day period.

While the subjects did not return to game play in this study, their ability to continue to reflect on their own self-directing strategies, their ability to remember and discuss particular glitches, and their spontaneous connection of these skills to real life suggest that, not only are skills being sustained, but also that they seem to flourish within an expanded context. It may be that encountering glitches within a self-directed experience lends itself to this kind of expanded critical thinking, which may, in turn, allow it to sustain itself across diverse experiences. This can be seen in the way the encounter with glitches expanded the scope of their critical thinking to questions such as ethics, and even further, their unexpected and spontaneous connection of these experiences to real life, and vice versa. To cite just one example, Subject I reported that what helped her finish the levels was that she imagined (as her therapist said) that she can only go forward, and that SMW was giving her the same message. She then further extrapolated this strategy in her visual essay as well.

If we consider media literacy to be the ability “to access, analyze, evaluate and communicate messages in a variety of forms” (Aufderheide, 1993, p. xx), and that a media literate person “can decode, evaluate, analyze, and produce both print and electronic media” (Aufderheide, 1997, p. 97), then the self-reports of the subjects suggest that they were not only able to sustain these skills, but develop connections across diverse contexts and apply them to their own self-learning and reflection.

Summary

In this chapter, I have outlined the conceptual synthesis of the data according to three phases around the experiences of glitches in SMW (game play, glitch, real life) and examined the patterns that emerged from the relationship of these three phases with the elements of memory, skills base, and self-directed learning. These close relationships allowed us to examine the research question and sub-questions as they emerged in light of these patterns from the data.

The interactions with glitches (as distinct from normal, glitch-free game play), both self-reported and observed in my subjects, seem to have elicited a diverse set of interrelated skills and inquiries highlighted by glitches, but perhaps also shifted the scope of the skill sets themselves, eliciting larger concerns about the ethics of glitch, bringing forth real-life connections, and rupturing established patterns of embodied skills.

A vital factor in this study is that the subjects' interactions with the SMW game were not facilitated or suggested by anyone else, including myself. What emerged, then, is how subjects engaged in a diverse set of responses toward game play and glitches on their own account, establishing their own goals and managing their own paths of learning. These data from this study suggest that self-motivated learning and exploration can be structured through the game space of the videogames themselves, but also through implied scenarios in the game space in which players might create, pursue, and even manage their own goals.

An important and unexpected element revealed through these data was the extent to which critical thinking was foregrounded in both the short-term engagements during game play, and in the longer term data revealed after 30 days of reflection. Subjects showed that the impulse to solve these glitch encounters yielded critical inquiries around the complexity of these engagements, allowing subjects to draw meaning into their own

lives and individually extrapolate a robust set of considerations about glitches in a larger context.

Chapter VI

EDUCATIONAL IMPLICATIONS

What has emerged from the analysis of our interview and data observations in my three-subject study was that videogame glitches can provide a framework for self-directed experimentation and learning. The subjects had a diverse and complex set of responses concerning taking responsibility for their own learning, including creating their own goals and managing their interests and impulses. I would like to discuss some possible implications of this study in terms of the broader picture of learning, both with and without a teacher. The results of looking at self-directed videogame play, and specifically the encounters with glitches, have broader implications for both self-learners and for teachers and facilitators who might be able to apply this to their own contexts. What can learners do to embrace their own self-learning, both on their own and with facilitators? And what can facilitators in classroom environments do to set up meaningful contexts for learners, both in their own presence and in their absence?

Self-learning without a Facilitator

Due to the general nature of videogames as a medium, particularly commercial games intended for self-use, they lend themselves very well to understanding the context of learning without a facilitator. In self-directed videogame play, what gets foregrounded is how learners utilize problem-solving and critical thinking, while drawing on their own previous learning and skills.

Given that a learner can learn independently, with their own goals and without overt external help, adult learners can bring their own goals with them or create their own goals (although oftentimes even young students bring with them significant previous experience and skills, particularly around technology). This has implications for the self-learning and development of critical thinking and connection with real-life inquiry.

There are many approaches of a learner to a videogame, just as there are many approaches to real life, as the subjects of my study showed when they connected their game play with the broader contexts of their lives. Perhaps within the game play structure, a player is expected to follow the normal course of rewards, gaining levels and points and extra lives from the beginning to the end of the game, defeating a succession of more and more challenging obstacles. But glitches, and particularly structural glitches, open the game up to other possibilities in which the player finds his or her own goals. Not only are the games themselves explored without facilitators, but within this, glitches present opportunities to move outside of the implied goals of the game itself. If a glitch in a videogame is like a tube of oil paint, then we as game players or new media users are its aspiring Van Goghs and Rembrandts. Children constantly play with their imagination. As adults, we do not always cultivate or value the imagination the way we could. The same could be said for the play that goes along with it. But I would argue that both play and the use of inquiry are utterly necessary elements in education. The reason for this is simple: play stems from one's own desire, and perhaps particularly a primordial need for non-goal oriented experimentation.

This kind of media play with videogames allows for the accidental, for the unanticipated, and glitches, rather than being merely disruptive, serve to further highlight this aspect of play and learning. This involves critical thinking about the game space and the game as a mutable, unpredictable world in itself. Videogames (and their glitches) thus provide a direct example of rich contexts for self-directed exploration and learning in which a facilitator is absent by design. Videogame play brings the power of self-directed

play to the forefront and leaves open the question of how the learner wants to direct it. Critical thinking is embedded in the problem-solving occurring in that moment. My subjects all mentioned in the interviews the connections and relationships they created to make meaning of what was happening after they identified a glitch and decided how they would incorporate it into their play. In the broader scope, it matters because glitches are a naturally occurring phenomenon in any technology we encounter nowadays and can give rise to inquiry concerning what to do with them. This is a largely untapped resource that, in activating self-directed learning, could be brought productively into pedagogical discussions.

Self-learning with a Facilitator

What I want to explore now is how teachers might foster the type of learning I have noticed spontaneously occurring across my subjects without teachers. I am interested in how teachers might calibrate their own teaching methods to support and enhance the subjects' own learning, considering all of the skills and motivations they bring. What does it mean to teach someone who already has these skills? What other skills might they need to augment what they already know? Students who bring a multitude of media literacy skills with them into the classroom are not just a glass to be filled with knowledge. Adult students, in particular, come to the classroom with diverse background skill sets, their own goals, and their own ways to apply themselves.

Here, I propose three examples of how teachers might foster this kind of learning in the classroom by addressing self-directed learning of their students: The first example is based upon the teaching techniques of JJ, the teacher in Rancière's (1987) *Ignorant Schoolmaster*, who used *Telemachus* as the text through which Flemish students taught themselves the French language. The second example is based on Yanagihara's (2015) facilitation of students using the videogame Minecraft to build native-Hawaiian ocean

vessels. And the third example is based on my own experience leading a creative open class for educators in Portugal. (Note that my own classroom example does not make up part of the data set from the research for this dissertation, but comprises a separate study entirely.)

1. With the *Ignorant Schoolmaster*, the classroom objective was to learn the French language. In this remarkable case, the teacher did not speak any Flemish and was tasked to teach a group of students French. The way the students learned was by self-directing themselves, and motivating and helping each other. The chosen strategy for the teacher or facilitator was not to teach French directly, but merely to check in from time to time to monitor the learning, which was happening. With this model, the teacher mainly reinforces the principle that students can think and learn for themselves. There is a certain amount of intellectual self-reliance that is inherent in this method, showing that the students are themselves the font of knowledge and that they must access their own learning centers and activate their own knowledge. The basis of this model is that students propelled by their own desire can learn and teach each other French, based on the idea that the will of the learning itself is what truly propels learning for the student.

In considering what skills the teacher brought to this classroom environment, however, this self-directed learning model is distinct from the others that follow in the sense that the instructor is an expert (native) French speaker, thus models the target knowledge. JJ, as an exiled French professor, brought to the classroom the expertise of speaking, reading, and writing perfectly in the target language. So while he could not relate to the students with their own Flemish, he could model and demonstrate the necessary grammar, vocabulary, sentence structures, and syntax that were the end goal of the class: the learning of the French language. So while JJ may have been ignorant in the sense of directly translating how the learning should take shape, he could serve as a living model of expertise of the subject himself as an individual, alive and available for interaction in the classroom. This is an important distinction. So the teacher brings desire

for communication as the goal to learn French. And the teacher brings an external check that allows the students to reflect on their own progress, as well as gain a sense that they are on the right track.

2. Another way to bring self-learning into the classroom is particularly relevant, because it involves incorporating videogames directly. While “educational” videogames are increasingly used in the classroom, in this case it is a commercial videogame, intended to be played without facilitation. Yanagihara (2015) explored the use of Minecraft with his students. During his class, he asked students to make a list of the typical learning steps they normally take when they approach a videogame and how they learned to navigate the game. This process may be different for each student, and what it did was set the context for a process of contemplation in each student regarding his or her own learning processes. Yanagihara then asked them to repurpose that learning process and apply it to real-life research on native Hawaiian construction of boats. As a facilitator, Yanagihara provided the topic and the idea of writing down the process of learning that the students undertook. He then observed that students had internalized this process (a process of learning independently, which was their own to begin with) and made more out of it than just memorization. With Yanagihara’s class, the process of the students’ self-management and reflection on their learning was as important as the outcome. This is an example of bringing to the surface the existing skills of the students (with videogames) and the teachers facilitating reflecting on their relationship with other skills needed, such as awareness of one’s process of learning. In this second example, the teacher gives the student a videogame for them to play and asks them to take notes while they are learning. These notes are the way the students approach their self-directed learning in the videogame. And these are the notes the teacher then asks them to utilize outside the classroom and use as a set to research about boats.

My study specifically worked with older subjects outside of typical learning contexts, in part to isolate the glitch encounter itself. Nevertheless, the results may be

instructive for working with younger children in facilitated school settings as well. Young children often have experience playing videogames outside of a school context and are often already engaging with glitches (and reflective thinking) on their own. This represents an opportunity for teachers to incorporate these self-directed experiences into facilitated classrooms. Teachers, especially if they are unfamiliar with videogames, can trust and encourage children to play. This may involve, for some teachers, a shift in thinking of videogames as themselves valid forms of learning. Dialogue and inquiry may emerge about the experience of game play and particularly glitch experiences. Teachers might also be encouraged not to treat glitches as problematic for the classroom, and to allow the children time and opportunity to learn from them. Teachers can observe how the children deal with glitches and engage in reflective processes. Through this process, the teachers can facilitate awareness about each student's process and reflection on their learning. If students are to "learn from their mistakes," they must be given opportunities to see that mistakes take many forms and are opportunities for true problem-solving. This need not be restricted to videogames. Learning to respond to glitches may also provide a context for dealing with unexpected challenges when learning how to ride a bicycle, for example, or programming a television remote control. Classrooms are often full of technical glitches, from electronics to pencil sharpeners. For a teacher who wants to facilitate self-directed learning in the classroom, I would advise an open mind about the importance of play at any age and how we can "learn by doing," as Dewey believed.

3. The third example is from an open class I administered to 49 adults, in which they were asked to play a typical videogame, but one for which I custom-coded the glitches. The students could choose the goals of the class, and I, as the teacher, tried to be the least present and intrusive, only setting the context and being a timekeeper to give everyone in the classroom an opportunity to participate. Mostly, I observed. I saw how students demonstrated learning from their mistakes and turned their mistakes into play, discovery, and, mainly, community, through learning from each other's techniques and

mistakes. Students were able to transform this play and experimentation into remarkable visual responses on almost zero notice, and receive and give valuable feedback. Their own responses were creative and catered to their own goals. Some of the groups created class exercises based on the glitches they encountered, so when they become teachers, they can ask their students to perform them. Others wanted to create interactive photos using mobile phone apps to show their critical thinking about having played the videogame and encountered glitches. The process and processes of critical thinking happened naturally within their groups and within themselves without the need for explicit teaching. What I came to understand was that the glitch encounter functioned to support self-learning. It was inspiring to have confirmation of the notion that students could be self-directed by videogame glitches, and it felt gratifying to observe—and to minimally participate in facilitating the class—allowing students to discover for themselves and utilize their new media literacy skills. This open class showed me that, as a facilitator, my role was to create a nurturing place of inquiry and an environment of play.

Conclusion

These three examples suggest that there are many different ways in which self-learning can be utilized in classroom contexts with facilitators. Although they vary in approaches, they do have some commonalities.

In all of these examples, the teacher sets up a context for media play: controlled adult play, which normally would not occur in a social classroom context. The teacher also utilizes media's capacity to stimulate engagement, and to create what Rancière would call "a thing in common." For JJ, the media is a traditional book, the text of *Telemachus*. For Yanagihara, the media is the videogame Minecraft, and for my own class I choose a custom-designed "glitchy" videogame. Regardless of the type of media,

in each example, the teacher as facilitator works as a referee of sorts, in order to facilitate the students' learning, providing the parameters of timekeeping, interactions with groups, and other practical considerations for running a smooth classroom. The teacher also adds a structure by which to approach and interact with the challenges brought by the media.

All of this would not be possible without the teacher also bringing a safe and nurturing classroom environment in which the students feel comfortable to set up and direct their own learning to begin with. The teacher also brings his or her own expertise and background, which cannot help but influence the environment of the classroom as well.

In the end, while the students are essentially directing and managing the bulk of their learning, the teacher as facilitator plays a crucial role in establishing the environment, stimulating with media, providing a structure, and fomenting an ambiance for critical inquiry around the media. This, in turn, spills into even the structures of play and self-directed learning being generated by the students themselves. So while this type of self-directed learning is inherently student-centered, the teacher must be present to facilitate, nurture, and guide the students. That being said, the students also have the opportunity to develop the skills they already had walking into the classroom, and through the structure and stimulation of the nurturing environment, they have the chance to explore further and develop further in these skills.

Given the potential for exploring how teachers can implement self-directed learning in their classrooms, there is much room for experimentation. Different forms of media might lead to different experiences, and in particular it would be interesting to experiment with videogames that students are already familiar with. There are also interesting questions about how this might go differently with different populations, with different levels and types of media literacy. Perhaps most exciting is the possibility of exploring not just different media, but errors and glitches themselves within these media.

Chapter VII

CONCLUSION

The journey of this study originated in my early interests in technological glitches, starting when I was around 10, first with glitches in televisions, telephones, video, and audio cassettes and other non-videogame technologies, and second with glitches in videogames, from the programmable Spectrum videogame system to the Nintendo Entertainment System, and finally the Super Nintendo Entertainment System, the console that brought us the exceptionally glitchy Super Mario World (SMW). I became curious how playing and solving these glitches might require the player to learn without relying on any external guidance. This interest in glitches also informed my teaching and art practices, where I found myself embracing and incorporating glitches as part of the process.

The problem that framed this study was derived from this initial curiosity in glitches and their hidden potentialities. What for commercial game developers have been unwanted errors or mistakes, I perceived as beautiful, strange, spontaneous encounters—not binary digital failings, but rather a force behind an untapped skillset. The problem statement was posed as a need to find the qualities present in videogame glitches that might serve for self-directed learning. Most of the research into the relationship between learning and videogames focuses either on the use of games with a facilitator, or on games specifically designed for educational purposes. Moreover, only three seem to mention glitches, two of them as an aside related to creativity, and the third with the

focus on glitch detection with the aim of eradicating them from the code (Bruckman & DiSalvo, 2011; Krapp, 2011; Menkman, 2011). I chose to concentrate on how glitches might foment self-directed learning without facilitation.

The main research question concerned pinpointing the range of skills called into play and challenged when an individual encounters glitches while playing videogames; more specifically, it concerned which *media literacy skills* are attained or developed independently of supervision. I further divided this into several sub-questions. First, since people bring their own history and skills with them, what kinds of skills do they draw on when they encounter glitches? Second, how do these responses interact in the complexity of solving for the glitches in the moment? And third, how do critical thinking skills come into being as a consequence of these responses? The aim was to understand what skills people draw on and perhaps develop as a result of encountering glitches, understood as something more than mere errors.

In examining the literature that informs this study, I discussed the research on new media literacy—that is, the technological literacies as situated in our contemporary digital environment—with a specific focus on critical thinking and self-directed learning in this context. The other main theme across the literature review is the significance of learning through play. I examine how experimentation through forms of play fosters profound and complex connections in adults between creativity, productivity, imagination, knowledge, and coping strategies. It is in the joining of these two main areas of research (new media literacies and the educational importance of play) and by taking glitches seriously that my study emerges in support of self-directed learning as a facilitator for critical thinking.

In order to embrace the complexity of the problem, I decided to use a case study methodology. Due to the case study approach allowing for studying real-world situations without scripts, it was ideally suited to the unpredictable nature of glitches, without defining ahead of time what kinds of skills and responses would be brought forward in the experience.

Working with a small set of subjects, I invited each to play two 30-minute levels of SMW, with the aim of giving them multiple encounters with glitches. This allowed me to directly observe how they responded, and in addition I interviewed them immediately afterward to attempt to understand better how they viewed the glitches and their responses. In order to see what stayed with them from this experience given more time to reflect, I asked them to keep visual essays and personal journals and return for a second interview 30 days later. The data from all of this were then coded and synthesized in order to pinpoint specific themes and skills that emerged to better understand how the glitch experiences were decoded, analyzed, and solved.

The patterns that emerged from the data involved three major themes: subjects first developed strategies for game play, second they made connections with real life, and third they engaged with the nature of glitches as a complex phenomenon. Across these themes, subjects were drawn to using a variety of skills, which I have divided as Embodied Skills (such as manual dexterity, hand-eye coordination) and Thinking Skills (critical thinking, inquiry, reflection). In some cases, such as problem-solving, skills were found to be interrelated between both Embodied Skills and Thinking Skills. Some skills, such as driving skills and visual-spatial skills, were found to be transferable to a certain extent across real life and videogames. Finally, in examining subjects' solutions to glitch encounters, themes of memory use in problem-solving and self-directed solutions emerged as an important pattern in the data. Broadly speaking, what emerged from this study was the conclusion that videogames, with their peculiar and spontaneous glitches, can provide a structural context for self-directed learning that draws on previous skills. Critical thinking and inquiry naturally emerged from this glitch confrontation, as the subjects were problem-solving the glitches and at the same time deciding how to solve for them and incorporate them into a strategy for continued game play.

Given the surprising extent to which critical thinking and inquiry were happening with my subjects as a result of one hour of playing, a natural question would be how

these glitch experiences might be harnessed for self-directed learning, both in and outside of the classroom, and both with and without a facilitator. This potential of glitch experiences in new media is developed in relationship to three examples, each with different educational contexts. The first is the case of JJ, in the *The Ignorant Schoolmaster*, which highlights the values of self-directed learning drawing on previous skills (Rancière, 1987). The second is Yanagihara's (2015) use of videogames specifically as an opportunity to draw out existing critical thinking skills and apply them to scholarly research. And the third draws on my own experience, specifically incorporating videogame glitches into the classroom with adult learners. Each of these provide opportunities for thinking about how the results of this study can be applied in diverse educational contexts. Given the educational implications, I am most interested in fomenting and nurturing a place for students to bring and play with their skills, and also bring awareness of these underlying skills, such as inquiry, critical thinking, and the processes of self-learning.

Although it was not my focus, one consideration would be a more detailed taxonomy of glitches, which could add to the precision of future research. Glitch taxonomies have already been developed with an eye toward removing them (Bainbridge & Bainbridge, 2007). Further elaborations, focusing on the experience of glitches themselves, might illuminate different user experiences, which may, in turn, have implications for the kinds of thinking and problem-solving they elicit. Although my research does not debate this factor, it should be said that glitches can be used and also interpreted or perceived in positive or negative ways. Instead, this research gives emphasis to the process of self-directing the learning and thinking that may come from the glitch encounter. The focus here is more about the importance of reflection and critical thinking that may be emphasized when students encounter a technological error.

Further Inquiry

As discussed, in the context of guided facilitation of videogames, the media literacy skills regarding spatial-visual and memory are well established. Further research on videogame play may foreground how thinking skills such as critical thinking are elicited both with and without facilitation.

1. Because little research has been done regarding glitches, this study suggests the value of continued research into their productive dimensions. Future research specifically looking at glitches might involve:

- a. The specific interactions and relationships between problem-solving with critical thinking in engagements with (1) videogame glitches and (2) other media glitches, such as computer-derived glitches or mobile-phone glitches. This might also provide insight into how different types of media affect the responses subjects have with the glitches.
- b. A comparative study of critical thinking engagements with videogames that have glitches and videogames that don't. This could further elucidate the specific qualities that glitches bring to the foreground over game play in general.

2. In addition to this broad study of glitches and new media literacy, more specifically research into how to incorporate technological glitches into the classroom might also prove valuable. Two possible directions of study are:

- a. How we (as teachers) can better promote facilitation of self-directed learning with glitches regarding: teaching new literacies, computer programming, art-making or art-history, as well as other subject areas such as history, philosophy, literature, political sciences, engineering, and onwards. In other words, how might minimal facilitation of self-directed learning incorporating glitches transfer to other subjects?

- b. How might further research benefit curriculum for children? In this research, I focused exclusively on how videogame glitch interactions occur with adult subjects, but I did not consider children. Given that play serves as a significant portion of the impulse to solve glitches in videogames, perhaps children might naturally explore glitches if allowed self-directed learning opportunities. Although it was not my focus, I would speculate that a larger pool of data drawn from children in research for this area might yield interesting quantitative and qualitative knowledge about how children might learn media literacy skills using glitches as a touchstone.

Personal Reflection

In reflecting back upon this research as a whole, one particular moment from this study stood out for me. When recognizing a glitch during her game play, Subject I asked out loud what she should do with the glitches. In my researcher role, I did not answer her, and eventually she decided for herself how she was going to handle them. In contemplating this moment, it occurs to me that it is natural to ask for guidance, but that providing it may in certain circumstances remove the opportunity for critical thinking and self-directed learning. Each learner may have different comfort levels with problem-solving on their own, but within this, there may be more opportunities for variation than we often take advantage of. While she looked for outside guidance or facilitation, in its absence, she came to decide for herself what to do with this glitch encounter. During the interview, she was able to articulate her decision-making process in relationship to the glitch and her overall goal. This is just one small example from my study that indicates the potential of bringing self-directed learning more fully into the classroom.

When I look back at how my research unfolded, I find myself reflecting on two main points. The first point I took away from doing this research is the extent to which I

now see that self-directed learning can be a process one can actively facilitate in classrooms. There could be great value in further research using self-directed learning techniques as applied to other knowledge, and not just videogames or even media literacy.

Second, the complexity behind the process of identification and decoding of glitches was like a puzzle or intricate game, which created a sense of play in identifying the glitches; and alongside this, I was impressed with how much critical thinking becomes intertwined at an early stage in the decoding process, which I noticed taking place in all of my subjects.

Given this research, it has altered my own experience and reflections upon play, videogames, and glitches. With my own interest in general technology glitches and then later glitches specifically in videogames, I can see there is a great deal of importance in play in adults and that videogame glitches have the potential to facilitate learning and to be applied in classroom learning. My early experimentations with glitches in technology have given way to a professional interest in the potentialities behind videogame glitches, and it has struck a chord of curiosity as to how other videogame glitches might be further explored for their creative and learning potentials.

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Appendix A

Images



Figure A.1. Subject C playing SMW on the “water level” and encountering a glitch.

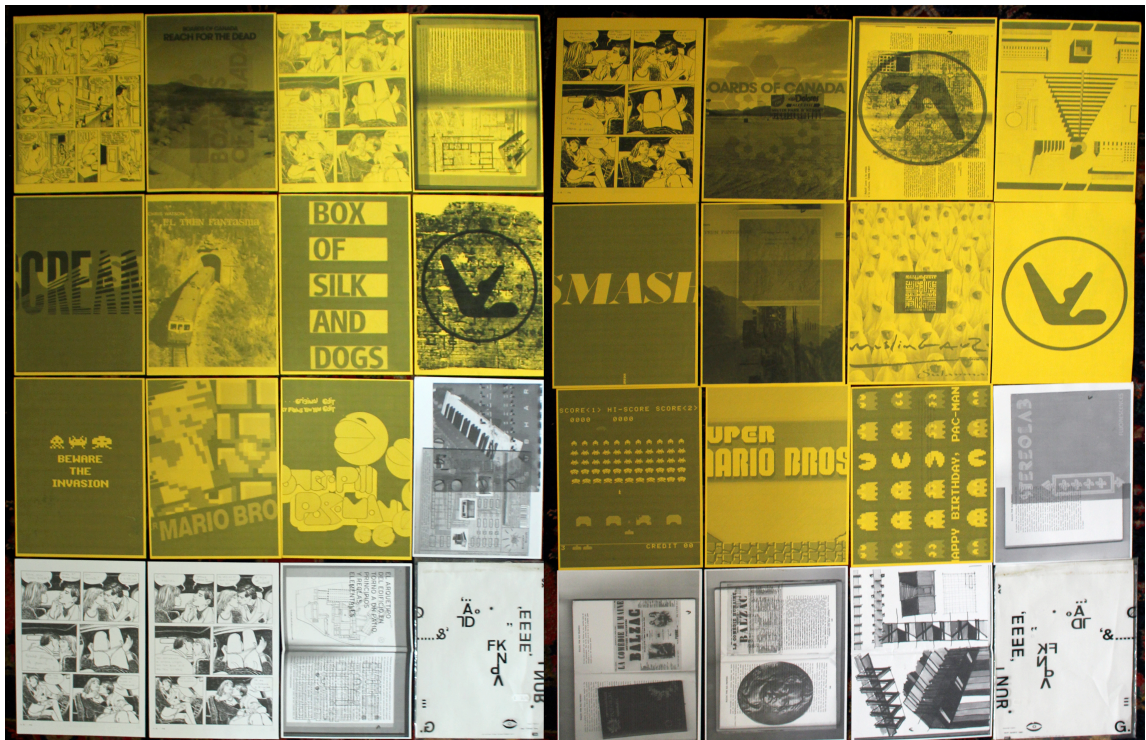


Figure A.2. Subject C, visual essay and personal journal.

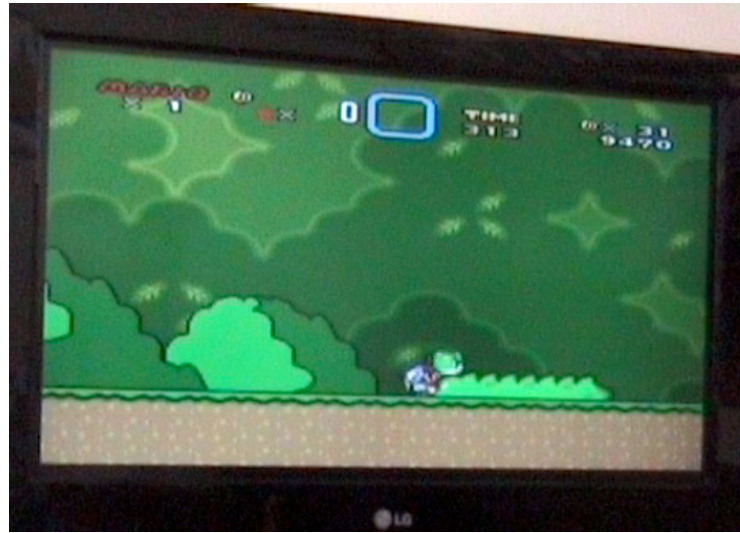


Figure A.3. Subject I playing SMW on the “1st level” and encountering a glitch.

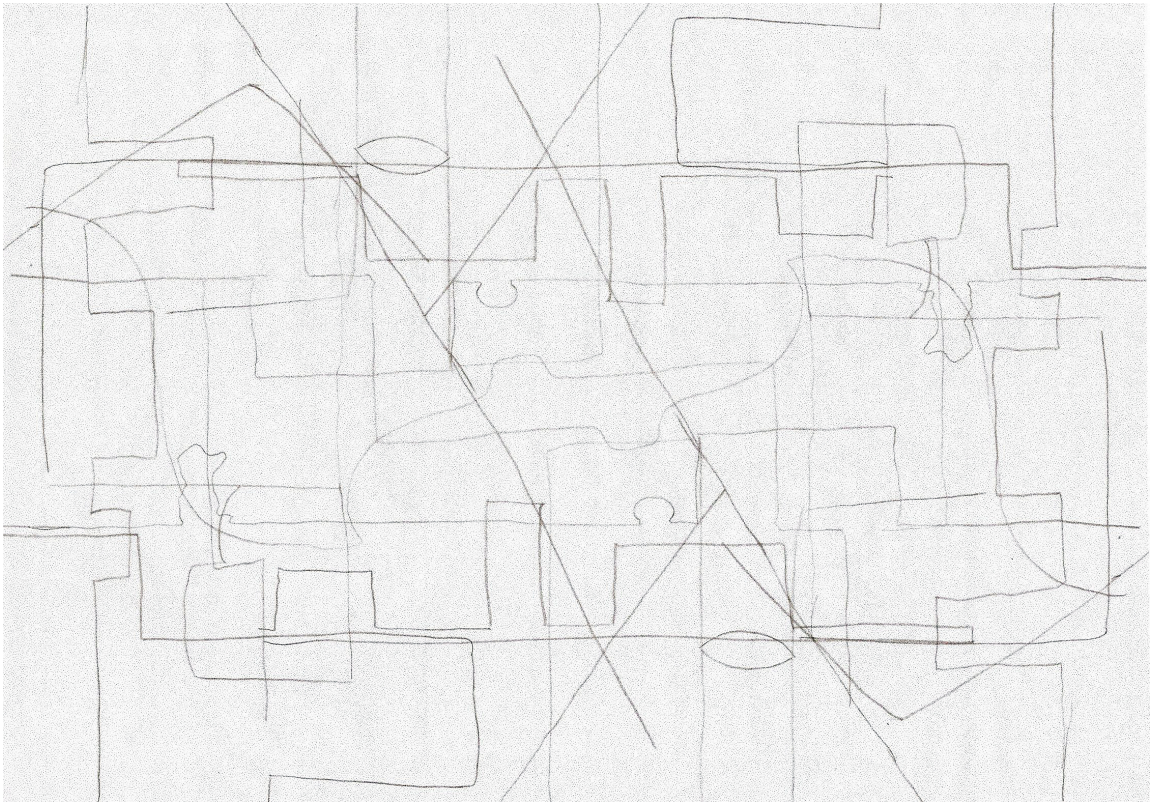


Figure A.4. Subject I, visual essay.

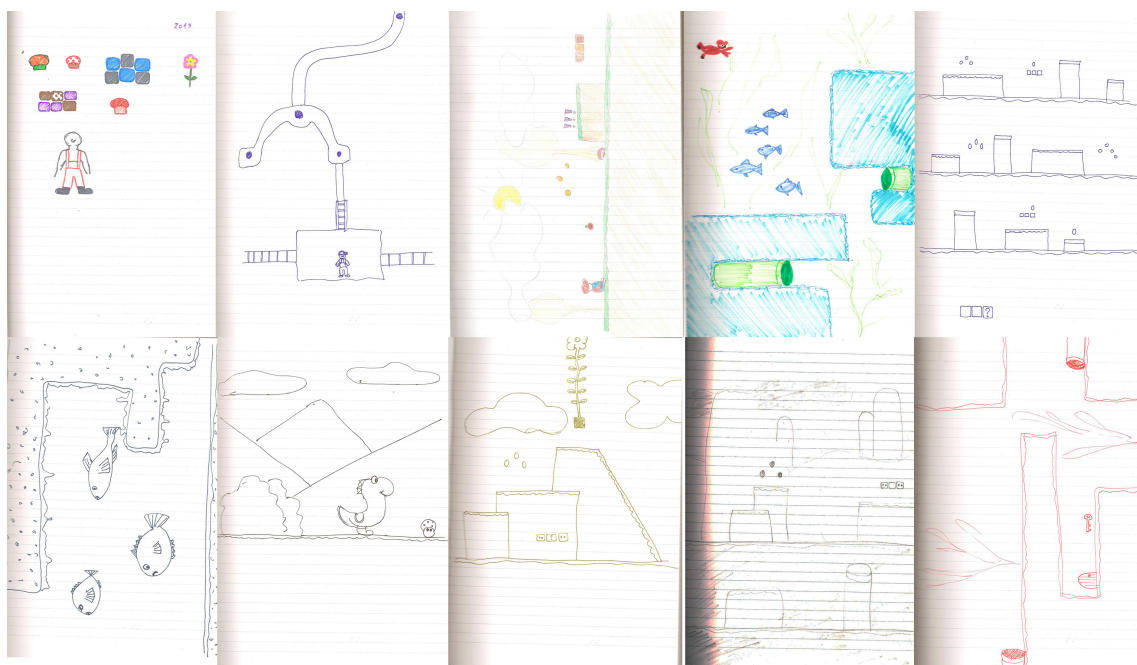


Figure A.5. Subject I, personal journal.



Figure A.6. Subject S playing SMW on the “water level” and encountering a glitch.

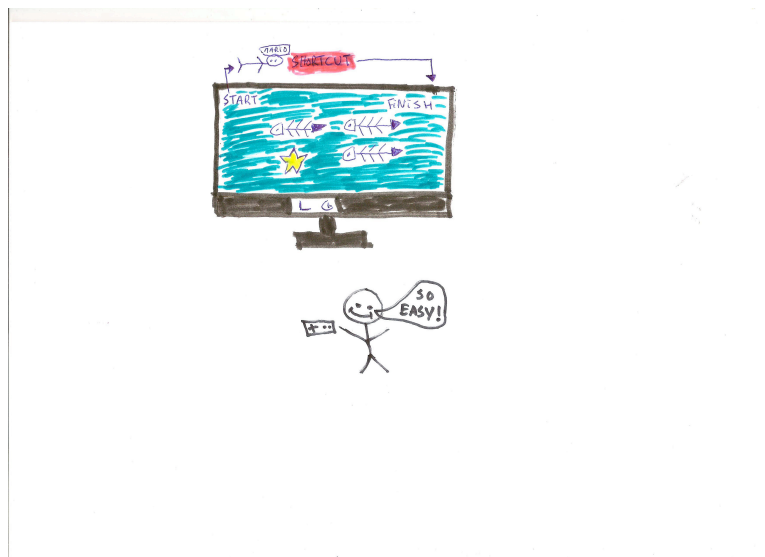


Figure A.7. Subject I, visual essay.

Ades o jogo nem jogo infantil, ~~mas~~ momento
 que melhora para ver as imagens caçadas por
 capitulo real. Existem jogos que realmente ajudam por
 melhor a raciocínio, o que não foi o caso. Jogos first
 person shooter realmente ajudam a desenvolver
 tempo de reação a situações de jogo, mas na vida
 real, porque nestes jogos estamos sob pressão constante
 e qualquer distração pode ser fatal. Pense que uma
 distração, este tipo de jogos pode ser útil, porque não
 são violentos e ajudam desenvolver, além disso de caçada
 de, o que não é o caso de adultos que já possuem
 capacidades superiores.
 Além de tudo acho que os jogos são uma ferramenta
 de entretenimento mais do que uma desenvolver capacidades
 para desenvolver capacidades, penso que existem atividades
 mais úteis.
 A maior parte dos videogames jogados as crianças em
 casa, quando já ficam a brincar com os amigos,
 desenvolvendo competências sociais.

Figure A.8. Subject I, personal journal.

Appendix B

Research Documents

Glossary of Terms

Arcade game: a professional videogame used in entertainment establishments. This game consists of an enclosure (box of wood or plastic), a picture tube (CRT) monitor (for image generation components, such as fly-back, resistors, capacitors, etc.), power supply, and game system. The latter varies according to the game manufacturer, with some being composed of a single board (PCB), or combinations such as the motherboard and cartridges (Tome, 2003).

Platform game: the name given to a genre of videogames where the player runs and jumps between platforms and obstacles facing enemies and collecting bonus objects.

Console: a microcomputer dedicated to running videogames, or videogames that are in a cartridges or optical disks (CDs and DVDs). The information of the games are processed inside the unit and made available to players with the aid of a graphical interface, presented in a display device such as a TV, monitor (*American Heritage Dictionary*, 2001). One can typically interact with the game through a control command such as a joystick.

Critical thinking: a process in which a person makes rational determinations upon how to act, or what statements, persons or actions to give credence to (Norris, 1985). Competency in critical thinking is achieved through a network of processes which inform the larger critical thinking skillset such as interpretation of information, its application, analysis, synthesis and evaluation; each of these processes in turn need specialized knowledge and particular attitudes which are directed towards critical thinking (Cretu & Cretu, 2014). To summarize, critical thinking is variously defined but largely agreed upon as containing skills such as analysis, evaluation and application of information (Ruminski & Hanks, 1995).

Media literacies: Aufderheide's (1993) definition of media literacy is the way in which a person decodes, analyses, evaluates and produces within the society utilizing the available media.

New literacies: this is a term used by Kist (2005) which expands the age-old concept of literacy to factor in the technologically embedded, multimedia society in which we live.

Glitch: in the *American Heritage Dictionary of the English Language* (2001), "glitch" is an English word borrowed from the German word *glitschig*, and its original meaning is "slip," but in the *Oxford Advanced Learner's Dictionary* (2014), glitch can also be considered "a small problem or fault that stops something working successfully." However, in the *Oxford Dictionary of Modern Slang* (2008) "Glitch" is a "sudden brief irregularity or malfunction (of equipment, etc., originally in a spacecraft), also, something causing this." The term was first used in the USA by American electronic engineers from the fifties to refer to the sudden malfunction of an electronic device.

Edutainment: educational entertainment. The first time this word was used was in 1984 by Electronic Arts, to market the game *Seven Cities of Gold* (Andersen, & Dalgaard, 2005; Buckingham & Scanlon, 2002; Okan, 2003).

Nintendo DS: portable game console released on Nov. 21, 2004 (Ryan, 2012).

SNES: Super Nintendo Entertainment System, known in Japan as Super Famicom. Videogame console from Nintendo (4th generation), released in the 1990s (Ryan, 2012).

Visual Essay: production of visual data (Pauwels, 2002, 2010). A visual form of visual research (Grady, 1991; Pauwels, 1993; Wagner, 1979).

Informed Consent Form Sample

Teachers College, Columbia University
 525 West 120th Street
 New York NY 10027
 212 678 3000
 www.tc.edu

INFORMED CONSENT

IRB Study # 13-296

DESCRIPTION OF THE RESEARCH: You are being asked to take part in a research study. Research studies include only people who choose to participate. This document is called an informed consent form. Please read this information carefully and take your time making your decision. Ask the researcher to discuss this consent form with you, and please ask her to explain any words or information you do not clearly understand. The nature of the study, risks, inconveniences, discomforts, and other important information about the study are listed below. The researcher is asking you to participate in a research study called: The Role of Videogame Glitch in Adult Learning. The person in charge of this research study is Beatriz Albuquerque. This person is a Portuguese student conducting research for her thesis dissertation. Her native language is Portuguese. The research will be conducted in her home office in Portugal.

Purpose of the study: The purpose of this study is to examine the viability of different approaches, engagements, influences and outcomes of learning vs. playing in the videogame realm without a teacher's interaction. The platform videogame used is the Super Mario World game from the 1990's. This research study provides the opportunity to study this dichotomy from the adult gamer's own experience and the scholar's point of view, and looks at the skills and influences gained through this game play.

Study Procedures: If you participate in this study, you will be asked to:

- Meet 2 times with a period of 30 days between the 2 sessions
- Play a videogame for one hour
- Participate in two interviews: both with a 30-day period between sessions which will last 1 hour each
- Create a personal journal of the experience of playing a videogame
- Create a visual essay based on the one hour experience of playing a videogame
- Present the visual essay and personal journal and after 30 days attend the 2nd interview

- Allow the interviews to be audio-taped with your consent and a fictitious name will be assigned to the tape. The tape will be destroyed after the dissertation thesis is concluded.
- Allow the monitor to be videotaped with the video-game running and a fictitious name will be assigned to the tape. In this video recording your face will never be shown. The tape will be destroyed after the dissertation thesis is concluded.
- Allow your personal journal and visual essay to be copied by the researcher, and the original will be returned to the participant. These copies will have a fictitious name and will be used solely in connection with this research study.

Total Number of Participants: About four adults will participate in this study.

All individuals are Portuguese and their native language is Portuguese. All the interactions will be conducted in the participants' native Portuguese.

RISKS AND BENEFITS: This research is considered to be of minimal risk to the participants. That means that the risks associated with this study are the same as what you face every day. There are no known additional risks for those who take part in this study. However, there are potential social benefits. While there are no immediate benefits for the participants, this research could improve and change the field in a scholarly way.

PAYMENTS: You will receive no payment or other compensation for taking part in this study.

DATA STORAGE TO PROTECT CONFIDENTIALITY: The researcher will keep your study records private and confidential. The only person who is allowed to see these records is the principal investigator. All data collected through notes/photos and audio/video tapes will be assigned a fictitious name and the participant's face will never be shown. The written, video and/or audio taped materials will be viewed only by the principal investigator. Also, the data will be stored in a locked box inside the refrigerator and will only be handled by the principal investigator, Beatriz Albuquerque. After the research dissertation is concluded, the audio/video tape will be destroyed by incineration. Also, the copies made from the visual essay and personal journal will be destroyed through incineration.

TIME INVOLVEMENT: Your participation will take approximately 3 hours on site to play the videogame and to participate in the 2 interviews. However, the time you may take to create the personal journal and visual essay is estimated to be about four hours.

HOW RESULTS WILL BE USED: The researcher will keep your study records private and confidential. The only person who will be allowed to see these records is the principal investigator.

The results of the study will be used for the researcher's dissertation thesis, and it may be used in conferences or be published in journals, or articles, or books. Results may be published from this study. If publication occurs, it will not include your real name.

Nothing will be published that would let people know your name.

Voluntary Participation/Withdrawal: You should only participate in this study if you are willing. You should not feel that there is any pressure to participate in this study. You are free to participate in this research or to withdraw at any time. There will be no penalty if you decide to withdraw from this study.

Consent to Take Part in this Research Study

It is up to you to decide whether you want to participate in this study. If you want to participate, please sign the form, if the following statements are true.

I freely give my consent to take part in this study. I understand that by signing this form I am agreeing to take part in research. I have received a copy of this form to take with me.

Signature of Person Participating in Study

Date

Printed Name of Person Participating in Study

Teachers College, Columbia University
525 West 120th Street
New York NY 10027
212 678 3000
www.tc.edu

PARTICIPANT'S RIGHTS

Principal Investigator:

Research Title:

- I have read and discussed the Research Description with the researcher. I have had the opportunity to ask questions about the purposes and procedures regarding this study.
- My participation in research is voluntary. I may refuse to participate or withdraw from participation at any time without jeopardy to future medical care, employment, student status or other entitlements.
- The researcher may withdraw me from the research at his/her professional discretion.
- If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue to participate, the investigator will provide this information to me.
- Any information derived from the research project that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.
- If at any time I have any questions regarding the research or my participation, I can contact the investigator, who will answer my questions. The investigator's phone number is (351)229963051.
- If at any time I have comments, or concerns regarding the conduct of the research or questions about my rights as a research subject, I should contact the Teachers College, Columbia University Institutional Review Board /IRB. The phone number for the IRB is (212) 678-4105. Or, I can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY, 10027, Box 151.

- I should receive a copy of the Research Description and this Participant's Rights document.
- If video and/or audio taping is part of this research, I () consent to be audio/video taped. I () do NOT consent to being video/audio taped. The written, video and/or audio taped materials will be viewed only by the principal investigator and members of the research team.
- Written, video and/or audio taped materials () may be viewed in an educational setting outside the research () may NOT be viewed in an educational setting outside the research.
- My signature means that I agree to participate in this study.

Participant's signature: _____

Date: ___/___/___

Name: _____

Interview Protocol Sample

Interview Protocol Form (approx. one hour)

Name _____ Age _____ Born in
 _____ Date _____

Interviewed by _____

Introductory Protocol

To facilitate our note-taking, we would like to video tape the monitor while you play the videogames and also to audio tape the interview following. Please sign the release form. For your information, only the researcher on the project will be privy to the tapes which will be destroyed after they are transcribed. You will also have a fictitious name, so you are anonymous in the research. In addition, you must sign a consent form made to meet our requirements for research with willing subjects. Essentially, the document states that: (1) all the information obtained from your willing participation will be held confidential, (2) your participation is voluntary and if you feel for any reason you want to stop, you may at any time, and (3) no harm whatsoever is intended. Thank you for your agreeing to participate.

Introduction

You have volunteered to play a videogame and speak with us today because you are interested in participating in a study that demonstrates literacy skills acquisition. This research project as a whole focuses on and examines the viability of different approaches, engagements, influences and outcomes of learning vs. playing in the videogame realm without a teacher's interaction. The platform videogame used is the Super Mario World game from the 90's. This research gives the opportunity to study this dichotomy from the gamer/adult's own experience and the scholar's point of view and looks at the skills and influences gained through this game play.

Questions.

- 1- What was the first videogame you played? What did you learn?
 - 2- How many hours do you play?
 - 3- Did you ever use what you learned while playing videogames? Did you ever draw pictures of your favorite games? Or make a sculpture?
 - 4- Do you think games are a good influence? Why?
 - 5- Now, what is your favorite game?
 - 6- What did you learn from them?
 - 7- How was your experience in this 1 hour? What makes you say/think that?
- Probes: What was positive? Less positive?
 What stands out in your mind?
- 8- What called your attention in the videogame? and memory? What makes you say/think that?
- Probes: What is the most significant thing that you remember? How did you deal with it?
- 9- Did you learn something in this one hour? What? What makes you say/think that?

10- Can you use this one hour experience in the future?

11- Did you notice any glitches?

12- Please fill the gaps in the sentences below:

What strikes me the most in this one hour of playing the videogame was _____

I did not learn in this one hour playing a videogame that _____
 I developed _____ skill(s) when I encountered _____ in the videogame.

I acquired _____ skill(s) while playing the videogame.

I did not develop _____ skill(s) when I encountered _____ in the videogame.

I can use what I experienced in this one hour playing videogame in _____.

I used my previous skills in _____ during this one hour.

I did encounter a glitch and I approached it _____.

13- Which of the following affirmations are not true and why?

1- I learned new skills.

2- I used new literacies skills.

3- I encountered a glitch.

4- I developed no skills.

5- I learned nothing.

6- I cannot use this experience in the future.

7- Nothing good can be learned by playing videogames.

8- New media literacy skills cannot be used in playing videogames.

9 - I did not encounter a technological error.

14- Is there anything I should have asked about this experience that I didn't?

15- Can you create a visual essay based on this experience and show it to me in 30 days?

Can you also keep a personal journal about your journey to create the visual essay?

Interview Protocol Form (approx. one hour)

Name _____ Age _____ Born in _____
Date _____

Interviewed by _____

Introductory Protocol

To facilitate our note-taking, we would like to audio tape our conversations today and take some photos of the visual essay. If you are comfortable with this, please fully read and sign the release form. For your information, only the researcher on the project will be privy to the tapes which will be destroyed after they are transcribed. Also, only the researcher will see and analyze the visual essay and personal journal that at all times will have a fictitious name attached to it. Also the photos of the visual essays and personal journal will be used, however at all times the subject will keep the original documents and the data will always be attached to a fictitious name. Essentially, the document states that: (1) all the information obtained from your willing participation will be held confidential, (2) your participation is voluntary and if you feel for any reason you want to stop, you may at any time, and (3) no harm whatsoever is intended.

Thank you for your agreeing to participate. We have planned the interview to last no longer than one hour. During this time, we have several questions that we would like to cover.

Introduction

You have volunteer to create a visual essay after playing a videogame from our last meeting. Our research project as a whole focuses on examines the viability of the different approaches, engagements, influences and outcomes of learning vs. playing in the videogame realm without a teacher's interaction. The platform videogame used is the Super Mario World game from the 90's. This research gives the opportunity to study this dichotomy from the gamer/adult's own experience and the scholar's point of view and looks at the skills and influences gained through this game play.

Questions.

1- How was your experience creating a visual essay and keeping a personal journal?

What makes you say/think that?

Probes: What was positive? Less positive?

What stands out in your mind about the experience?

2- What grabbed your attention in this experience? and memory? What makes you say/think that?

Probes: What is the most significant thing that you remember from this experience? How did you deal with it?

3- What do you think is going on in your visual essay? What makes you say/think that?

4- What feelings and emotions did this _____ bring you?

5- How do you connect this _____ with the one hour experience playing a videogame? What makes you say/think that?

6- Did you learn something in that one hour? What? What makes you say/think that?

7- Can you use this one hour experience in the future? In what context?

8- Are you satisfied with your visual essay? What makes you say/think that?

9- Please fill the gaps in the sentences below:

One thing that I did not learn while creating a personal journal and creating this visual essay was _____

What struck me the most in creating the visual essay was _____

What struck me the least in creating my personal journal was _____

I developed _____ skill(s) when I created my visual essay.

I acquired a _____ skill(s) while creating my visual essay.

I did not develop _____ skill(s) when I created my visual essay.

I can use what I experienced in the making of my visual essay

in _____

I used my previous skills in _____ to create my visual essay.

I acquired a _____ skill(s) while writing in my journal.

I developed _____ skill(s) while writing in my journal.

I did not develop _____ skill(s) while writing my personal journal.

What struck me the most in keeping a personal journal was _____

10- Which of the affirmations are not true and why?

1- I learned new skills.

2- I used new media literacy skills.

3- I encountered a glitch.

4- I developed no skills.

5- I learned nothing.

6- I cannot use this experience in the future.

7- Nothing good can be learned by creating a visual essay.

8- New media literacy skills cannot be used in creating a visual essay.

9- I did not think critically while creating my personal journal.

10- Nothing good can be learned by creating a personal journal.

11- I did not encounter a technological error.

11- Is there anything I should have asked about the visual essay or personal journal that I didn't?

Appendix C

Analysis Coding

In Appendix C, which follows, I will describe the initial three stages of coding as applied to the data. This Appendix shows the full extent from which the three-stage coding system was derived and the full extent to which it was applied in the initial three stage coding system here.

Synthesized for approachable reading within the context of the larger research, these same data are discussed in the main text. These data are displayed in this synthesized version of this coding as presented in Tables 2, 3, and 4.

Following this, I have the quotations from the interviews which is what the conceptual synthesis is derived from in the main text as Table 5.

1st Stage Code

In the first stage, the video and observation data were summarized and organized into the conceptual model of *Bloom's (1956)* taxonomy in education: Cognitive (remember, understand, apply, analyze, evaluate, create) and Simpson (1972), who built upon Bloom's work and created the taxonomy of the Psychomotor (perception, set, guide response, mechanism, complex overt response, adaptation, origination). The visual essay and personal journal (with respective 2nd interview data included) were summarized and organized through Aufderheide's (1993) definition of media literacy: access, analyze, evaluate and communicate.

Video, Observation Data and 1st interview: Bloom's (1956) Taxonomy in Education. Cognitive

Remembering (perceiving/diagnosing, accessing memory, retrieving). All three subjects experimented with the buttons of the controller and observed how Mario could navigate in the videogame. All three subjects mentioned in the 1st interview that they used their memory to recognize when and how to avoid enemies.

Understanding (interpreting, describing concepts, organizing, deducting, contrasting, articulating meaning). All three subjects when playing the videogame used the controller to move the Mario character and each time they died, they avoided the enemy on the next level and took a different route in the game, then clicked on a different box and won a different icon to reach the end. All three subjects mentioned that they did not play that videogame previously, however all three showed during game play that they moved the Mario toward the end of the game. All reached the end of the 1st and 2nd level, without anyone telling them where or how to find the end of the level. Subject I mentioned at the beginning, "How do I play this? or use the controller commands?" For Subject S, the 1st time, when the character Mario died he swore, "How do you play this? He only jumps," and, "Fuck, I died, how do we play?" The 2nd time he died he said, "Fuck, don't know what to do." The 3rd time he "died," he sighed and said, "Don't know what the controller does! How I am going to play this?"

Applying (administering, employing, actualizing knowledge and information). All of the subjects showed while playing that they found the glitch on the water level and all subjects applied that knowledge during the game to avoid the enemies. Subject C showed while he was playing the game and also in his first interview that he chose to use that information in a different way, such avoiding it and not using it again to reach the end of the game. All subjects used the tools to play the game. Subject C lost 4 of Mario's lives, and Subject S lost 9 lives. Subject I was had the most, at 53 Mario "deaths."

Analyzing (discerning, compartmentalizing, crediting, connecting, interrelating, brainstorming, big picture thinking). All subjects while playing looked very attentively at

the screen and did movements with their body while playing. Subject C was the first to become more relaxed in posture, followed by Subject S, while Subject I had more relaxed posture only in the end of the 1 hour of game play. Subject I during the 1st interview mentioned that the music was something very important to her, because she applied that to avoid enemies and to discern if the Mario character was becoming weak.

Evaluating (cross-referencing, critiquing, backing choices, opinions based on analysis and referencing sources, critical engagement). Subject C (water level) said: “Oh, this way I disappear and no one can nag me.” Subjects S (1st level) mentioned: “Why did I die? Oh...there is a time limit.” On the 7th time he said, “Poor thing ... can't kill it anymore,” when Mario died trying to kill the rugby player enemy. On the water level: “Does this do anything?” While Subject I (1st level) said: “It's hard ... I'm going to die ... where is he?” On the 12th game, she died and she asked me, “what should I do?” Further along in the game, she said, “I bet I'm the dumbest person you have had until now.” Later, she asked, “Oh...what if I go back inside the tube? Can it be?... Or if I go down, can it be?...there is nothing!”

Creating. This part did not happen while they played the videogame, but afterwards, when Subjects were asked to create a visual response to playing the videogame and a personal journal related to the experience of playing SMW.

Video and Observation Data: *Simpson (1972) based on Bloom. Psychomotor*

Perception. Input from touch, taste, smell, sound and sight determines physical actions. All subjects' eyes moved along with the action in the game, while their body positioning was upright and attentive. They tried different sets of sequences on the controller with their hands and when playing their body moved when Mario jumped in the videogame. Subject S also made hopping and ducking motions.

Set. Mood and state of health in mind and body which effect response. Subject S swore many times and his lip twitched during game play. Subject I's voice became

emotional and she shook a little when she commented that “it’s hard... I’m going to die,” and commented about her own ability during game play. Subject I said she was frustrated from “dying” many times. Subject S said he was bored.

Guided response. As attempts fail and succeed, practice leads to improving approach. All subjects during the 1st interview mentioned trial-and-error while playing the game. Subject I mentioned that she felt it was a safe place to fail and compared it with being a child. Subject C also mentioned trial-and-error and connected with real life experience learning through it.

Mechanism. The middle stage of becoming proficient with physical skill. Not yet fully integrated the new learning. All the subjects learned how to use the command and navigate the game and reach the end of the game. One possible measurement with regards to Subject mechanism is the following data: Subject C “lost” 4 lives, Subject S “lost” 9 lives, Subject I had 53 “deaths.”

Complex overt response. Efficient use of physical movement with complicated tasks, confidence level very good. Subject S started going backwards instead of forward in the videogame to catch Yoshi or more coins to gain more points instead of finishing the game early.

Adaptation. Changeability of approach for differing or unusual situations. Subject C discovered the glitch on the water level and showed while he was playing the game as also in his 1st interview that he chose to use that information in a different way, such as to avoid it and not use it again to reach the end of the game.

Origination. Generating entirely new movements for unique circumstances was not observed during the 1 hour the three subjects were playing the videogame.

Visual Essay, Personal Journal and 2nd Interview: Aufderheide’s (1993) Definition of Media Literacy

Access: can effectively use multiple media tools to access information, audio, images, search engines, databases, manuals or other data for needed information. Subject

C and Subject I both said they used the computer, researched, used the scanner and printer. Subject S did not mention the use of any multimedia tools.

Analyze: questions media contents and tools of their intended purposes, critically examines meaning as intended or perceived beyond the immediate or apparent. All three Subjects questioned their own approaches to the visual essay. Related to use of tools, Subject C said “I am the glitch.” Subject I compared herself with the error. Subject I was concerned about the message that her error with the Post-It note would send. Subject S talked about how glitch was a shortcut (which he said should not be used), analyzing the usage of the water glitch as something morally wrong.

Evaluate: can diagnose and perceive harmful content and has the tools to shield from such content, and is able to judge its ethical appropriateness. Subject S judged the glitch as a shortcut, as something morally wrong, as shown by a trembling voice and raised volume. Through his discussion in the interviews, it seems apparent that Subject S perceived the water glitch as harmful, but did not shield himself from the content, because he used the glitch. Subject C used the water glitch only once, then followed the game without using the glitch. He wanted to play the way it was intended to be, according to what he said, showing a sense of judgment.

Communicate: ability to assess, judge potential effect of media content on others; ability to articulate and lead online discussions or meetings, or generate social, political awareness using media. In the visual essays and personal journals, there is the culmination of their assessment of media technologies. Other assessments and reflections they had was with the 2nd interview, in which they all critically reflected, communicated the repercussions of their playing SMW as well as their thoughts on their own responses in the visual essays and journals. During 2nd interview, none of the subjects mentioned anything about online postings or media creation.

2nd Stage Codes

Interview Data words. In the second stage, all interview data were summarized and key words were mentioned for at least 2 of the subjects chosen to inform, identify and summarize key information found in the data. These words capture the first essence of what the data carried and were organized into cluster groups that helped identify and search for patterns in the data and then choose the key ideas that were organized further in the 3rd stage code.

While organizing the words that all subjects said, I noticed that categories were emerging from the words in these 2nd stage data such as Skills, Learning, Glitch, Experience, Critical thinking, Real life, Games. These words capture the first essence of what the data carried and were organized into cluster groups that helped to identify and look into patterns in the data and to choose the key ideas that became important for the 3rd stage code analysis.

Group 1. Understand, know, acquire, develop, explore, avoid (problems) and solve (problems).

Group 2. Imagination, creation, create /creating, critic, criticizing, criticism, creativity and reflection / reflect.

Group 3. Function, response and reaction.

Group 4. Game, play, playing, played, coordination and result.

Group 5. Discover, trial - error, response – reaction, problem, error, jamming, freezing / freeze, glitch or bug, and different.

Group 6. Digital, computer, internet, printer, scan, mobile (phone), music or sound, writing / write / written, drawing / drawn / draw, reading and read.

Group 7. Process, repetition, superimposing and transfer.

Group 8. Skill / skills, hand-eye (coordination), motor (skills), manual (dexterity), and printing / print/ printed.

Group 9. Visual, memory and remember.

Group 10. Programming and code.

Group 11. Graphics, layout and design.

Group 12. Real and life.

Group 13. Irritation, patience, entertain/entertainment and fun.

	SUBJECT C First Interview	SUBJECT C Second Interview
Understand	0	0
Know	9 (know) 1 (known)	4
Acquire	1	0
Developed	1 (developed) 2 (developing) 3 (develop)	1 (develop) 1 (developed)
Explore	1 (explore)	2 (exploring)
Avoid (problems)	3	0
Solve (problems)	0	0
Imagination	2 imagination 3 imaginative	0
Creation	0	0
Create / creating	3 (created)	2 (created) 3 (create)
Critic	0	3 (critical)
Criticizing	0	0
Criticism	0	1
Creativity	0	0
Reflection / reflect	1 reflect	2 (reflection, reflect)
Function	2	0
Response	0	0
Reaction	0	0
Game	56	42
Play	4	1
Playing	6	11
Played	4	8
Coordination	0	0
Result	0	9
Discover	2 (discover, discovered)	0
Trial - error	1	0
Response - reaction	0	0
Problem	0	1

	SUBJECT C First Interview	SUBJECT C Second Interview
Error	9	6
Jamming	0	0
Freezing / freeze	0	0
Glitch or Bug	22	9
Different	0	12
Digital	1	1
Computer	2	6
Internet	0	4
Printer	0	9
Scan	0	2 (scanner) 1 (scanned)
Mobile (phone)	0	0
Music or sound	8 (music) 4 (sound)	20 (music) 1 (musicians)
Writing / write / written	4 write 1 written	4 write 1 written
Drawing / drawn / draw	0	4 (drawing)
Reading	0	3
Read	0	3
Process	1	17
Repetition	0	9
Superimposing	0	2
Transfer	0	2
Skill / skills	11	2
Hand-eye (coordination)	0	0
Motor (skills)	3	0
Printing / print/ printed	0	11(printing) 4 (print) 3 (printed) 9 (printer)
Visual	2	7
Memory	2	0
Remember	5 (remember) 1 (remembered)	3 (remember) 1 (remembered)
Programming	1	0
Code	0	1
Graphics	8	2
Layout	0	0
Design	2 (designed) 1 (designer)	1
Real	3 (reality)	1 (real life)

	SUBJECT C First Interview	SUBJECT C Second Interview
	1 (realistic)	
Life	1	1 (real life) 3 (life)
Irritation	2 (irritation, irritated)	0
Patience	0	0
Entertain/entertainment	1	1 (entertaining)
Fun	2	0

Subject C

Words never mentioned. Understand, solve (problems), creation, criticizing, creativity, response, reaction, coordination, response - reaction, mobile (phone), hand-eye (coordination), layout and patience.

Ten words mentioned more in the first interview. The word "game" was mentioned 56 times. The word "glitch or bug" was mentioned 22 times. The word "music or sound" was mentioned 12 times. The word "skill/skills" was mentioned 11 times. The word "know" was mentioned 10 times. The word "error" was mentioned 9 times. The word "remember", "developed" and "playing" was mentioned 6 times. The word "imagination" was mentioned 5 times.

Words mentioned in the first interview but not in the second interview. Acquire, avoid (problems), imagination, function, discover, trial - error, motor (skills), memory, programming, irritation and fun.

Ten words mentioned more in the second interview. The word "Game" was mentioned 42 times. The word "Printing / print/ printed" was mentioned 26 times. The word "Music or sound" was mentioned 21 times. The word "Process" was mentioned 17 times. The word "Different" was mentioned 12 times. The word "Playing" was mentioned 11 times. The words "Result," "Glitch," or "Bug" and "Printer" were mentioned 9 times.

Words not mentioned in the first interview but mentioned in the 2nd interview. Critic, result, problem, different, internet, printer, scan, drawing / drawn / draw, reading, read, repetition, superimposing, transfer, printing / print/ printed and code.

Words mentioned in the first and second interview. Know, developed, explore, create / creating, reflection / reflect, game, play, playing, played, error, glitch or bug, digital, computer, music or sound, writing / write / written, skill / skills, visual, remember, graphics, design, real, life and entertain/entertainment.

	SUBJECT I First Interview	SUBJECT I Second Interview
Understand	0	1 (question 11)
Know	6	8
Acquire	0	0
Developed	3	3
Explore	2	2
Avoid (problems)	1	0
Solve (problems)	2	0
Imagination	0	0
Creation	0	1 (question11)
Create / creating	0	3
Critic	0	0
Criticizing	0	3
Criticism	0	1
Creativity	0	1 (question10-6)
Reflection / reflect	0	3 (question10-10)
Function	1	0
Response	0	0
Reaction	0	0
Game	33	29
Play	9	3
Playing	4	1
Played	1	2
Coordination	4	0
Result	0	1
Discover	1	0
Trial - error	0	0
Response - reaction	0	0
Problem	5	0
Error	2	4 (question 10-11)
Jamming	0	0

	SUBJECT I First Interview	SUBJECT I Second Interview
Freezing / freeze	1	1
Glitch or Bug	4	1
Different	2	5
Digital	0	0
Computer	4	0
Internet	1	0
Printer	0	5
Scan	0	8
Mobile (phone)	0	0
Music or sound	3 (music) 1 (sound)	3
Writing / write / written	0	3
Drawing / drawn / draw	0	41
Reading	0	0
Read	0	0
Process	0	5
Repetition	0	0
Superimposing	0	2
Transfer	0	1
Skill / skills	3	6
Hand-eye (coordination)	2(hand-eye coordination) 1(hand coordination)	0
Motor (skills)	3 (motor skills) 2 (manual dexterity)	1
Printing / print/ printed	0	8
Visual	3 (visual level, visual patterns, visual memory)	4
Memory	2	2
Remember	0	7
Graphics	1	0
Programming	0	0
Code	0	0
Layout	0	1
Design	0	3
Real	0	2 (real life, real live)
Life	0	1
Irritation	1 (irritating)	0
Patience	0	0
Entertain/entertainment	0	0
Fun	3	0

Subject I

Words never mentioned. Acquire, imagination, critic, response, reaction, trial - error, response - reaction, jamming, digital, mobile (phone), reading, read, repetition, programming, code, patience and entertain / entertainment.

Ten words mentioned more in the first interview. The word "game" was mentioned 33 times. The word "Know" was mentioned 6 times. The word "play" was mentioned 9 times. The word "problem" was mentioned 5 times. The word "Motor (skills)" was mentioned 5 times. The word "playing" was mentioned 4 times. The word "Coordination" was mentioned 4 times. The word "Glitch" or "Bug" was mentioned 4 times. The word "Computer" was mentioned 4 times. The word "Music or sound" was mentioned 4 times.

Words mentioned in the first interview but not in the second interview. Avoid (problems), solve (problems), function, coordination, discover, problem, computer, internet, hand-eye (coordination), irritation and fun.

Ten words mentioned more in the second interview. The word "Drawing / drawn / draw" was mentioned 41 times. The word "Game" was mentioned 29 times. The word "know" was mentioned 8 times. The word "Scan" was mentioned 8 times. The word "Printing / print/ printed" was mentioned 8 times. The word "Remember" was mentioned 7 times. The word "Skill / skills" was mentioned 6 times. The word "Process" was mentioned 5 times. The word "Different" was mentioned 5 times. The word "Printer" was mentioned 5 times.

Words not mentioned in the first interview but mentioned in the 2nd interview. Understand, creation, create / creating, criticizing, criticism, creativity, reflection / reflect, result, printer, scan, mobile (phone), writing / write / written, drawing / drawn / draw, process, superimposing, transfer, printing / print/ printed, remember, Layout, design, real and life.

Words mentioned in the first and second interview. Know, developed, explore, game, play, playing, played, error, freezing / freeze, glitch or bug, different, music or sound, skill / skills, motor (skills), visual and memory

	SUBJECT S First Interview	SUBJECT S Second Interview
Understand	1	0
Know	6	4
Acquire	2	0
Developed	11 1 (development)	16 1 (development)
Explore	0	0
Avoid (problems)	0	0
Solve (problems)	1 (solve) 2 (resolve)	0
Imagination	0	0
Creation	0	0
Create / creating	0	0
Critic	0	2 (critic, critical skills)
Criticizing	0	1 (criticized)
Criticism	0	0
Creativity	0	0
Reflection / reflect	0	4 (reflected) 3 (reflect) 1 reflection 3 reflective
Function	1	0
Response	0	4 (response- reaction; reaction – response)
Reaction	0	4 (response- reaction; reaction – response)
Game	95	58
Play	18	3
Playing	4	4
Played	6	1
Coordination	0	0
Result	0	0
Discover	2	1
Trial - error	1	0
Response - reaction	0	4
Problem	1	1
Error	1	2
Jamming	0	0

	SUBJECT S First Interview	SUBJECT S Second Interview
Freezing / freeze	0	0
Glitch or Bug	19	14
Different	1	0
Digital	0	0
Computer	2	0
Internet	1 (internet skills)	0
Printer	0	0
Scan	0	0
Mobile (phone)	0	0
Music or sound	0	0
Writing / write / written	0	0
Drawing / drawn / draw	0	11 (2 “drawing skills” and 1 “drawing manner”)
Reading	0	0
Read	0	0
Process	0	0
Repetition	2 (repetition, repetitive)	0
Superimposing	0	0
Transfer	0	3
Skill / skills	12	11
Hand-eye (coordination)	0	0
Motor (skills)	0	0
Printing / print/ printed	0	0
Visual	0	0
Memory	2 (memorized, memory)	0
Remember	4	2
Programming	0	1(programmers)
Code	0	0
Graphics	0	0
Layout	0	0
Design	0	0
Real	6 (real-life)	11 (real-life)
Life	6 (real-life) 1 (life)	11 (real-life) 3 (life)
Irritation	0	0
Patience	2	0
Entertain /entertainment	2 (entertainment, entertaining)	1 (entertainment)
Fun	1	5

Subject S

Words never mentioned. Explore, avoid (problems), imagination, creation, create / creating, criticism, creativity, coordination, result, jamming, freezing / freeze, digital, printer, scan, Mobile (phone), music or sound, writing / write / written, reading, read, process, hand-eye (coordination), motor (skills), printing / print/ printed, visual, code, graphics, layout, design and irritation.

Ten words mentioned more in the first interview. The word "Game" was mentioned 95 times. The word "Glitch" or "Bug" was mentioned 19 times. The word "Play" was mentioned 18 times. The word "Skill / skills" was mentioned 12 times. The word "Developed" was mentioned 12 times. The word "Life" was mentioned 7 times. The word "Real" was mentioned 6 times. The word "Played" was mentioned 6 times. The word "know" was mentioned 6 times. The word "Remember" was mentioned 4 times.

Words mentioned in the first interview but not in the second interview. Understand, acquire, solve (problems), function, trial - error, computer, internet, repetition, memory and patience.

Ten words mentioned more in the second interview. The word "Developed" was mentioned 17 times. The word "life" was mentioned 14 times. The word "Glitch" or "Bug" was mentioned 14 times. The word "Drawing / drawn / draw" was mentioned 11 times. The word "real" was mentioned 11 times. The word "Reflection / reflect" was mentioned 11 times. The word "fun" was mentioned 5 times. The word "know" was mentioned 4 times. The word "Response" was mentioned 4 times. The word "Reaction" was mentioned 4 times.

Words not mentioned in the first interview but mentioned in the 2nd interview. Critic, criticizing, reflection / reflect, response, reaction, response - reaction, drawing / drawn / draw, transfer and programming.

Words mentioned in the first and second interview. Developed, game, play, playing, played, discover, problem, error, glitch or bug, skill / skills, remember, real, life, entertain /entertainment and fun.

Summary

Looking into patterns in the data. While organizing the words that all subjects said, I noticed that categories were emerging from the words in these 2nd stage data such as Skills, Learning, Glitch, Experience, Critical thinking, Real life, Games.

Learning

Group 1. All subjects mentioned the words “know” and “developed “in the first interview. Subject C and S during the 1st interview also mentioned the word “acquire” and Subjects E, I and S mentioned the word “solve.”

During the second interview all subjects mentioned “know” and “developed.” Subject C and I also mentioned the word “explore.”

Group 7. None of the three subjects mentioned the same word in the first interview. During the second interview all subjects mentioned “transfer” and Subject C and I mentioned “process.”

Skills

Group 2. None of the three subjects mentioned the same word in the first interview. During the second interview all subjects mentioned “reflection, reflect.” Subject C and I mentioned the word “creation.” Subject C and S mentioned the word “critic.”

Group 8. All subjects mentioned the word “skill(s)” in the first and second interview. During the second interview Subject C and I mentioned the word “Printing/print/printed”.

Group 9. All subjects mentioned the words “memory” in the first interview. Subject C and I mentioned the word “visual” and Subject C and S mentioned “remember.” During the second interview all subjects mentioned “remember” and Subject C and I mentioned “visual.”

Critical Thinking

Group 2. None of the three subjects mentioned the same word in the first interview. During the second interview all subjects mentioned “reflection, reflect.” Subject C and I mentioned the word “creation.” Subject C and S mentioned the word “critic.”

Game

Group 4. All subjects mentioned the words “game,” “play,” “playing,” “played,” in the first and second interview.

Glitch

Group 5. All subjects mentioned the words “discover” in the first interview and the word “error” and “glitch or bug” in the first and second interview. Subject C, and S also mentioned the word “trial-error” and Subject C, I and S mentioned the word “problem.”

During the second interview Subject C and S mentioned the word “error”.

Experience

Group 6. All subjects mentioned the words “computer” in the first interview. Subject I and S mentioned the word “Internet” and Subject C and I mentioned the word “music or sound.”

During the second interview all subjects mentioned “drawing/drawn/draw” and Subject C and I mentioned the word “music or sound” and “writing/write/written.”

Group 13. All subjects mentioned the word “fun “in the first interview. Subject C and S mentioned the words “entertain/entertainment”. None of the three subjects mentioned the same word in the second interview.

Real Life

Group 12. All subjects mentioned the words “real” and “life” in the first and second interview.

No Match

Group 3. None of the three subjects mentioned the same word in the first interview. Subject C, I and S mentioned the word “function”. During the second interview none of the three subjects mentioned the same word.

Group 10. None of the three subjects mentioned the same word in the first and second interview.

Group 11. None of the three subjects mentioned the same word in the first and second interview. Subject C and I mentioned the word “Design” in the second interview.

These words capture the first essence of what the data carried and were organized into cluster groups that helped to identify and look into patterns in the data and to choose the key ideas that became important for the 3rd stage code analysis.

3rd Stage Codes

Interview, Notes, Personal Journal, Visual Responses Data and 1st and 2nd Code Data

In the third stage, the data were coded based on an overall reading of the interviews and an open capture of some of the relevant information that emerged from the data in the previous stage codes. This key information emerged from the data by taking into account the previous code stages and also the relationship between the interview data and other

findings such as the personal journal and visual responses and also looking at patterns related to the literature, as well as the research questions. In this way capturing the essence of what the data were showing us - in short sentence codes – helped to seek for patterns in the data. The coding scheme developed was in direct relation to the research question and sub-questions. This coding created was: Pattern recognition (connection), patience / annoying, leisure/ relaxation, discovery, making connections, multi-faceted learning, questioning boundaries, application of knowledge, problem-solving, cognition skills (memory), recognition skills, experimentation skills, exploration skill, creation skill, synthesizing skill, applications/development, making connections, critical skills, real life skills and benefits of glitches.

Question. What are the range of skills called into play and challenged when an individual encounters a glitch while using or playing videogames? Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World (SMW)?

Codes. Pattern recognition (connection), patience / annoying, leisure/ relaxation, discovery, making connections, multi-faceted learning, questioning boundaries, application of knowledge, problem-solving, cognition skills (memory), recognition skills, experimentation skills, real life skills and benefits of glitches.

Subject C	
General: What are the range of skills called into play and challenged when an individual encounters a glitch while using or playing videogames? Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World (SMW)?	
Code	Source
Pattern Recognition	<ul style="list-style-type: none"> • Interview 1, Question 12: "... related with the keys, I remember. I was thinking, cool - a treasure! But nothing spectacular happened so it could be a glitch or not. But it should not be a glitch because glitches are not so ..." • Interview 1, Question 13-H: "... more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It's like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again." • Interview 1, Question 14-3: "... because the character (Mario) is not supposed to disappear from the screen and go through the level in that way so easily. It is not supposed to. The level is supposed to be hard to reach the end. I found the glitch interesting. Oh, I found this!" • Interview 1, Question 14-9: "The glitch may go unnoticed, but I'm not sure what a glitch is, but what I think is that a glitch can go unnoticed. The people who discover a glitch and say - "ah want to see? Ok ... yes." Today, I did not notice many mistakes." • Interview 2, Question 1: "To reach the end of the game, I can choose several paths such as A, B, or C, and if I didn't reach the end it was my mistake, in printing this piece also. I got there anyway by making mistakes, attempts, one after another in a different way and the result was maybe different. In the case of the printing, the process can be equal, or repeated, and in the game it's not very difficult to always change variants. Because of the code the printer can be identical. But it can never completely identical and well, because ink can blur, it can never be perfect."
Patience	<ul style="list-style-type: none"> • Interview 1, Question 14-5: "... it's not common sense, but the ability to sacrifice, maybe, or not, but to control irritation and emotions. A few kids become easily irritated with a game and send the controller into the air (laughing) but I was never that way. I dealt well with it (laughing)."
Leisure/ relaxation	<ul style="list-style-type: none"> • Interview 2, Question 7: "At the beginning, I was more relaxed but then it helps in concentration."
Discovery, Making connections	<ul style="list-style-type: none"> • Interview 1, Question 3: "At architecture school I had a project from a client, a demo project in which I chose a fictional character from a computer game. I chose a videogame character. I used "Prince of Persia" as the client, and based in his home and what I remembered in that game that was his refuge, a hiding place / a refuge for him the Prince of Persia. So as research I saw the game scenarios of the game ... it has many images of ancient Persia, the

	<p>scenarios have some reality, and that inspired me in some environments that I created in the project. I had played the game before. Maybe I learned something when doing this exercise but I don't have awareness of it. I know there are games about ancient Rome, for example, and you end up learning stuff, but not in a literal way because most games were not designed for it, they are not educational games. But these types I never played much.”</p> <ul style="list-style-type: none"> • Interview 1, Question 9: “The music and graphics stayed in my memory, the most important part of the game. A lot of people make music this way, a return to the simplest way, want to do this type of music, kids from now that never played these games before. It's not nostalgia. It's like they want to make and adapt to that time in some way. The other day I was in Porto and I heard a concert of music created for two Nintendo consoles which then alternated between each other and did a lot of improvisation in between. This music was composed for Nintendo, and they need to program the sounds. You have to write it. I never learned to do it but I've seen others doing it. It's a very time consuming job so I never learned it. It's almost like learning to write in a notebook but with 0's and 1's, it's very "Geeky".” • Interview 1, Question 10: “I think yes, but it's too recent of an experience for me to respond to it, and therefore hard. I think I used skills that I knew before so I did not have to learn from scratch. It's like when you stop using a bike. I learned nothing new, but I can re-use it. It's like picking up an old toy and playing with it.” • Interview 1, Question 13-H: “... more than once in the same place of the game. Until reaching the error, which was my fault, not the game's, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It's like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 2, Question 1: “I could not summarize my thinking so well, so it's easier with images and associations of images. The process and the final product (visual essay/journal) are together, and as an architect I was always this way, because the process is as important as the final product. There is no product without the process. The final product reflects the process, the process and thinking. The technological conditions I use influence the work, the way the work was done, I guess. In this way I wanted to get there faster to the final product, it was how I wanted to get there, faster. . .The starting point was the videogame that I played here. After that I started associating what happened to me in daily life, like reading a book about architecture patios. We even can connect the patio as the meeting place of various disciplines (points to the image page), in the center. I wasn't too worried, but it was a succession of images from different disciplines, music, literature, comics, (shows the pages and points to the images while talking). I wrote this by hand (points to the speech bubbles), but it has no order, all of it is independent in form. But here is the idea of repetition; even this comic area was made with different dialogues (continuously showing the image while pointing).
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	<p>Here also we can see the overlap, here the zen symbol (flips pages and pointing to yin-yang), here's more (changes pages) but there is no correct way of looking at it.”</p> <ul style="list-style-type: none"> • Interview 2, Question 3: “First I was thinking of it as if it were a publication bought at some place, because there is a price tag so it can be purchased in an independent bookstore, one copy only. Then it depends on the experience of each person, for me I realize that I created all this..... I see a number of elements that can connect with each other, for example, the games you can join (joins now these 2 pages side by side, continuously turning pages and pointing), music with music, with songs, games, literature, literature, music, music, architecture, courtyard, comic, comic, (continues to point at pages) and here is one with various music, literature, literature and then may be this. Architecture, music, comics, literature, publication and videogame images (continues showing pages). And here, perhaps with this courtyard as a meeting place of various disciplines and the repeating elements based on the experience of playing the games and the different levels.”
Multi-faceted skills	<ul style="list-style-type: none"> • Interview 1, Question 4: “I think yes, because they help you develop motor skills. Motor skills such as sight, brain, parts of the brain, motor skills, and in the latest games that are more interactive games you can develop it. I do not believe the idea that a person is violent because of the games he plays. Games mimic reality, not the opposite.” • Interview 1, Question 6: “It’s very imaginative and you can develop much imagination, a whole lot. It’s really imaginative. • Interview 1, Question 7: “Yes, several of them. I would try to get around the glitch in some videogames, in some situations, tried to avoid a wall or jump that has a glitch because I got trapped there, so I tried to avoid the glitch. The opposite also happens, as we don’t know where the glitch is coming from and then we find it. For example, in the game of football, there was a glitch that you could score 30 goals, because of a failure in the game. These are the most obvious glitches. And maybe now it happens less. Still, it happens. I remember the games in the late 90’s with the 3D, the more digital games, or games for console Amiga with lower processors that brought errors. Now it’s harder. • Interview 1, Question 13-D: “... perhaps perception and reasoning skills in games, self-reflection and self control - there it is - when you click the keypad, you’re developing a videogame skill. The children who do not have this skill will physically jump while playing ...” • Interview 1, Question 13-H; “... more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again. • Interview 1, Question 14-5: “...because I failed several times in the same place in the game and learned not to make the same mistake. I learned to avoid mistakes. Well there is not so much learning but...

	<p>you learn and learn again not to go there to that place, and go on to other places. Games functions by trial and error, again, and errors that lead to success in the game, and you have to repeat, repeat until you succeed. It takes persistence and, I cannot find the word ...”</p> <ul style="list-style-type: none"> • Interview 2, Question 3: “... the computer had computer failures between computer and printer, some images I wanted to be smaller and appeared larger, and also larger ones I wanted smaller so there were glitches that appeared among them. I let it happen and embraced it, I did not throw out any pages, everything stayed in the pages, all the glitches. In the game, I had the ability to replay the game and here the glitch - error – I made another printing impression on top – in the same way as repeating the same level in a game.” • Interview 2, Question 3: “I learned to control better what I want to print, and using black and white printing, image overlays, even with the flaws, the glitches, and perhaps the flaws are the most interesting, that gives interesting results.” • Interview 2, Question 7: “... in various contexts such as concentration, playing, you have to repeat the same things if you want to do them well ...” • Interview 2, Question 11: “To reach the end of the game, I can choose several paths such as A, B, or C, and if I didn’t reach the end it was my mistake, in printing this piece also. I got there anyway by making mistakes, attempts, one after another in a different way and the results were maybe different.”
Questioning boundaries	<ul style="list-style-type: none"> • Interview 2, Question 11: “To It happens to me, the error is in us, but we always blame the machine with sentences like, "that sucks .. I do not know what happened!" and then we see that the error was our fault. And then the errors that are caused by the lack of ink, missing red or yellow, but here it was just black and white ink and yet when the ink ended, the black ink, this was the end of the process, the lack of ink. So these glitches, these errors of being out of ink can bring good results, and experience in the future ... I am the glitch (laughs).”
Application of knowledge	<ul style="list-style-type: none"> • Interview 1, Question 7: “Yes, several of them. I would try to get around the glitch in some videogames, in some situations, tried to avoid a wall or jump that has a glitch because I got trapped there, so I tried to avoid the glitch. The opposite also happens, as we don’t know where the glitch is coming from and then we find it. For example, in the game of football, there was a glitch that you could score 30 goals, because of a failure in the game. These are the most obvious glitches. And maybe now it happens less. Still, it happens. I remember the games in the late 90s with the 3d, the more digital games, or games for console Amiga with lower processors that brought errors. Now it’s harder.” • Interview 1, Question 13-H: “... more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 1, Question 14-6: “I think I can re-use it. You can never

	<p>say no. The experience of doing this type of work compels you to think about what you did in a more psychological way, but used in a useful way. But at a subconscious level of experience.”</p> <ul style="list-style-type: none"> • Interview 2, Question 10-3: ”In the game, I had the ability to replay the game and here the glitch - error – I made another printing impression on top – in the same way as repeating the same level in a game.” • Interview 2, Question 11: “To reach the end of the game, I can choose several paths such as A, B, or C, and if I didn’t reach the end it was my mistake, in printing this piece also. I got there anyway by making mistakes, attempts, one after another in a different way and the results were maybe different. In the case of the printing, the process can be equal, or repeated, and in the game it’s not very difficult to always change variants. Because of the code the printer can be identical. But it can never completely identical and well, because ink can blur, it can never be perfect. “
Problem-solving	<ul style="list-style-type: none"> • Interview 1, Question 7: “Yes, several of them. I would try to get around the glitch in some videogames, in some situations, tried to avoid a wall or jump that has a glitch because I got trapped there, so I tried to avoid the glitch. The opposite also happens, as we don’t know where the glitch is coming from and then we find it. For example, in the game of football, there was a glitch that you could score 30 goals, because of a failure in the game. These are the most obvious glitches. And maybe now it happens less. Still, it happens. I remember the games in the late 90’s with the 3D, the more digital games, or games for console Amiga with lower processors that brought errors. Now it’s harder.” • Interview 1, Question 13-H: “... more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 1, Question 14-5: ”...because I failed several times in the same place in the game and learned not to make the same mistake. I learned to avoid mistakes. Well there is not so much learning but... you learn and learn again not to go there to that place, and go on to other places. Games function by trial and error, again, and errors that lead to success in the game, and you have to repeat, repeat until you succeed. It takes persistence and, I cannot find the word ...” • Interview 2, Question 7: “But I think the idea of never making mistakes is impossible because people have to fail to learn and do better later. In real life maybe we have to be more open to things ... I think part of it is the concentration we get we can then use day-to-day like driving and exploring. I think games are good for those who have problems with concentration.”
Cognition	<ul style="list-style-type: none"> • Interview 1, Question 7: “Yes, related with the keys, I remember. I was thinking, cool - a treasure! But nothing spectacular happened so it could be a glitch or not.” • Interview 1, Question 2: “...based in his home and what I

	<p>remembered in that game that was his refuge, a hiding place / a refuge for him the Prince of Persia. So as research I saw the game scenarios of the game ... it has many images of ancient Persia, the scenarios have some reality, and that inspired me in some environments that I created in the project. I dad played the game before. Maybe I learned something when doing this exercise but I don't have awareness of it.”</p> <ul style="list-style-type: none"> • Interview 1, Question 9: “The music and graphics stayed in my memory, the most important part of the game. A lot of people make music this way, a return to the simplest way, want to do this type of music, kids from now that never played these games before. It’s not nostalgia. It’s like they want to make and adapt to that time in some way.” • Interview 1, Question 12: ”It’s too easy to use a glitch (laughing), but from time to time there were visual glitches, some graphics glitches coming from the graphic parts that were most interesting. But I don’t remember more glitches.” • Interview 2, Question 1: “... it’s a set of sheets that show my memories of things I did. I read, I listened, I drew, literature. A set of memories of the present after playing the game. The starting point was the videogame that I played here. After that I started associating what happened to me in daily life, like reading a book about architecture patios. We even can connect the patio as the meeting place of various disciplines (points to the image page), in the center... I then remembered the experience of playing the game as a process, when you have played and that’s what struck me from the experience, and then I connected my day-to-day experience with the game... a set of memories after playing.” • Interview 2, Question 2: ”I remember the music of the game I played and the music of “Aphex Twin”, independent and experimental music. When I was playing, the music is the image that came to my mind which I associate with the 90s.” • Interview 2, Question 4: ”Feelings of nostalgia, past memories with present memories, records that I had studied in my architecture courses at university. It expresses what I felt. “
Benefits of glitches	<ul style="list-style-type: none"> • Interview 1, Question 12: “Oh yeah, and when I discovered a hidden characteristics, when Mario went up the screen and Super Mario disappeared and did not touch any enemy I got to spend the entire level like that, so that is a kind of glitch. Not a visual glitch but a fault of the game or the screen, maybe some parts disappeared, I don’t know. It’s too easy to use a glitch (laughing), but from time to time there were visual glitches, some graphics glitches coming from the graphic parts that were most interesting.”
Real life	<ul style="list-style-type: none"> • Interview 1, Question 4: “I think yes, because they help you develop motor skills. Motor skills such as sight, brain, parts of the brain, motor skills, and in the latest games that are more interactive games you can develop it. I do not believe the idea that a person is violent because of the games he plays. Games mimic reality, not the opposite.” • Interview 1, Question 10: “I think I used skills that I knew before so I did not have to learn from scratch. It’s like when you stop using a

	<p>bike. I learned nothing new, but I can re-use it. It's like picking up an old toy and playing with it.”</p> <ul style="list-style-type: none"> • Interview 1, Question 13-H: “...more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It's like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 1, Question 14-3: “Glitch can be annoying also but in this case I handled it well, it didn't upset me and I didn't return to repeat it again in the level. I need to be more honest and complete all the game levels, that is - eat all the lines, clean everything (laughing) and get maximum score. It's not only to get to the end of the level. I'm always like this - a perfectionist.” • Interview 2, Question7: “But I think the idea of never making mistakes is impossible because people have to fail to learn and do better later. In real life maybe we have to be more open to things ... I think part of it is the concentration we get we can then use day-to-day like driving and exploring. I think games are good for those who have problems with concentration.” • Interview 2, Question 11: “The errors that I found were mine and not from the technology. The glitches of printing, ink failure, I was the glitch. My mistakes that gave wrong orders to the printer were made by me, and not by the machine.”
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Subject I	
General: What are the range of skills called into play and challenged when an individual encounters a glitch while using or playing videogames? Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World (SMW)?	
Code	Source
Pattern Recognition	<ul style="list-style-type: none"> • Interview 1, Question 6: “I did not learn anything unless on a visual level, ‘cause I get faster at seeing combinations of parts, visual patterns, when I play.” • Interview 1, Question 9: “But through the music I could realize - 2nd game – that by (Mario) catching the stars – he (Mario) would not be eaten by the enemies, and when he (Mario) loses power, the music changes, and so this is a sign that we lost the bonus. When this happened I (Mario) had to jump so I (Mario) would not die. I dealt with this problem with an unnerving feeling, because I would press the wrong keys on the game controller. The intention was to pass through this part of the game, so I dealt with it in a way so that I could pass that part.” • Interview 1, Question 14-3: “The glitches were in the first and second levels of the game, as I had previously said. When the dragon (Yoshi) appears the doll super Mario was frozen. I could not do

	<p>anything with this glitch, nor could I solve it, I (Mario) had to stand and could not go anywhere. I had to wait so I waited. It was nothing too dramatic. This was at least the only one I noticed and it always happens at the same stage levels, like a pattern.”</p> <ul style="list-style-type: none"> • Interview 2, Question 11: “From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1st page (tracing paper), to cover the page and not be transparent. This sheet had a "post it" slogan written on it - to use for scanning with tracing paper - I put the part of the post it on the wrong side and printed it. I'm not going to bring a drawing with a post it saying - to use ... with tracing paper - So, this was other glitch but a mistake on my part.”
Annoying	<ul style="list-style-type: none"> • Interview 2, Question 2: “The music of the game was sometimes annoying, especially the part of the game when I died and then an annoying music came up behind. It became annoying when he (Mario) died.”
Leisure/ relaxation	<ul style="list-style-type: none"> • Interview 1, Question 5: “Bejwell, a Facebook game, in which I have to add 3 equal pieces in a line. I like the game ‘cause it distracts me. I don’t need to think too much, and it’s not stressful.”
Discovery, Making connections	<ul style="list-style-type: none"> • Interview 2, Question 2: “...remember the game screen as the doll (Mario) ran from one side to the other, trying to hit, while I was trying to dominate the game controller to see how it works, as the doll (Mario) goes forward and backward. After that, I remember the music but that was just now me being influenced by the sound of the phone ringing (the telephone rings). The music of the game was sometimes annoying, especially the part of the game when I died and then an annoying music came up behind. It became annoying when he (Mario) died.”
Multi-faceted skills	<ul style="list-style-type: none"> • Interview 1, Question 10: “Maybe better coordination with my right and left hand. I think the glitch and the game it’s like going to a shrink, because I have to continue my path walking straight ahead. Often, I thought about how he (Mario) walked forward and carried himself to one side and he went to another, then I thought that he (Mario) would jump and he didn’t move, which was a hand-eye coordination problem. This influences the way the game is played, if I had more practice playing games with this game controller or type of game, I would advance more in the game.” • Interview 1, Question 13-D: “... acquired Motor skill(s) ...” • Interview 1, Question 13-C: “...motor skills skill(s) ...when I had to coordinate for him (Mario) to move in the game, or when he (Mario) swam and disappears from the screen, and had to keep an eye on it so he (Mario) will not descend in the screen and get caught by enemies...” • Interview 1, Question 13-F: “I need to be persistent, learn the tricks

	<p>to jump at the right time in the game, or to memorize when some of the animals (enemies) appear and run or jump before it.”</p> <ul style="list-style-type: none"> • Interview 1, Question 14-1: “Maybe I learned to take more risks when I play, and try to solve problems in different ways, and to explore various possibilities. That part of the key, realizing that he (Mario) could swim down in that scenario and pick up the key, and explore the scenery.” • Interview 1, Question 14-4: “I think I developed motor skills, as I had said before I developed the part of manual dexterity and problem-solving. In the part that I (Mario) went beyond the screen, I learned that. But maybe that was a glitch and it was strange because I could not see the doll (Mario), but maybe it was intentional, I do not know.” • Interview 1, Question 14-6: “I do not know. I might need it. Whatever. I may need to play super Mario again. The part of the manual dexterity or visual memory, I might need in the future.”
Questioning boundaries	<ul style="list-style-type: none"> • Interview 1, Question 14-4: “I think I developed motor skills, as I had said before I developed the part of manual dexterity and problem-solving. In the part that I (Mario) went beyond the screen, I learned that. But maybe that was a glitch and it was strange because I could not see the doll (Mario), but maybe it was intentional, I do not know.”
Application of knowledge	<ul style="list-style-type: none"> • Interview 1, Question 9: “In my memory what stays is the music, that was the most fun. But through the music I could realize - 2nd game – that by (Mario) catching the stars – he (Mario) would not be eaten by the enemies, and when he (Mario) loses power, the music changes, and so this is a sign that we lost the bonus. When this happened I (Mario) had to jump so I (Mario) would not die. I dealt with this problem with an unnerving feeling, because I would press the wrong keys on the game controller. The intention was to pass through this part of the game, so I dealt with it in a way so that I could pass that part.” • Interview 2, Question 11: “In the game. I already answered before what I found in the game. But in the creation ... in the beginning in the first attempt there was a mistake. The copy was pale, and I could not see any of the lines. When I came back the second time and I put the sheet over another scanner, so all that was printed on the same page. Yes, there was a technological error. I had some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1st page (tracing paper), to cover the page and not be transparent. This sheet had a "post it" slogan written on it - to use for scanning with tracing paper - I put the part of the post it on the wrong side and printed it. I'm not going to bring a drawing

	with a post it saying to use ... with tracing paper - So, this was other glitch but a mistake on my part.”
Problem-solving	<ul style="list-style-type: none"> • Interview 1, Question 9: “But through the music I could realize - 2nd game – that by (Mario) catching the stars – he (Mario) would not be eaten by the enemies, and when he (Mario) loses power, the music changes, and so this is a sign that we lost the bonus. When this happened I (Mario) had to jump so I (Mario) would not die. I dealt with this problem with an unnerving feeling, because I would press the wrong keys on the game controller. The intention was to pass through this part of the game, so I dealt with it in a way so that I could pass that part. “ • Interview 1, Question 14-1: “Maybe I learned to take more risks when I play, and try to solve problems in different ways, and to explore various possibilities. That part of the key, realizing that he (Mario) could swim down in that scenario and pick up the key, and explore the scenery.”
Cognition	<ul style="list-style-type: none"> • Interview 1, Question 9: “In my memory what stays is the music that was the most fun. But through the music I could realize - 2nd game – that by (Mario) catching the stars – he (Mario) would not be eaten by the enemies, and when he (Mario) loses power, the music changes, and so this is a sign that we lost the bonus. When this happened I (Mario) had to jump so I (Mario) would not die. I dealt with this problem with an unnerving feeling, because I would press the wrong keys on the game controller. The intention was to pass through this part of the game, so I dealt with it in a way so that I could pass that part.” • Interview 1, Question 13-F: “...to memorize when some of the animals (enemies) appear and run or jump before it.” • Interview 1, Question 13C: “...motor skills ... when I had to coordinate for him (Mario) to move in the game, or when he (Mario) swam and disappears from the screen, and had to keep an eye on it so he (Mario) will not descend in the screen and get caught by enemies.” • Interview 1, Question 14-6: “I do not know. I might need it. Whatever. I may need to play super Mario again. The part of the manual dexterity or visual memory, I might need in the future.” • Interview 1, Question 14-6: “Whatever. I may need to play super Mario again. The part of the manual dexterity or visual memory, I might need in the future.” • Interview 2, Question 2: “I remember the game screen as the doll (Mario) ran from one side to the other, trying to hit, while I was trying to dominate the game controller to see how it works, as the doll (Mario) goes forward and backward. After that, I remember the music but that was just now me being influenced by the sound of the phone ringing (the telephone rings). The music of the game was sometimes annoying, especially the part of the game when I died and then an annoying music came up behind. It became annoying when he (Mario) died.”
Benefits of glitches	<ul style="list-style-type: none"> • Interview 1, Question 13-C: “...when I had to coordinate for him (Mario) to move in the game, or when he (Mario) swam and disappears from the screen, and had to keep an eye on it so he

	(Mario) will not descend in the screen and get caught by enemies...”
Real life	<ul style="list-style-type: none"> • Interview 1, Question 11: “For touching (softly said, laughs). I do not know, I have no idea. Maybe in anything new that requires hand coordination such as playing drums or piano (laugh).” • Interview 1, Question 14-7: “In educational games, we can learn something there. It depends on the type of game. In Super Mario ... meh... I would say, you can learn mathematics by counting fish or the points he (Mario) eats.” • Interview 2, Question 11: “Yes, there was a technological error. I had some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1st page (tracing paper), to cover the page and not be transparent. This sheet had a "post it" slogan written on it - to use for scanning with tracing paper - I put the part of the post it on the wrong side and printed it. I'm not going to bring a drawing with a post it saying - to use ... with tracing paper - So, this was other glitch but a mistake on my part.”

Subject S	
General: What are the range of skills called into play and challenged when an individual encounters a glitch while using or playing videogames? Which media literacy skills are acquired and sustained independently of a teacher or educator when an individual plays Super Mario World (SMW)?	
Code	Source
Pattern Recognition	<ul style="list-style-type: none"> • Interview 1, Question 9: “The learning curve of the game controller doesn't take long to play the game. This was done through experience, trying to see what each button was used for, learning through trial and error, gaining experience of killing the enemies, in this way I learned how to play the game. In my memory I remember a situation when I (Mario) walked into a tube, a plumbing pipe, and there were some squares with wings flying around. When I (Mario) jumped, I could not hit the cubes because they were too high, so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game. The most important thing is how to defeat the game, so I learned to defeat the enemies and there were various types of enemies. I also learned that I (Mario) can grab and throw objects and this would allow killing multiple enemies at once. I also discovered that in the water level I could grab little Yoshi and that would function like a jet ski that allowed Mario to move faster. Then, I found this little Yoshi after eating enemies would become a regular

	<p>Yoshi. This normal Yoshi at the end of the level - like at the end of the level, there is a bar like an Olympic games bar that goes up and down - I found that to jump the bar with Yoshi's would give me (Mario) some power and I would jump higher.”</p> <ul style="list-style-type: none"> • Interview 2, Question 1: “More positive I thought was the error of the game, the mistake of the programmers of the game that allowed me to reach the end easily. As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life: <ol style="list-style-type: none"> 1-more difficult/ challenging 2-easier/ most people go for the easier. Going for the hardest way is more positive because it would increase my capacity of killing enemies faster. In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them. <p>When I wrote the journal, I was thinking that this is a game for kids – it’s childish. This is positive to the extent that it entertains kids and they can develop some of their skills... My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive... The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.”</p> <ul style="list-style-type: none"> • Interview 2, Question 6: “I learned that this glitch allows the player easily to get to the end of the game, and that was it. I learned this useful technique of this game” • Interview 2, Question 10-6: “I can use it because I discovered errors in other games, and as with this game, when I encounter them I use them.”
Patience	<ul style="list-style-type: none"> • Interview 1, Question 8: “It was super boring, because I have no patience for platform games or any other games” (negative).
Leisure/ relaxation	<ul style="list-style-type: none"> • Interview 1, Question 8: “When we are children everything fascinates us, and when we are children we have so much free time inside the house that we can play video-games to distract us and stay in that fascinating world.” • Interview 2, Question 4: “But if a game is played occasionally for distraction and does not detract time from doing other things - like studying or working – I do not think there is any harm in playing.” <p>Interview 2, Question 6: “I learned ... I think that videogames are more for distraction. However, I use the games more for distraction, entertainment.”</p> <ul style="list-style-type: none"> • Interview 2, Question 2: “In the experience of doing this, what I remember the most was the fun part of the glitch in the videogame, that was funny... don’t know ... I faced the glitch as a ridiculous situation and that’s it.” • Interview 2, Question 4: “Laughing. In the game, (the glitch) is ridiculous so I laughed.”
Discovery, Making	<ul style="list-style-type: none"> • Interview 1, Question 3: “I think it helped me to better understand

connections	<p>English, the only thing that foreign games help is to learn and improve my English and maybe videogames help me resolve puzzles.”</p> <ul style="list-style-type: none"> • Interview 1, Question 9: “...so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game... Then, I found this little Yoshi after eating enemies would become a regular Yoshi. This normal Yoshi at the end of the level - like at the end of the level, there is a bar like an Olympic games bar that goes up and down - I found that to jump the bar with Yoshi's would give me (Mario) some power and I would jump higher.” • Interview 2, Question 10-11: “I found a glitch in the water level. I experienced a glitch that consisted of Mario disappearing from the screen, and quickly arrived to the end of the game...”
Multi-faceted skills	<ul style="list-style-type: none"> • Interview 1, Question 1: “I learned how to play, and practice videogames, practice in how to develop and win the game without losing lives. I was 11 years old.” • Interview 1, Question 9: “This time it was relatively short; because as a platform game, it is not very elaborate. The learning curve of the game controller doesn't take long to play the game. This was done through experience, trying to see what each button was used for, learning through trial and error, gaining experience of killing the enemies, in this way I learned how to play the game. <p>I remember a situation when I (Mario) walked into a tube, a plumbing pipe, and there were some squares with wings flying around. When I (Mario) jumped, I could not hit the cubes because they were too high, so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game.</p> <p>The most important thing is how to defeat the game, so I learned to defeat the enemies and there were various types of enemies. I also learned that I (Mario) can grab and throw objects and this would allow killing multiple enemies at once. I also discovered that in the water level I could grab little Yoshi and that would function like a jet ski that allowed Mario to move faster. Then, I found this little Yoshi after eating enemies would become a regular Yoshi. This normal Yoshi at the end of the level - like at the end of the level, there is a bar like an Olympic games bar that goes up and down - I found that to jump the bar with Yoshi's would give me (Mario) some power and I would jump higher.”</p> <ul style="list-style-type: none"> • Interview 1, Question 11: “I learned what the buttons on game controller are used for, I learned some techniques to be faster, kill the enemies, but this is basic reasoning, nothing too elaborate, so for real life, it adds only a little.” • Interview 1, Question 13-H: “I did encounter a glitch and I approached it every time I died, I made a mistake, but it is lack of skills development” (negative). • Interview 1, Question 13-H: “I learned how to be quick and how to kill enemies ...”

	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “I found it a serious flaw, the videogame producers should have paid attention to this. However, a person who does not think that the game is boring, maybe it advances the game to kill all the enemies, but I think most people for convenience use this (glitch) to go faster and reach the end. For example, there are people who will take advantage of the glitch, and for example there are people who take advantage of the glitches in other games, tricks to make the character invincible, however, the game was bought with the intention of being a challenge to get to the end. I think a glitch is a serious flaw, but if people want to enjoy the game they can choose to ignore the glitch, and to not use it. Really, if they play the game, they should play the game by itself and not use the glitch. But as I said, there are people who use tricks to pass levels, which is stupid. Despite the fact the producers of the game failed if a glitch happens, people can choose not to use the glitch. For some people, a glitch is an easier way to achieve their objective, like in real life, there are many people that will step on other people. There is not a lack of examples of people who try to take advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the easiest method to achieve their objectives. Ethics. I'm already developing my opinion very much” (critic). • Interview 1, Question 14-6: “...because the experience is specific to this game, since the game is so basic and there is no complicated puzzle that appears so I could develop my reasoning, thinking and interpretation skills. This game was basic” (negative). • Interview 1, Question 14-7: “...for kids, this is good because their learning mechanism of fighting, defending, problem-solving, so I think that for children they can develop skills and that is good but for me, as an adult, no.” • Interview 2, Question 1: “For example, how I developed the ability to effectively kill the enemies and then I made a comparison with the most advanced games - because this game is for children. For example, for a FPS (First-person shooter) you must have a capacity for quick reflexes, because constant danger and any distraction can be fatal in the game. So you need to be very watchful and attentive. So, in real life, it helps the response-reaction skill, which is the reflex to react quickly in situations in real life..... For example, when I am driving, and I have to hit the brakes in the case of an emergency, my reflexes are lower because I have not developed the skill to kill someone quickly during a videogame, because if I could kill him and get away from him fast enough in the videogame, then I have developed my ability of response-reaction. And I think that's it. The reaction-response when I drive a car and someone crosses in the front of me, I think I have a fast response because I'm quick at playing games, and through that I developed the response-reaction.As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life: 1-more difficult/ challenging
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	<p>2-easier/ most people go for the easier. Going for the hardest way is more positive because it would increase my capacity of killing enemies faster. In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them.</p> <p>When I wrote the journal, I was thinking that this is a game for kids – it’s childish. This is positive to the extent that it entertains kids and they can develop some of their skills... My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive... The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.”</p> <ul style="list-style-type: none"> • Interview 2, Question 7: “...because I developed skills pertaining to this game. Other games, no, because they are different. The glitch, if I find it in other games I would use it to achieve my purposes more quickly, if I want it, if I do not want to play the game the challenging way.” • Interview 2, Question 6: “I learned that this glitch allows the player easily to get to the end of the game, and that was it. I learned this useful technique of this game ...” • Interview 2, Question 9-C: “I summarized all that happened in the game despite being brief ...” • Interview 2, Question 9-J: “I developed reflective and critical capacities, that I possess ...” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option. “ • Interview 2, Question 10-10: “... as I reflected and criticized what happened in the videogame, and in what I had experienced.” • Interview 2, Question 10-9: “I developed my thinking because I had to think about what happened in the videogame, and I developed and analyzed what I experienced, and then I wrote and drew it.”
Questioning boundaries	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “I found it a serious flaw, the videogame producers should have paid attention to this. However, a person who does not think that the game is boring, maybe it advances the game to kill all the enemies, but I think most people for convenience use this (glitch) to go faster and reach the end. For example, there are people who will take advantage of the glitch, and for example there are people who take advantage of the glitches in other games, tricks to make the character invincible, however, the

	<p>game was bought with the intention of being a challenge to get to the end. I think a glitch is a serious flaw, but if people want to enjoy the game they can choose to ignore the glitch, and to not use it. Really, if they play the game, they should play the game by itself and not use the glitch. But as I said, there are people who use tricks to pass levels, which is stupid. Despite the fact the producers of the game failed if a glitch happens, people can choose not to use the glitch. For some people, a glitch is an easier way to achieve their objective, like in real life; there are many people that will step on other people. There is not a lack of examples of people who try to take advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the easiest method to achieve their objectives. Ethics. I'm already developing my opinion very much.”</p>
Application of knowledge	<ul style="list-style-type: none"> • Interview 1, Question 9: “This time it was relatively short; because as a platform game, it is not very elaborate. The learning curve of the game controller doesn’t take long to play the game. This was done through experience, trying to see what each button was used for, learning through trial and error, gaining experience of killing the enemies, in this way I learned how to play the game. In my memory I remember a situation when I (Mario) walked into a tube, a plumbing pipe, and there were some squares with wings flying around. When I (Mario) jumped, I could not hit the cubes because they were too high, so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game. <p>The most important thing is how to defeat the game, so I learned to defeat the enemies and there were various types of enemies. I also learned that I (Mario) can grab and throw objects and this would allow killing multiple enemies at once. I also discovered that in the water level I could grab little Yoshi and that would function like a jet ski that allowed Mario to move faster. Then, I found this little Yoshi after eating enemies would become a regular Yoshi. This normal Yoshi at the end of the level - like at the end of the level, there is a bar like an Olympic games bar that goes up and down - I found that to jump the bar with Yoshi's would give me (Mario) some power and I would jump higher.”</p> <ul style="list-style-type: none"> • Interview 2, Question 3: “Is the character Mario taking advantage of a flaw in the game, he passes over the monitor and disappears, invisible, there he has no enemies, and comes in flash to the finish quickly and gets all happy. The drawing has the character coming out of the television and then he goes through the upper part of level and then back down to the television only in the end of the level.” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the

	<p>difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”</p>
Problem-solving	<ul style="list-style-type: none"> • Interview 1, Question 5: “...puzzles to be solved, it was basically this.” • Interview 1, Question 6: “I developed some intellectual capacities, for example, to resolve the puzzles behind the games, you have to reason a little. There are games that we can develop our intellectual capacity.” • Interview 1, Question 9: “This was done through experience, trying to see what each button was used for, learning through trial and error, gaining experience of killing the enemies, in this way I learned how to play the game.” • Interview 1, Question 14-7: “...for kids, this is good because their learning mechanism of fighting, defending, problem-solving, so I think that for children they can develop skills and that is good but for me, as an adult, no.”
Cognition (memory)	<ul style="list-style-type: none"> • Interview 1, Question 9: “In my memory I remember a situation when I (Mario) walked into a tube, a plumbing pipe, and there were some squares with wings flying around. When I (Mario) jumped, I could not hit the cubes because they were too high, so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game. The most important thing is how to defeat the game, so I learned to defeat the enemies and there were various types of enemies. I also learned that I (Mario) can grab and throw objects and this would allow killing multiple enemies at once. I also discovered that in the water level I could grab little Yoshi and that would function like a jet ski that allowed Mario to move faster. Then, I found this little Yoshi after eating enemies would become a regular Yoshi. This normal Yoshi at the end of the level - like at the end of the level, there is a bar like an Olympic games bar that goes up and down - I found that to jump the bar with Yoshi's would give me (Mario) some power and I would jump higher.” • Interview 1, Question 12: “I noticed on the water level, if we are going in the part that the enemy cannot see us and we can not see Mario, I quickly came to the end of the level because no one could reach me. I remember that well; suddenly I cannot remember anything else.” • Interview 1, Question 9: “In my memory I remember a situation when I (Mario) walked into a tube, a plumbing pipe, and there were some squares with wings flying around. When I (Mario) jumped, I could not hit the cubes because they were too high, so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game.” • Interview 1, Question 12: “I noticed in the water level, if we are

	<p>going in the part that the enemy cannot see us and we can not see Mario, I quickly came to the end of the level because no one could reach me. I remember that well; suddenly I cannot remember anything else. I used this glitch for my benefit to arrive faster at the end of the game.”</p> <ul style="list-style-type: none"> • Interview 1, Question 13-E: “I remember an enemy that looks like a rugby player (football player), he’s really fast and it took me a while to learn how to kill him. I know I had to give several strokes over or rotate on top of him, but many times I (Mario) died. Since I did not know how to do the rotation very good, I decided to skip the rotation and always jump on top of this enemy.” • Interview 2, Question 1: “I remember the situation that was the most interesting in the game and recorded it on paper. That was the underwater level in which Mario disappeared, not visible on the screen and then he vanished, and the enemies did not see him. And he would arrive to the end in a super fast way. ...My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive. The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.” • Interview 2, Question 2: “... what I remember the most was the fun part of the glitch in the videogame, that was funny.. don’t know ... I faced the glitch as a ridiculous situation and that’s it.” • Interview 2, Question 5: “...reminds me of when I was playing and how easy it was to reach the end using this glitch, that’s what reminds me of, basically.”
Benefits of glitches	<ul style="list-style-type: none"> • Interview 1, Question 7: “However I had previously used the “bug” for my benefit. There was a bug in the game in which I could pass through the walls, so I used this glitch to reach the end of the game, but right now I don’t recall the name of the game where this happened. “ • Interview 1, Question 12: “I noticed in the water level, if we are going in the part that the enemy cannot see us and we can not see Mario, I quickly came to the end of the level because no one could reach me. I remember that well; suddenly I cannot remember anything else. I used this glitch for my benefit to arrive faster at the end of the game.” • Interview 1, Question 13-D: “I acquired no great skills, I learned how to be quick and how to kill enemies, and I also took advantage of the glitch in my favor to beat the level faster...” • Interview 2, Question 3: “Is the character Mario taking advantage of a flaw in the game, he passes over the monitor and disappears, invisible, there he has no enemies, and comes in flash to the finish quickly and gets all happy. The drawing has the character coming out of the television and then he goes through the upper part of level and then back down to the television only in the end of the level.” • Interview 2, Question 7: “...because I developed skills pertaining to this game. Other games, no, because they are different. The glitch,

	<p>if I find it in other games I would use it to achieve my purposes more quickly, if I want it, if I do not want to play the game the challenging way.”</p> <ul style="list-style-type: none"> • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”
Real life	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “For some people, a glitch is an easier way to achieve their objective, like in real life; there are many people that will step on other people. There is not a lack of examples of people who try to take advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the easiest method to achieve their objectives. Ethics.” Interview 2, Question 1: “As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life: <ol style="list-style-type: none"> 1-more difficult/ challenging 2-easier/ most people go for the easier. ... In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them. <p>When I wrote the journal, I was thinking that this is a game for kids – it’s childish. This is positive to the extent that it entertains kids and they can develop some of their skills. .. I reflected a bit on videogames and how they affect people's lives and this was a positive experience. “</p> • Interview 2, Question 2: “It was not a very positive experience to play – it was boring - because this game does not match my age, but it allowed me to draw parallels with real life. In the experience of doing this, what I remember the most was the fun part of the glitch in the videogame, that was funny.. don’t know ... I faced the glitch as a ridiculous situation and that’s it.” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”

Question. Given that meeting the challenge of a glitch is encountered when playing SMW, what kind of skills come into being to solve the perceived problem of the glitch?

Codes. Pattern recognition (connection), multi-faceted skills, problem-solving, cognition skills (memory), recognition skills, experimentation skills, real-life skills and patience.

Subject C	
Sub-question: Given that meeting the challenge of a glitch is encountered when playing SMW, what kind of skills come into being to solve the perceived problem of the glitch?	
Code	Source
Pattern recognition (connection)	<ul style="list-style-type: none"> • Interview 1, Question 7: “I would try to get around the glitch in some videogames, in some situations, tried to avoid a wall or jump that has a glitch because I got trapped there, so I tried to avoid the glitch. The opposite also happens, as we don’t know where the glitch is coming from and then we find it. For example, in the game of football, there was a glitch that you could score 30 goals, because of a failure in the game. These are the most obvious glitches. And maybe now it happens less. Still, it happens. I remember the games in the late 90s with the 3d, the more digital games, or games for console Amiga with lower processors that brought errors. Now it’s harder.” • Interview 1, Question 14-9: “Today, I did not notice many mistakes.”
Multi-faceted skills	<ul style="list-style-type: none"> • Interview 1, Question 7: “I would try to get around the glitch in some videogames, in some situations, tried to avoid a wall or jump that has a glitch because I got trapped there, so I tried to avoid the glitch. The opposite also happens, as we don’t know where the glitch is coming from and then we find it.” • Interview 1, Question 13-G: “...other videogames, these kind of imaginative games, maybe because I see some movies, maybe think too much of previous experience in videogames, in which you gain skills that will serve to be better in other videogames. But at the time period this game was created it was a groundbreaking game...”
Problem-solving	<ul style="list-style-type: none"> • Interview 1, Question 7: “I would try to get around the glitch in some videogames, in some situations, tried to avoid a wall or jump that has a glitch because I got trapped there, so I tried to avoid the glitch. The opposite also happens, as we don’t know where the glitch is coming from and then we find it.” • Interview 1, Question 13-H: “... more than once in the same place of the game. Until reaching the error, which was my fault, not the game’s, and I almost did not learn at first ...”

Cognition skills (memory)	<ul style="list-style-type: none"> • Interview 1, Question 7: “I would try to get around the glitch in some videogames, in some situations, tried to avoid a wall or jump that has a glitch because I got trapped there, so I tried to avoid the glitch. The opposite also happens, as we don’t know where the glitch is coming from and then we find it. For example, in the game of football, there was a glitch that you could score 30 goals, because of a failure in the game. These are the most obvious glitches. And maybe now it happens less. Still, it happens. I remember the games in the late 90s with the 3d, the more digital games, or games for console Amiga with lower processors that brought errors. Now it’s harder.”
Recognition skills	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “... because the character (Mario) is not supposed to disappear from the screen and go through the level in that way so easily. It is not supposed to. The level is supposed to be hard to reach the end. I found the glitch interesting. Oh, I found this!”
Experimentation skills	<ul style="list-style-type: none"> • Interview 1, Question 2: “...therefore I wanted to reach the end of the game I started playing. And it was natural that I spent up to a few hours playing until I reached the end of the game.”
Real life skills	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “I need to be more honest and complete all the game levels, that is - eat all the lines, clean everything (laughing) and get maximum score. It’s not only to get to the end of the level. I’m always like this - a perfectionist.”
Patience	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “Glitch can be annoying also but in this case I handled it well, it didn’t upset me and I didn’t return to repeat it again in the level.”

Subject I	
Sub-question: Given that meeting the challenge of a glitch is encountered when playing SMW, what kind of skills come into being to solve the perceived problem of the glitch?	
Code	Source
Pattern recognition (connection)	<ul style="list-style-type: none"> • Interview 1, Question 7: “Possibly, yes, but I do not play games that much or this kind of stuff. Online, when the connection fails or the server fails or when a bug happens, I choose to close the window and I leave or I wait for the game to function again, and if it takes more than 1 or 2 minutes then forget it. I’m going to do another thing.” • Interview 1, Question 14-3: “The glitches were in the first and second levels of the game, as I had previously said. When the dragon (Yoshi) appears the doll super Mario was frozen. I could not do anything with this glitch, nor could I solve it, I (Mario) had to stand and could not go anywhere. I had to wait so I waited. It was nothing too dramatic. This was at least the only one I noticed and it always happens at the same stage levels, like a pattern.”
Multi-faceted skills	<ul style="list-style-type: none"> • Interview 1, Question 13-G: “I used my previous skills ... to avoid problems” Interview 2, Question 2: “I remember the game screen as the doll (Mario) ran from one side to the other, trying to hit, while I was

	trying to dominate the game controller to see how it works, as the doll (Mario) goes forward and backward.”
Problem-solving	<ul style="list-style-type: none"> • Interview 1, Question 7: “Possibly, yes, but I do not play games that much or this kind of stuff. Online, when the connection fails or the server fails or when a bug happens, I choose to close the window and I leave or I wait for the game to function again, and if it takes more than 1 or 2 minutes then forget it. I’m going to do another thing” (avoid solving the problem).
Cognition skills (memory)	<ul style="list-style-type: none"> • Interview 2, Question 2: “I remember the game screen as the doll (Mario) ran from one side to the other, trying to hit, while I was trying to dominate the game controller to see how it works, as the doll (Mario) goes forward and backward. The music of the game was sometimes annoying, especially the part of the game when I died and then an annoying music came up behind. It became annoying when he (Mario) died.”
Recognition skills	<ul style="list-style-type: none"> • Interview 1, Question 7: ”Possibly, yes, but I do not play games that much or this kind of stuff. Online, when the connection fails or the server fails or when a bug happens, I choose to close the window and I leave or I wait for the game to function again, and if it takes more than 1 or 2 minutes then forget it. I’m going to do another thing.” • Interview 2, Question 2: “The music of the game was sometimes annoying, especially the part of the game when I died and then annoying music came up behind. It became annoying when he (Mario) died.”
Experimentation skills	<ul style="list-style-type: none"> • Interview 2, Question 2: “I remember the game screen as the doll (Mario) ran from one side to the other, trying to hit, while I was trying to dominate the game controller to see how it works, as the doll (Mario) goes forward and backward. The music of the game was sometimes annoying, especially the part of the game when I died and then an annoying music came up behind. It became annoying when he (Mario) died.”
Real life skills	<ul style="list-style-type: none"> • Interview 2, Question 2: “After that, I remember the music but that was just now me being influenced by the sound of the phone ringing (the telephone rings). The music of the game was sometimes annoying, especially the part of the game when I died and then an annoying music came up behind. It became annoying when he (Mario) died.”
Patience	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “I could not do anything with this glitch, nor could I solve it, I (Mario) had to stand and could not go anywhere. I had to wait so I waited. It was nothing too dramatic. This was at least the only one I noticed and it always happens at the same stage levels, like a pattern.”

Subject S	
Sub-question: Given that meeting the challenge of a glitch is encountered when playing SMW, what kind of skills come into being to solve the perceived problem of the glitch?	
Code	Source
Pattern recognition (connection)	<ul style="list-style-type: none"> • Interview 1, Question 7: “Yes in the Fallout in which his legs disappear, his head becomes upside down it is a video-game for <i>PlayStation console</i>, and RPG (<i>role-playing game</i>). I saw also glitches in other games such as Crysic for the computer in which the character will walk through walls, so from time to time in the games glitches can appear.” • Interview 1, Question 12: “I noticed in the water level, if we are going in the part that the enemy cannot see us and we can not see Mario, I quickly came to the end of the level because no one could reach me. I remember that well; suddenly I cannot remember anything else.” • Interview 2, Question 1: “More positive I thought was the error of the game, the mistake of the programmers of the game that allowed me to reach the end easily.”
Multi-faceted skills	<ul style="list-style-type: none"> • Interview 1, Question 13-F: “I think this game is basic and did not contribute anything for my real life. I guess I do not know. I do not see usefulness in what I learned or skills in this game because I already developed them in other videogames, such as being fast, in this videogame I do not know (negative).” • Interview 2, Question 5: “The feeling of effortlessness in using this glitch. This has no logic and should not happen but it is super easy to use it (negative).” • Interview 2, Question 6: “I learned techniques pertaining to this game, like how to fight enemies, specific techniques of this game as the other basic techniques that I already knew before.”
Problem-solving	<ul style="list-style-type: none"> • Interview 1, Question 7: “I get upset with glitches because the producers of the videogame did not have too much time to develop the game, so that happens. It disgusts me. If I paid for a game, that was tested several times, “bugs” should not happen, so when it happens, I leave the game and then come back again to join the game and hope the glitch disappears” (avoid).
Cognition skills (memory)	<ul style="list-style-type: none"> • Interview 1, Question 7: “Yes in the Fallout in which his legs disappear, his head becomes upside down it is a video-game for <i>PlayStation console</i>, and RPG (<i>role-playing game</i>). I saw also glitches in other games such as Crysic for the computer in which the character will walk through walls, so from time to time in the games glitches can appear.”
Recognition skills	<ul style="list-style-type: none"> • Interview 2, Question 1: “More positive I thought was the error of the game, the mistake of the programmers of the game that allowed me to reach the end easily.” • Interview 2, Question 4: “Laughing. In the game, (the glitch) is ridiculous so I laughed.”
Experimentation skills	<ul style="list-style-type: none"> • Interview 2, Question 10-11: “I found a glitch in the water level. I experienced a glitch that consisted of Mario disappearing from the

		screen, and quickly arrived to the end of the game.”
Real life skills		• Interview 1, Question 13-F: “I think this game is basic and did not contribute anything for my real life. I guess I do not know. I do not see usefulness in what I learned or skills in this game because I already developed them in other videogames, such as being fast, in this videogame I do not know” (negative).
Patience		

Question. Given that an individual confronting a SMW glitch calls into play a range of responses, how do these responses interplay with each other as the individual tries to solve the problem?

Codes. Pattern recognition, multi-faceted learning skills, questioning boundaries, application of knowledge, cognition (memory), exploration, real-life skills, reflection skills and benefit from it.

Subject C		
Sub-question: Given that an individual confronting a SMW glitch calls into play a range of responses, how do these responses interplay with each other as the individual tries to solve the problem?		
Code		Source
Pattern recognition		<ul style="list-style-type: none"> • Interview 1, Question 12: “...related with the keys, I remember. I was thinking, cool - a treasure! But nothing spectacular happened so it could be a glitch or not. But it should not be a glitch because glitches are not so ...” • Interview 1, Question 13-H: “...more than once in the same place of the game. Until reaching the error, which was my fault, not the game’s, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 1, Question 14-3: ”...because the character (Mario) is not supposed to disappear from the screen and go through the level in that way so easily. It is not supposed to. The level is supposed to be hard to reach the end. I found the glitch interesting. Oh, I found this!” • Interview 1, Question 14-9: ”The glitch may go unnoticed, but I’m not sure what a glitch is, but what I think is that a glitch can go unnoticed. The people who discover a glitch and say - "ah want to see? Ok ... yes ". Today, I did not notice many mistakes.” • Interview 2, Question 11: “To reach the end of the game, I can choose several paths such as A, B, or C, and if I didn’t reach the end it was my mistake, in printing this piece also. I got there anyway by making mistakes, attempts, one after another in a different way and the results were maybe different. In the case of the printing, the process

	<p>can be equal, or repeated, and in the game it's not very difficult to always change variants. Because of the code the printer can be identical. But it can never completely identical and well, because ink can blur, it can never be perfect. "</p>
Multi-faceted learning skills	<ul style="list-style-type: none"> • Interview 1, Question 13-H: "... more than once in the same place of the game. Until reaching the error, which was my fault, not the game's, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It's like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again." • Interview 2, Question 3: "... the computer had computer failures between computer and printer, some images I wanted to be smaller and appeared larger, and also larger ones I wanted smaller so there were glitches that appeared among them. I let it happen and embraced it, I did not throw out any pages, everything stayed in the pages, all the glitches. In the game, I had the ability to replay the game and here the glitch - error - I made another printing impression on top - in the same way as repeating the same level in a game." • Interview 2, Question 3: "I learned to control better what I want to print, and using black and white printing, image overlays, even with the flaws, the glitches, and perhaps the flaws are the most interesting, that gives interesting results." • Interview 2, Question 11: "To reach the end of the game, I can choose several paths such as A, B, or C, and if I didn't reach the end it was my mistake, in printing this piece also. I got there anyway by making mistakes, attempts, one after another in a different way and the result were maybe different."
Questioning boundaries	<ul style="list-style-type: none"> • Interview 2, Question 11: "To It happens to me, the error is in us, but we always blame the machine with sentences like, "that sucks .. I do not know what happened!" and then we see that the error was our fault. And then the errors that are caused by the lack of ink, missing red or yellow, but here it was just black and white ink and yet when the ink ended, the black ink, this was the end of the process, the lack of ink. So these glitches, these errors of being out of ink can bring good results, and experience in the future ... I am the glitch (laughs)."
Application of knowledge	<ul style="list-style-type: none"> • Interview 1, Question 13-H: "... more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It's like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again." • Interview 2, Question 11: "To To reach the end of the game, I can choose several paths such as A, B, or C, and if I didn't reach the end it was my mistake, in printing this piece also. I got there anyway by making mistakes, attempts, one after another in a different way and the result were maybe different. In the case of the printing, the process can be equal, or repeated, and in the game it's not very difficult to always change variants. Because of the code the printer can be identical. But it can never completely identical and well, because ink can blur, it can never be perfect. "

Cognition (memory)	<ul style="list-style-type: none"> • Interview 1, Question 7: “Yes, related with the keys, I remember. I was thinking, cool - a treasure! But nothing spectacular happened so it could be a glitch or not.” • Interview 1, Question 13-H: “...more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.”
Exploration	<ul style="list-style-type: none"> • Interview 1, Question 12: “Oh yeah, and when I discovered a hidden characteristics, when Mario went up the screen and Super Mario disappeared and did not touch any enemy I got to spend the entire level like that, so that is a kind of glitch.” • Interview 1, Question 13-H: “...more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 2, Question 3: “...the computer had computer failures between computer and printer, some images I wanted to be smaller and appeared larger, and also larger ones I wanted smaller so there were glitches that appeared among them. I let it happen and embraced it, I did not throw out any pages, everything stayed in the pages, all the glitches. In the game, I had the ability to replay the game and here the glitch - error – I made another printing impression on top – in the same way as repeating the same level in a game.”
Real-life skills	<ul style="list-style-type: none"> • Interview 1, Question 13-H: “...more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 2, Question 11: “The errors that I found were mine and not from the technology. The glitches of printing, ink failure, I was the glitch. My mistakes that gave wrong orders to the printer, were made by me, and not by the machine.”
Reflection skills	<ul style="list-style-type: none"> • Interview 2, Question 11: “The errors that I found were mine and not from the technology. The glitches of printing, ink failure, I was the glitch. My mistakes that gave wrong orders to the printer were made by me, and not by the machine... It often happens to be the machine, but sometimes it's me. It happens to me, the error is in us, but we always blame the machine with sentences like, "that sucks ... I do not know what happened!" and then we see that the error was our fault. And then the errors that are caused by the lack of ink, missing red or yellow, but here it was just black and white ink and yet when the ink ended, the black ink, this was the end of the process, the lack of ink. So these glitches, these errors of being out of ink can bring good results, and experience in the future ... I am the glitch (laughs). When I play a game my goal is to reach the end of the level, and when something does not let us get to the end it's because I made a mistake.

	<p>But this is not a glitch, unless it's in the Nintendo (laughs) , but the mistake is mine, not the game or machine, it's my mistake. To reach the end of the game, I can choose several paths such as A, B, or C, and if I didn't reach the end it was my mistake, in printing this piece also. I got there anyway by making mistakes, attempts, one after another in a different way and the results were maybe different. In the case of the printing, the process can be equal, or repeated, and in the game it's not very difficult to always change variants. Because of the code the printer can be identical. But it can never completely identical and well, because ink can blur, it can never be perfect."</p>
Benefit from it	<ul style="list-style-type: none"> • Interview 1, Question 12: "Oh yeah, and when I discovered a hidden characteristics, when Mario went up the screen and Super Mario disappeared and did not touch any enemy I got to spend the entire level like that, so that is a kind of glitch. Not a visual glitch but a fault of the game or the screen, maybe some parts disappeared, I don't know. <p>It's too easy to use a glitch (laughing), but from time to time there were visual glitches, some graphics glitches coming from the graphic parts that were most interesting."</p>

Subject I	
Sub-question: Given that an individual confronting a SMW glitch calls into play a range of responses, how do these responses interplay with each other as the individual tries to solve the problem?	
Code	Source
Pattern recognition	<ul style="list-style-type: none"> • Interview 1, Question 14-3: "The glitches were in the first and second levels of the game, as I had previously said. When the dragon (Yoshi) appears the doll super Mario was frozen. I could not do anything with this glitch, nor could I solve it, I (Mario) had to stand and could not go anywhere. I had to wait so I waited. It was nothing too dramatic. This was at least the only one I noticed and it always happens at the same stage levels, like a pattern." • Interview 2, Question 11: "From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1st page (tracing paper), to cover the page and not be transparent. This sheet had a "post it" slogan written on it - to use for scanning with tracing paper - I put the part of the post it on the wrong side and printed it. I'm not going to bring a drawing with a post it saying - to use ... with tracing paper - So, this was other glitch but a mistake on my part."
Multi-faceted learning skills	<ul style="list-style-type: none"> • Interview 1, Question 13-C: "motor skills...when I had to coordinate for him (Mario) to move in the game, or when he (Mario) swam and

	<p>disappears from the screen, and had to keep an eye on it so he (Mario) will not descend in the screen and get caught by enemies...”</p> <ul style="list-style-type: none"> • Interview 1, Question 13-F: “I need to be persistent, learn the tricks to jump at the right time in the game, or to memorize when some of the animals (enemies) appear and run or jump before it.” • Interview 1, Question 14-4: ”I think I developed motor skills, as I had said before I developed the part of manual dexterity and problem-solving. In the part that I (Mario) went beyond the screen, I learned that. But maybe that was a glitch and it was strange because I could not see the doll (Mario), but maybe it was intentional, I do not know.”
Questioning boundaries	<ul style="list-style-type: none"> • Interview 1, Question 14-4: “I think I developed motor skills, as I had said before I developed the part of manual dexterity and problem-solving. In the part that I (Mario) went beyond the screen, I learned that. But maybe that was a glitch and it was strange because I could not see the doll (Mario), but maybe it was intentional, I do not know.”
Application of knowledge	<ul style="list-style-type: none"> • Interview 2, Question 11: “In the game. I already answered before what I found in the game. But in the creation ... in the beginning in the first attempt there was a mistake. The copy was pale, and I could not see any of the lines. When I came back the second time and I put the sheet over another scanner, so all that was printed on the same page. Yes, there was a technological error. I had some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1st page (tracing paper), to cover the page and not be transparent. This sheet had a "post it" slogan written on it - to use for scanning with tracing paper - I put the part of the post it on the wrong side and printed it. I'm not going to bring a drawing with a post it saying - to use ... with tracing paper - So, this was other glitch but a mistake on my part.”
Cognition (memory)	<ul style="list-style-type: none"> • Interview 1, Question 13-C: “motor skills ... when I had to coordinate for him (Mario) to move in the game, or when he (Mario) swam and disappears from the screen, and had to keep an eye on it so he (Mario) will not descend in the screen and get caught by enemies ...”
Exploration	<ul style="list-style-type: none"> • Interview 1, Question 11: “... in the creation ... in the beginning in the first attempt there was a mistake. The copy was pale, and I could not see any of the lines. When I came back the second time and I put the sheet over another scanner, so all that was printed on the same page. Yes, there was a technological error. I had some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I

	repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1 st page (tracing paper), to cover the page and not be transparent. This sheet had a "post it" slogan written on it ... I put the part of the post it on the wrong side and printed it."
Real-life skills	<ul style="list-style-type: none"> • Interview 2, Question 11: "Yes, there was a technological error. I had some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines. The other, when I did the first printing, I put the page on the top of the printer, and the machine had a thick white sheet over it to cover the 1st page (tracing paper), to cover the page and not be transparent ... I put the part of the post it on the wrong side and printed it ... So, this was other glitch but a mistake on my part."
Reflection skills	<ul style="list-style-type: none"> • Interview 1, Question 14-9: "When the dragon is born, whatever you call it. That was the only one that I was aware of."
Benefit from it	<ul style="list-style-type: none"> • Interview 1, Question 13-C: "...when I had to coordinate for him (Mario) to move in the game, or when he (Mario) swam and disappears from the screen, and had to keep an eye on it so he (Mario) will not descend in the screen and get caught by enemies..."

Subject S	
Sub-question: Given that an individual confronting a SMW glitch calls into play a range of responses, how do these responses interplay with each other as the individual tries to solve the problem?	
Code	Source
Pattern recognition	<ul style="list-style-type: none"> • Interview 2, Question 1: "More positive I thought was the error of the game, the mistake of the programmers of the game that allowed me to reach the end easily. As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life: 1-more difficult/ challenging 2-easier/ most people go for the easier. Going for the hardest way is more positive because it would increase my capacity of killing enemies faster. In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them.

	<p>When I wrote the journal, I was thinking that this is a game for kids – it’s childish. This is positive to the extent that it entertains kids and they can develop some of their skills.</p> <p>My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive.</p> <p>The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.”</p> <ul style="list-style-type: none"> • Interview 2, Question 6: “I learned that this glitch allows the player easily to get to the end of the game, and that was it. I learned this useful technique of this game.” • Interview 2, Question 10-6: “I can use it because I discovered errors in other games, and as with this game, when I encounter them I use them.”
Multi-faceted learning skills	<ul style="list-style-type: none"> • Interview 1, Question 13-H: “I did encounter a glitch and I approached it every time I died, I made a mistake, but it is lack of skills development” (negative). • Interview 2, Question 2: “I reflected on the role of videogames in training people. • Interview 2, Question 6: “I learned that this glitch allows the player easily to get to the end of the game, and that was it. I learned this useful technique of this game.” • Interview 2, Question 7: “...because I developed skills pertaining to this game. Other games, no, because they are different. The glitch, if I find it in other games I would use it to achieve my purposes more quickly, if I want it, if I do not want to play the game the challenging way.”
Questioning boundaries	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “I found it a serious flaw, the videogame producers should have paid attention to this. However, a person who does not think that the game is boring, maybe it advances the game to kill all the enemies, but I think most people for convenience use this (glitch) to go faster and reach the end. For example, there are people who will take advantage of the glitch, and for example there are people who take advantage of the glitches in other games, tricks to make the character invincible, however, the game was bought with the intention of being a challenge to get to the end. I think a glitch is a serious flaw, but if people want to enjoy the game they can choose to ignore the glitch, and to not use it. Really, if they play the game, they should play the game by itself and not use the glitch. But as I said, there are people who use tricks to pass levels, which is stupid. Despite the fact the producers of the game failed if a glitch happens, people can choose not to use the glitch. For some people, a glitch is an easier way to achieve their objective, like in real life, there are many people that will step on other people. There is not a lack of examples of people who try to take advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the easiest method to achieve their objectives. Ethics. I'm already developing my opinion very

	much.”
Application of knowledge	<ul style="list-style-type: none"> • Interview 2, Question 3: “Is the character Mario taking advantage of a flaw in the game, he passes over the monitor and disappears, invisible, there he has no enemies, and comes in flash to the finish quickly and gets all happy. The drawing has the character coming out of the television and then he goes through the upper part of level and then back down to the television only in the end of the level.” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”
Cognition (memory)	<ul style="list-style-type: none"> • Interview 1, Question 12: “I noticed in the water level, if we are going in the part that the enemy cannot see us and we cannot see Mario, I quickly came to the end of the level because no one could reach me. I remember that well; suddenly I cannot remember anything else.” • Interview 2, Question 1: “I remember the situation that was the most interesting in the game and recorded it on paper. That was the underwater level in which Mario disappeared, not visible on the screen and then he vanished, and the enemies did not see him.” • Interview 2, Question 2: “It was not a very positive experience to play – it was boring - because this game does not match my age, but it allowed me to draw parallels with real life. In the experience of doing this, what I remember the most was the fun part of the glitch in the videogame, that was funny.. don’t know ... I faced the glitch as a ridiculous situation and that’s it.” • Interview 2, Question 5: “This drawing reminds me of when I was playing and how easy it was to reach the end using this glitch, that’s what reminds me of, basically.”
Exploration	<ul style="list-style-type: none"> • Interview 2, Question 1: “These two experiments were fun, to do the drawing portraying the glitch situation in the game was fun, to do the drawing. It was nice. Portraying the glitch into the paper.” • Interview 2, Question 2: “It was not a very positive experience to play – it was boring - because this game does not match my age, but it allowed me to draw parallels with real life. In the experience of doing this, what I remember the most was the fun part of the glitch in the videogame, that was funny.. don’t know ... I faced the glitch as a ridiculous situation and that’s it.”
Real-life skills	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “For some people, a glitch is an easier way to achieve their objective, like in real life, there are many people that will step on other people. There is not a lack of examples of people who try to take advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the

	<p>easiest method to achieve their objectives. Ethics.</p> <p>Interview 2, Question 1: “As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life: 1-more difficult/ challenging 2-easier/ most people go for the easier. ... In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them. When I wrote the journal, I was thinking that this is a game for kids – it’s childish. This is positive to the extent that it entertains kids and they can develop some of their skills. .. I reflected a bit on videogames and how they affect people's lives and this was a positive experience. “</p> <ul style="list-style-type: none"> • Interview 2, Question 2: “It was not a very positive experience to play – it was boring - because this game does not match my age, but it allowed me to draw parallels with real life. In the experience of doing this, what I remember the most was the fun part of the glitch in the videogame, that was funny.. don’t know ... I faced the glitch as a ridiculous situation and that’s it.” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”
Reflection skills	<ul style="list-style-type: none"> • Interview 1, Question 7: “I get upset with glitches because the producers of the videogame did not have too much time to develop the game, so that happens. It disgusts me. If I paid for a game, that was tested several times, “bugs” should not happen, so when it happens...” • Interview 1, Question 14-3: “I found it a serious flaw, the videogame producers should have paid attention to this. However, a person who does not think that the game is boring, maybe it advances the game to kill all the enemies, but I think most people for convenience use this (glitch) to go faster and reach the end. For example, there are people who will take advantage of the glitch, and for example there are people who take advantage of the glitches in other games, tricks to make the character invincible, however, the game was bought with the intention of being a challenge to get to the end. I think a glitch is a serious flaw, but if people want to enjoy the game they can choose to ignore the glitch, and to not use it. Really, if they play the game, they should play the game by itself and not use the glitch. But as I said, there are people who use tricks to pass levels, which is stupid. Despite the fact the producers of the game failed if a glitch happens, people can choose not to use the glitch. For some people, a glitch is an easier way to achieve their objective, like in real life, there are many people that will step on other people. There is not a lack of examples of people who try to take

	<p>advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the easiest method to achieve their objectives. Ethics. I'm already developing my opinion very much.”</p> <ul style="list-style-type: none"> • Interview 2, Question 1: “As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life: 1-more difficult/ challenging 2-easier/ most people go for the easier. Going for the hardest way is more positive because it would increase my capacity of killing enemies faster. In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them. When I wrote the journal, I was thinking that this is a game for kids – it’s childish. This is positive to the extent that it entertains kids and they can develop some of their skills. My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive. The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”
Benefit from it	<ul style="list-style-type: none"> • Interview 1, Question 7: “However I had previously used the “bug” for my benefit. There was a bug in the game in which I could pass through the walls, so I used this glitch to reach the end of the game, but right now I don’t recall the name of the game where this happened. “ • Interview 1, Question 12: “I noticed in the water level, if we are going in the part that the enemy cannot see us and we can not see Mario, I quickly came to the end of the level because no one could reach me. I remember that well; suddenly I cannot remember anything else. I used this glitch for my benefit to arrive faster at the end of the game.” • Interview 1, Question 13-D: “I acquired no great skills, I learned how to be quick and how to kill enemies, and I also took advantage of the glitch in my favor to beat the level faster ...” • Interview 2, Question 3: “Is the character Mario taking advantage of

	<p>a flaw in the game, he passes over the monitor and disappears, invisible, there he has no enemies, and comes in flash to the finish quickly and gets all happy. The drawing has the character coming out of the television and then he goes through the upper part of level and then back down to the television only in the end of the level.”</p> <ul style="list-style-type: none"> • Interview 2, Question 7: “... because I developed skills pertaining to this game. Other games, no, because they are different. The glitch, if I find it in other games I would use it to achieve my purposes more quickly, if I want it, if I do not want to play the game the challenging way.” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”
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Question. Given that an individual meeting the challenge of a glitch when playing SMW arrives at a resolution of the problem, how do critical thinking skills come into being as a consequence of these responses?

Codes. Reflection skill, memory skill, exploration skill, creation skill, synthesizing skill, applications/development, making connections and critical skills.

Subject C	
Sub-question: Given that an individual meeting the challenge of a glitch when playing SMW arrives at a resolution of the problem, how do critical thinking skills come into being as a consequence of these responses?	
Code	Source
Reflection skill	<ul style="list-style-type: none"> • Interview 1, Question 9: “...because it takes imagination to fill the gap, because nowadays everything is realistic, fantastic graphics and there's nothing to imagine.” • Interview 1, Question 13-D: “...perhaps perception and reasoning skills in games, self-reflection and self-control - there it is - when you click the keypad, you’re developing a videogame skill. The children who do not have this skill will physically jump while playing ...” • Interview 1, Question 14-6: “The experience of doing this type of work compels you to think about what you did in a more psychological way, but used in a useful way. But at a subconscious level of experience.” • Interview 2, Question 1: “I could not summarize my thinking

	<p>so well, so it's easier with images and associations of images. The process and the final product (visual essay/journal) are together, and as an architect I was always this way, because the process is as important as the final product. There is no product without the process. The final product reflects the process, the process and thinking. The technological conditions I use influence the work, the way the work was done, I guess. In this way I wanted to get there faster to the final product, it was how I wanted to get there, faster.”</p> <ul style="list-style-type: none"> • Interview 2, Question 2: “While the starting point was the game and the sound of the game, the end result is a little bit different than the starting point, it no longer has anything to do with it formally. That means it is like the trunk of tree whose origin is lost from going so far out on a branch. I used associations, of the same type of game and models, associated to each music then I moved away from this process. If this were independently viewed by someone else it could be interpreted in various ways, that is, if it needed to be interpreted, and perhaps people would not associate anything with the initial point of departure – the videogame.” • Interview 2, Question 3: “First I was thinking of it as if it were a publication bought at some place, because there is a price tag so it can be purchased in an independent bookstore, one copy only. Then it depends on the experience of each person, for me I realize that I created all this.” • Interview 2, Question 10-9: “Because this association of images requires critical thinking, reflection, some association between them, and that is critical thinking. But there is no grand theory. This is more obvious here, therefore what happens is a combination of several disciplines. Each image has a specific discipline or disciplines that are associated with each other in some way, which to me is obvious. For example, on this page, the courtyard symbolizes, invokes this meeting point of various disciplines. Coming from several places which meet in the park. This part is in common (points to page). The critical thinking is almost self-criticism.”
Memory skill	<ul style="list-style-type: none"> • Interview 1, Question 2: “...based in his home and what I remembered in that game that was his refuge, a hiding place / a refuge for him the Prince of Persia. So as research I saw the game scenarios of the game ... it has many images of ancient Persia, the scenarios have some reality, and that inspired me in some environments that I created in the project. I dad played the game before. Maybe I learned something when doing this exercise but I don't have awareness of it.” • Interview 1, Question 9: “The music and graphics stayed in my memory, the most important part of the game. A lot of people make music this way, a return to the simplest way, want to do this type of music, kids from now that never played these games before. It's not nostalgia. It's like they want to make and adapt to that time in some way.” • Interview 1, Question 12: “It's too easy to use a glitch

	<p>(laughing), but from time to time there were visual glitches, some graphics glitches coming from the graphic parts that were most interesting. But I don't remember more glitches. They were not obvious. I was distracted with other things and did not notice. By the way, could you tell me if you saw one?"</p> <ul style="list-style-type: none"> • Interview 2, Question 1: "... it's a set of sheets that show my memories of things I did. I read, I listened, I drew, literature. A set of memories of the present after playing the game. The starting point was the videogame that I played here. After that I started associating what happened to me in daily life, like reading a book about architecture patios. We even can connect the patio as the meeting place of various disciplines (points to the image page), in the center... I then remembered the experience of playing the game as a process, when you have played and that's what struck me from the experience, and then I connected my day-to-day experience with the game... a set of memories after playing." • Interview 2, Question 2: "I remember the music of the game I played and the music of "Aphex Twin", independent and experimental music. When I was playing, the music is the image that came to my mind which I associate with the 90s." • Interview 2, Question 4: "Feelings of nostalgia, past memories with present memories, records that I had studied in my architecture courses at university. It expresses what I felt. "
Exploration skill	<ul style="list-style-type: none"> • Interview 1, Question 13-H: "... more than once in the same place of the game. Until reaching the error, which was my fault, not the game's, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It's like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again." • Interview 2, Question 1: "This experience of creating the object (final product) was, first I played the game, after the 1st interview, and then I did not think about it anymore. It was a random day when I decided to start doing this and did not know what to do because I had no rigid direction. I then remembered the experience of playing the game as a process, when you have played and that's what struck me from the experience, and then I connected my day-to-day experience with the game... But I have never done this sort of thing and did not even know what was the final result would be. It was like a test, an experiment, and it eventually resulted in this. I created some constraints, like deadlines for myself, such as for the B/W photocopies, the yellow paper and print images always or almost always had to be low quality and include different disciplines as a starting point and I related them to the videogames I played. I also included comics." • Interview 2, Question 6: "With this piece (the journal/visual essay) you also have repetition and overlapping of images over other images, and the act of repetition exists as a previous experience like when I played, and they have a relationship."

	<p>When I was creating this piece (visual essay/journal) I would print lighter colors and then darker to superimpose them. In the background colors are lighter and the color stains overlapped. “</p>
Creation skill	<ul style="list-style-type: none"> • Interview 1, Question 2: “...based in his home and what I remembered in that game that was his refuge, a hiding place / a refuge for him the Prince of Persia. So as research I saw the game scenarios of the game ... it has many images of ancient Persia, the scenarios have some reality, and that inspired me in some environments that I created in the project. I had played the game before. Maybe I learned something when doing this exercise but I don't have awareness of it.” • Interview 2, Question 1: “This experience of creating the object (final product) was, first I played the game, after the 1st interview, and then I did not think about it anymore. It was a random day when I decided to start doing this and did not know what to do because I had no rigid direction. I then remembered the experience of playing the game as a process, when you have played and that's what struck me from the experience, and then I connected my day-to-day experience with the game. This was the starting point, I but did not keep a daily journal.” • Interview 2, Question 2: “When I was playing, the music is the image that came to my mind which I associate with the 90s. While the starting point was the game and the sound of the game, the end result is a little bit different than the starting point, it no longer has anything to do with it formally. That means it is like the trunk of tree whose origin is lost from going so far out on a branch. I used associations, of the same type of game and models, associated to each music then I moved away from this process. If this were independently viewed by someone else it could be interpreted in various ways, that is, if it needed to be interpreted, and perhaps people would not associate anything with the initial point of departure – the videogame.” • Interview 2, Question 6: “With this piece (the journal/visual essay) you also have repetition and overlapping of images over other images, and the act of repetition exists as a previous experience like when I played, and they have a relationship. When I was creating this piece (visual essay/journal) I would print lighter colors and then darker to superimpose them. In the background colors are lighter and the color stains overlapped. “ • Interview 2, Question 9-I: “...ability to express my creative process using a printer...”
Synthesizing skill	<ul style="list-style-type: none"> • Interview 2, Question 1: “That is, all is part of the whole thing. The entire set, even the cover, so I don't lose the papers but ... they are a set of prints in A4 in which I overlapped – it's a set of sheets that show my memories of things I did. I read, I listened, I drew, literature. This started after playing the game, and I searched through disc covers and images related to arcade games from the 90s, and this was the start for the file (final product).” • Interview 2, Question 2: “I liked the end result and like this as a piece in itself, even as a visual experience I think it works well.”
Applications/development	<ul style="list-style-type: none"> • Interview 1, Question 3: “I guess at Architecture school I had a

	<p>project from a client, a demo project in which I chose a fictional character from a computer game. I chose a videogame character. I used "Prince of Persia" as the client, and based in his home and what I remembered in that game that was his refuge, a hiding place / a refuge for him the Prince of Persia. So as research I saw the game scenarios of the game ... it has many images of ancient Persia, the scenarios have some reality, and that inspired me in some environments that I created in the project. I dad played the game before. Maybe I learned something when doing this exercise but I don't have awareness of it. I know there are games about ancient Rome, for example, and you end up learning stuff, but not in a literal way because most games were not designed for it, they are not educational games. But these types I never played much."</p> <ul style="list-style-type: none"> • Interview 1, Question 9: "The music and graphics stayed in my memory, the most important part of the game. A lot of people make music this way, a return to the simplest way, want to do this type of music, kids from now that never played these games before. It's not nostalgia. It's like they want to make and adapt to that time in some way. The other day I was in Porto and I heard a concert of music created for two Nintendo consoles which then alternated between each other and did a lot of improvisation in between. This music was composed for Nintendo, and they need to program the sounds. You have to write it. I never learned to do it but I've seen others doing it. It's a very time consuming job so I never learned it. It's almost like learning to write in a notebook but with 0's and 1's, it's very "Geeky"." • Interview 2, Question 7: "...in various contexts such as concentration, playing, you have to repeat the same things if you want to do them well. At the beginning, I was more relaxed but then it helps in concentration. But I think the idea of never making mistakes is impossible because people have to fail to learn and do better later. In real life maybe we have to be more open to things ... I think part of it is the concentration we get we can then use day-to-day like driving and exploring. I think games are good for those who have problems with concentration." • Interview 2, Question 10-6: "I can use it again and repeat this method for different purposes and I can re-use it in the future."
Making connections	<ul style="list-style-type: none"> • Interview 1, Question 3: "Architecture school I had a project from a client, a demo project in which I chose a fictional character from a computer game. I chose a videogame character. I used "Prince of Persia" as the client, and based in his home and what I remembered in that game that was his refuge, a hiding place / a refuge for him the Prince of Persia. So as research I saw the game scenarios of the game ... it has many images of ancient Persia, the scenarios have some reality, and that inspired me in some environments that I created in the project. I dad played the game before. Maybe I learned something when doing this exercise but I don't have awareness of it. I know there are games about ancient Rome, for example, and you end up learning stuff, but not in a literal way because most games were not designed

	<p>for it, they are not educational games. But these types I never played much.”</p> <ul style="list-style-type: none"> • Interview 1, Question 9: “The music and graphics stayed in my memory, the most important part of the game. A lot of people make music this way, a return to the simplest way, want to do this type of music, kids from now that never played these games before. It’s not nostalgia. It’s like they want to make and adapt to that time in some way. The other day I was in Porto and I heard a concert of music created for two Nintendo consoles which then alternated between each other and did a lot of improvisation in between. This music was composed for Nintendo, and they need to program the sounds. You have to write it. I never learned to do it but I’ve seen others doing it. It’s a very time consuming job so I never learned it. It’s almost like learning to write in a notebook but with 0’s and 1’s, it’s very "Geeky".” • Interview 1, Question 10: “I think yes, but it’s too recent of an experience for me to respond to it, and therefore hard. I think I used skills that I knew before so I did not have to learn from scratch. It’s like when you stop using a bike. I learned nothing new, but I can re-use it. It’s like picking up an old toy and playing with it.” • Interview 1, Question 13-H: “...more than once in the same place of the game. Until reaching the error, which was my fault, not the games, and I almost did not learn at first, so I learned the second time, if not the second time I learned it on the third try. So in the end you will learn it. It’s like when you get burned in a fire, you get burned only once or twice, because after that you will not touch it again.” • Interview 2, Question 1: “I could not summarize my thinking so well, so it's easier with images and associations of images. The process and the final product (visual essay/journal) are together, and as an architect I was always this way, because the process is as important as the final product. There is no product without the process. The final product reflects the process, the process and thinking. The technological conditions I use influence the work, the way the work was done, I guess. In this way I wanted to get there faster to the final product, it was how I wanted to get there, faster. ...The starting point was the videogame that I played here. After that I started associating what happened to me in daily life, like reading a book about architecture patios. We even can connect the patio as the meeting place of various disciplines (points to the image page), in the center. I wasn't too worried, but it was a succession of images from different disciplines, music, literature, comics, (shows the pages and points to the images while talking). I wrote this by hand (points to the speech bubbles), but it has no order, all of it is independent in form. But here is the idea of repetition; even this comic area was made with different dialogues (continuously showing the image while pointing). Here also we can see the overlap, here the zen symbol (flips pages and pointing to yin-yang), here's more (changes pages) but there is no correct way of
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	<p>looking at it.”</p> <ul style="list-style-type: none"> • Interview 2, Question 3: “First I was thinking of it as if it were a publication bought at some place, because there is a price tag so it can be purchased in an independent bookstore, one copy only. Then it depends on the experience of each person, for me I realize that I created all this..... I see a number of elements that can connect with each other, for example, the games you can join (joins now these 2 pages side by side, continuously turning pages and pointing), music with music, with songs, games, literature, literature, music, music, architecture, courtyard, comic, comic, (continues to point at pages) and here is one with various music, literature, literature and then may be this. Architecture, music, comics, literature, publication and videogame images (continues showing pages). And here, perhaps with this courtyard as a meeting place of various disciplines and the repeating elements based on the experience of playing the games and the different levels.”
Critical skills	<ul style="list-style-type: none"> • Interview 1, Question 3: “I know there are games about ancient Rome, for example, and you end up learning stuff, but not in a literal way because most games were not designed for it, they are not educational games. But these types I never played much.” • Interview 1, Question 13-D: “...perhaps perception and reasoning skills in games, self-reflection and self-control - there it is - when you click the keypad, you’re developing a videogame skill. The children who do not have this skill will physically jump while playing ...” • Interview 2, Question 1: “...the process, the process and thinking.... It is difficult to evaluate my process but I chose ... I could have made more copies, I could have chosen more things and continued the process, but for this deadline, I had to close the process and this needed to be sufficient.” • Interview 2, Question 8: “I guess I am not in love with it, but it would be more interesting to develop this even further, but in a more extensive way, with the memories of the day-to-day, almost as an archive of life's moments and experiences.” • Interview 2, Question 10-9: “Because this association of images requires critical thinking, reflection, some association between them, and that is critical thinking. But there is no grand theory. This is more obvious here, therefore what happens is a combination of several disciplines. Each image has a specific discipline or disciplines that are associated with each other in some way, which to me is obvious. For example, on this page, the courtyard symbolizes, invokes this meeting point of various disciplines. Coming from several places which meet in the park. This part is in common (points to page). The critical thinking is almost self-criticism.”

Subject I	
Sub-question: Given that an individual meeting the challenge of a glitch when playing SMW arrives at a resolution of the problem, how do critical thinking skills come into being as a consequence of these responses?	
Code	Source
Reflection skill	<ul style="list-style-type: none"> • Interview 2, Question 1: “A reflection from doing this is that the drawings are childish, and what concerns me is what that could represent psychologically. I liked the process of making scribbles.” • Interview 2, Question 10-10: “Because it’s a reflection. It’s a beginning of reflection. You are doing something in it (journal) that will help you to reflect on things. So, it can be an escape, a journal can be an escape for the person to be 1, 2 or 3 h and not be worried about anything, just to write and draw.”
Memory skill	<ul style="list-style-type: none"> • Interview 1, Question 9: “In my memory what stays is the music, that was the most fun. But through the music I could realize - 2nd game – that by (Mario) catching the stars – he (Mario) would not be eaten by the enemies, and when he (Mario) loses power, the music changes, and so this is a sign that we lost the bonus. When this happened I (Mario) had to jump so I (Mario) would not die. I dealt with this problem with an unnerving feeling, because I would press the wrong keys on the game controller. The intention was to pass through this part of the game, so I dealt with it in a way so that I could pass that part. “ • Interview 1, Question 13-F: ”...to memorize when some of the animals (enemies) appear and run or jump before it.” • Interview 1, Question 14-6: “Whatever. I may need to play Super Mario again. The part of the manual dexterity or visual memory, I might need in the future.” • Interview 2, Question 1: “It was interesting and difficult, and sometimes a little difficult because I was inspired to do that idea of the game, and I reached a time that it was not easy to remember the details of the game. It was interesting. I had this idea a few days in advance, I was already thinking of doing the superimposing. After x number of days with these designs and after spending all that time I played the game I had no idea of the details in my memories. The only memory I had was the "frames," the "layout" of the game. I only had ideas about that, the images that were kept in my memory were the various schemes of the game. Related to the details of the coins and dolls I couldn’t recall that well how to draw them.... Maybe by doing this, by layering, it reminds me of the levels of the game.... Positive maybe, because I was occupied with drawing and painting.... Because sometimes it’s frustrating, because I wanted to draw something and I could not, or did not know how, or could not remember and so I did not draw it.... The image that comes to mind is from Mario. I could not draw the doll (Mario), he is not very noticeable in the game because he is

	<p>two-dimensional, you only see the doll (Mario) from one side, a very little guy.”</p> <ul style="list-style-type: none"> • Interview 2, Question 2: “I remember the game screen as the doll (Mario) ran from one side to the other, trying to hit, while I was trying to dominate the game controller to see how it works, as the doll (Mario) goes forward and backward. After that, I remember the music but that was just now me being influenced by the sound of the phone ringing (the telephone rings). The music of the game was sometimes annoying, especially the part of the game when I died and then an annoying music came up behind. It became annoying when he (Mario) died. When I was drawing (in the journal) from time to time, it made me want to play the game a little, to have the experience of being there playing again. When I was drawing, I was trying to remember the graphics and the design as closely as possible to what I could remember of the game, knowing that it was impossible to do it exactly as it was in the game.” • Interview 2, Question 3: “But it represents the various levels, screens, I say that reminded me of the game, as several overlapping levels of the game and several images superimposed, like layers.”
Exploration skill	<ul style="list-style-type: none"> • Interview 1, Question 14-1: “...and to explore various possibilities. That part of the key, realizing that he (Mario) could swim down in that scenario and pick up the key, and explore the scenery. “ • Interview 2, Question 4: “In this moment I want to take home (visual essay) and paint it because I would like to explore more of these interesting forms.” • Interview 2, Question 5: “Maybe with what I said before, I would like to take it home and experiment, to try to draw or paint this, as if I could go home and try to play and experience the game, try to pass the levels. The challenging part of the game, I was challenged to try to pass ... like this experience.” • Interview 2, Question 9-D: “I developed skills of experimenting with decals and different methods of drawings ...”
Creation skill	<ul style="list-style-type: none"> • Interview 2, Question 1: “I liked the process of making scribbles. This is not intended be perfect, it’s free drawing. I could even have drawn up some weird monkeys, as I was free and good. It’s good to create at free will without having to worry that the outcome is perfect.” • Interview 2, Question 10-6: “I can use the idea of the journal for future projects. With a drawing journal I would have to draw every day for example, or to develop other skills at a drawing level, such as creativity.” • Interview 2, Question 10-11: “In the game. I already answered before what I found in the game. But in the creation ... in the beginning in the first attempt there was a mistake. The copy was pale, and I could not see any of the lines. When I came back the second time and I put the sheet over another scanner, so all that was printed on the same page. Yes, there

	<p>was a technological error. I had some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash.”</p>
Synthesizing skill	<ul style="list-style-type: none"> • Interview 2, Question 3: “If I had not known the process and thought behind it, it would look like confusion, a little strange. But it represents the various levels, screens...” • Interview 2, Question 10-8: ”I used the scanner and printer to scan, to print and re-print it. Because at the time this was the only way I could think of to reach this result, using these technologies.”
Applications/development	<ul style="list-style-type: none"> • Interview 2, Question 9-D: “I developed skills of experimenting with decals and different methods of drawings ...” • Interview 2, Question 10-11: “... in the beginning in the first attempt there was a mistake. The copy was pale, and I could not see any of the lines. When I came back the second time and I put the sheet over another scanner, so all that was printed on the same page. Yes, there was a technological error. I had some errors during the process of creating it, from the machine and from my own errors. From the machine, the lines were printed unclearly and I could not understand why. And the second error was my mistake because I put something that was not supposed to be there and it was printed. So I repeated it again, and kept the old one, because I had no time to throw it to the trash. I did not bring it here because I was not going to bring something that was wrong. One of the pages you could not even see the lines.”
Making connections	<ul style="list-style-type: none"> • Interview 1, Question 9: “In my memory what stays is the music, that was the most fun. But through the music I could realize - 2nd game – that by (Mario) catching the stars – he (Mario) would not be eaten by the enemies, and when he (Mario) loses power, the music changes, and so this is a sign that we lost the bonus. When this happened I (Mario) had to jump so I (Mario) would not die. I dealt with this problem with an unnerving feeling, because I would press the wrong keys on the game controller. The intention was to pass through this part of the game, so I dealt with it in a way so that I could pass that part.” • Interview 2, Question 3: “If you look at the right side you can see a wave, if you turn it upside down, the left side has another wave, on the contrary – oh, and I found now that I had drawn a wave. (Shows visual essay while moving it around) I think this is a mess in the middle. If I had not known the process and thought behind it, it would look like confusion, a little strange. But it represents the various levels, screens; I say that reminded me of the game, as several overlapping levels of the game and several images superimposed, like layers.”

	<ul style="list-style-type: none"> • Interview 2, Question 10-9: “I look at the pictures and I think they could be different, not better, but more subjectively, they could be less childish. Look at them (the drawings). Of course I'm criticizing, and during the process of creating them after drawing back and forth also, I am criticizing. So, I thought what could I have done differently in the process of drawing them... I never related the drawings with the experience of real life because I believe that this had to be only related to the game, right? I explored the game more.”
Critical skills	<ul style="list-style-type: none"> • Interview 2, Question 1: “So, this was other glitch but a mistake on my part... It's not perfect, it's crooked, I wonder if it is going to be judged or criticized.” • Interview 2, Question 2: “I think this is a mess in the middle. If I had not known the process and thought behind it, it would look like confusion, a little strange. “ • Interview 2, Question 8: “Average. It meets my average satisfaction because it could be painted. I could have done something more interesting, aesthetically more colorful, less static, if I had added color this would be more interesting.” • Interview 2, Question 10-9: “I look at the pictures and I think they could be different, not better, but more subjectively, they could be less childish. Look at them (the drawings). Of course I'm criticizing, and during the process of creating them after drawing back and forth also, I am criticizing. “ • Interview 2, Question 10-10: “It's just the person, paper, pencils, pens and whatever, with no one around to judge or nag. You can cross out whatever you want without worrying about the criticism of others; you draw this for yourself and you write for yourself.”

Subject S	
Sub-question: Given that an individual meeting the challenge of a glitch when playing SMW arrives at a resolution of the problem, how do critical thinking skills come into being as a consequence of these responses?	
Code	Source
Reflection skill	<ul style="list-style-type: none"> • Interview 1, Question 8: “When we are children everything fascinates us, and when we are children we have so much free time inside the house that we can play video-games to distract us and stay in that fascinating world... But when we reach adulthood we can do other activities and playing a game is not new anymore, because we have already played so much that is not fascinating anymore. Unless it is something new, revolutionary that allows us to start gaming again, but that depends on the profile of the person, because any person of any age can enjoy a game. I think this is all more or less positive. What would be good would be if I were currently studying or had a job that is the dream. Nothing positive, nothing negative exists.” • Interview 2, Question 1: “My experience with the game, what

	<p>I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive. The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.”</p> <ul style="list-style-type: none"> • Interview 2, Question 2: “I reflected on the role of videogames in training people. It was not a very positive experience to play – it was boring - because this game does not match my age, but it allowed me to draw parallels with real life.” • Interview 2, Question 8: “... and reflects what happened to me in the game. It portrays the situations happening in the game in which I took the character to easily reach the end. It expresses that.” • Interview 2, Question 9-I: “... to find something in the game and transcribe it on paper - like saying the ability of reflection and critical skill ...” • Interview 2, Question 9-J: “I developed reflective and critical capacities, that I possess ...” • Interviews 2, Question 10-2: “I developed drawing skills and reflective capacity because I reflected on the game that I had experienced.” • Interview 2, Question 10-9: “I developed my thinking because I had to think about what happened in the videogame, and I developed and analyzed what I experienced, and then I wrote and drew it.” • Interview 2, Question 10-10: “...as I reflected and criticized what happened in the videogame, and in what I had experienced.”
Memory skill	<ul style="list-style-type: none"> • Interview 1, Question 9: “In my memory I remember a situation when I (Mario) walked into a tube, a plumbing pipe, and there were some squares with wings flying around. When I (Mario) jumped, I could not hit the cubes because they were too high, so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game.” • Interview 1, Question 12: “I noticed in the water level, if we are going in the part that the enemy cannot see us and we can not see Mario, I quickly came to the end of the level because no one could reach me. I remember that well; suddenly I cannot remember anything else. I used this glitch for my benefit to arrive faster at the end of the game.” • Interview 1, Question 13-E: “I remember an enemy that looks like a rugby player (football player), he’s really fast and it took me a while to learn how to kill him. I know I had to give several strokes over or rotate on top of him, but many times I (Mario) died. Since I did not know how to do the rotation very good, I decided to skip the rotation and always jump on top of

	<p>this enemy.”</p> <ul style="list-style-type: none"> • Interview 2, Question 1: “I remember the situation that was the most interesting in the game and recorded it on paper. That was the underwater level in which Mario disappeared, not visible on the screen and then he vanished, and the enemies did not see him. And he would arrive to the end in a super fast way. ...My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive. The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.” • Interview 2, Question 2: “...what I remember the most was the fun part of the glitch in the videogame, that was funny... don't know ... I faced the glitch as a ridiculous situation and that's it.” • Interview 2, Question 5: “...reminds me of when I was playing and how easy it was to reach the end using this glitch, that's what reminds me of, basically.”
Exploration skill	<ul style="list-style-type: none"> • Interview 1, Question 9: “The learning curve of the game controller doesn't take long to play the game. This was done through experience, trying to see what each button was used for, learning through trial and error, gaining experience of killing the enemies, in this way I learned how to play the game. I remember a situation when I (Mario) walked into a tube, a plumbing pipe, and there were some squares with wings flying around. When I (Mario) jumped, I could not hit the cubes because they were too high, so what I found out was that if I enter this area with Yoshi, Yoshi endows a certain power for Mario so that when Mario jumps he has enough propulsion to jump to these cubes. This was something that I learned through the game. The most important thing is how to defeat the game, so I learned to defeat the enemies and there were various types of enemies. I also learned that I (Mario) can grab and throw objects and this would allow killing multiple enemies at once. I also discovered that in the water level I could grab little Yoshi and that would function like a jet ski that allowed Mario to move faster. Then, I found this little Yoshi after eating enemies would become a regular Yoshi. This normal Yoshi at the end of the level - like at the end of the level, there is a bar like an Olympic games bar that goes up and down - I found that to jump the bar with Yoshi's would give me (Mario) some power and I would jump higher.” • Interview 2, Question 2: “In the experience of doing this, what I remember the most was the fun part of the glitch in the videogame, that was funny ... don't know ... I faced the glitch as a ridiculous situation and that's it.” • Interview 2, Question 10-9: “I developed my thinking because I had to think about what happened in the videogame,

	<p>and I developed and analyzed what I experienced, and then I wrote and drew it.”</p> <ul style="list-style-type: none"> • Interview 2, Question 10-11: “I found a glitch in the water level. I experienced a glitch that consisted of Mario disappearing from the screen, and quickly arrived to the end of the game.”
Creation skill	
Synthesizing skill	<ul style="list-style-type: none"> • Interview 2, Question 1: “In the personal journal, I summarized my impressions throughout the game, all impressions about the way the game can help people in real life. I did a summary of it all. For example, how I developed the ability to effectively kill the enemies and then I made a comparison with the most advanced games - because this game is for children. <p>For example, for a FPS (First-person shooter) you must have a capacity for quick reflexes, because constant danger and any distraction can be fatal in the game. So you need to be very watchful and attentive. So, in real life, it helps the response-reaction skill, which is the reflex to react quickly in situations in real life. In this game I played, it is more to develop child’s skills, because they are not so evolved as an adult. However, I made a comparison with real life and what skills can be most effective to develop through playing games. Despite this, videogames are more a form of entertainment than a way of personal development, although you can develop personal skills that can help in real life. For example, when I am driving, and I have to hit the brakes in the case of an emergency, my reflexes are lower because I have not developed the skill to kill someone quickly during a videogame, because if I could kill him and get away from him fast enough in the videogame, then I have developed my ability of response-reaction. And I think that’s it. The reaction-response when I drive a car and someone crosses in the front of me, I think I have a fast response because I’m quick at playing games, and through that I developed the response-reaction. But I think this happens more not in this game so much because it’s a kid’s game, but in a First Person Shooters Game, of course... More positive I thought was the error of the game, the mistake of the programmers of the game that allowed me to reach the end easily.... The negative part was to reach the conclusion that maybe games are not as positive as they may seem.”</p> <ul style="list-style-type: none"> • Interview 2, Question 9-C: “I summarized all that happened in the game despite being brief ...”
Applications/development	<ul style="list-style-type: none"> • Interview 2, Question 1: “For example, how I developed the ability to effectively kill the enemies and then I made a comparison with the most advanced games - because this game is for children. For example, for a FPS (First-person shooter) you must have a capacity for quick reflexes, because constant danger and any distraction can be fatal in the game. So you need to be very watchful and attentive. So, in real life, it helps the response-reaction skill, which is the reflex to react quickly

	<p>in situations in real life. In this game I played, it is more to develop child's skills, because they are not so evolved as an adult. However, I made a comparison with real life and what skills can be most effective to develop through playing games. Despite this, videogames are more a form of entertainment than a way of personal development, although you can develop personal skills that can help in real life. For example, when I am driving, and I have to hit the brakes in the case of an emergency, my reflexes are lower because I have not developed the skill to kill someone quickly during a videogame, because if I could kill him and get away from him fast enough in the videogame, then I have developed my ability of response-reaction. And I think that's it. The reaction-response when I drive a car and someone crosses in the front of me, I think I have a fast response because I'm quick at playing games, and through that I developed the response-reaction. But I think this happens more not in this game so much because it's a kid's game, but in a First Person Shooters Game, of course. More positive I thought was the error of the game, the mistake of the programmers of the game that allowed me to reach the end easily. As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life:</p> <p>1-more difficult/ challenging 2-easier/ most people go for the easier.</p> <p>Going for the hardest way is more positive because it would increase my capacity of killing enemies faster. In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them.</p> <p>When I wrote the journal, I was thinking that this is a game for kids – it's childish. This is positive to the extent that it entertains kids and they can develop some of their skills. My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive.</p> <p>The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that maybe people should do activities with each other instead of playing games. This is a negative aspect.</p> <p>These two experiments were fun, to do the drawing portraying the glitch situation in the game was fun, to do the drawing. It was nice. Portraying the glitch onto the paper.”</p> <ul style="list-style-type: none"> • Interview 2, Question 3: “Is the character Mario taking advantage of a flaw in the game, he passes over the monitor and disappears, invisible, there he has no enemies, and comes in flash to the finish quickly and gets all happy.
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	<p>The drawing has the character coming out of the television and then he goes through the upper part of level and then back down to the television only in the end of the level.”</p> <ul style="list-style-type: none"> • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option.”
Making connections	<ul style="list-style-type: none"> • Interview 1, Question 14-3: “In the water level, I was up above the screen and quickly came to the end of the level and no enemy could reach me. I found it a serious flaw, the videogame producers should have paid attention to this. However, a person who does not think that the game is boring, maybe it advances the game to kill all the enemies, but I think most people for convenience use this (glitch) to go faster and reach the end. For example, there are people who will take advantage of the glitch, and for example there are people who take advantage of the glitches in other games, tricks to make the character invincible, however, the game was bought with the intention of being a challenge to get to the end. I think a glitch is a serious flaw, but if people want to enjoy the game they can choose to ignore the glitch, and to not use it. Really, if they play the game, they should play the game by itself and not use the glitch. But as I said, there are people who use tricks to pass levels, which is stupid. Despite the fact the producers of the game failed if a glitch happens, people can choose not to use the glitch. For some people, a glitch is an easier way to achieve their objective, like in real life, there are many people that will step on other people. There is not a lack of examples of people who try to take advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the easiest method to achieve their objectives. Ethics. I'm already developing my opinion very much.” • Interview 2, Question 10-9: “I developed my thinking because I had to think about what happened in the videogame, and I developed and analyzed what I experienced, and then I wrote and drew it.”
Critical skills	<ul style="list-style-type: none"> • Interview 1, Question 7: “I get upset with glitches because the producers of the videogame did not have too much time to develop the game, so that happens. It disgusts me. If I paid for a game, that was tested several times, “bugs” should not happen, so when it happens...” • Interview 1, Question 14-3: “I found it a serious flaw, the

	<p>videogame producers should have paid attention to this. However, a person who does not think that the game is boring, maybe it advances the game to kill all the enemies, but I think most people for convenience use this (glitch) to go faster and reach the end. For example, there are people who will take advantage of the glitch, and for example there are people who take advantage of the glitches in other games, tricks to make the character invincible, however, the game was bought with the intention of being a challenge to get to the end. I think a glitch is a serious flaw, but if people want to enjoy the game they can choose to ignore the glitch, and to not use it. Really, if they play the game, they should play the game by itself and not use the glitch. But as I said, there are people who use tricks to pass levels, which is stupid. Despite the fact the producers of the game failed if a glitch happens, people can choose not to use the glitch. For some people, a glitch is an easier way to achieve their objective, like in real life, there are many people that will step on other people. There is not a lack of examples of people who try to take advantage of other people for the sake of convenience, an easier way to achieve their goals. I do not know how to say it, but it is a lack of seriousness. Depends, but people choose the easiest method to achieve their objectives. Ethics. I'm already developing my opinion very much. “</p> <ul style="list-style-type: none"> • Interview 1, Question 4-6: “...because the experience is specific to this game, since the game is so basic and there is no complicated puzzle that appears so I could develop my reasoning, thinking and interpretation skills. This game was basic.” • Interview 2, Question 1: “As I said, this might have parallels in real life in the way that people take the easy way out, or the fastest. Less positive is the same, as I said before, there are two options in life: 1-more difficult/ challenging 2-easier/ most people go for the easier. Going for the hardest way is more positive because it would increase my capacity of killing enemies faster. In real life, opting for the easy way is not always the best. For example, a person with an easy-going life does not know what a hard life is, and does not develop resistance. And when faced with problems, in the future, that person will not know how to react to them. <p>When I wrote the journal, I was thinking that this is a game for kids – it’s childish. This is positive to the extent that it entertains kids and they can develop some of their skills. My experience with the game, what I wrote in the journal, well, I reflected a bit on videogames and how they affect people's lives and this was a positive experience. For example, to reflect about this is positive.</p> <p>The negative part was to reach the conclusion that maybe games are not as positive as they may seem. I reflected that</p>
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	<p>maybe people should do activities with each other instead of playing games. This is a negative aspect.”</p> <ul style="list-style-type: none"> • Interview 2, Question 9-I: “...to find something in the game and transcribe it on paper - like saying the ability of reflection and critical skill” • Interview 2, Question 9-J: “I developed reflective and critical capacities, that I possess ...” • Interview 2, Question 10-1: “I found parallels between videogames and real life. I learned how I explained previously in the glitch situation; I took advantage of the glitch in the game to reach the end quickly, as in real life it is easier to choose the easier way out, without difficulties. The way people choose to take advantage of the glitch to quickly move to the end without going through the difficulties of the game as in real life, people opt for the easy way instead of the best way. To choose the easiest way, without learning with this path, however, if they choose the difficult way they would learn better and it would be the better option. “ • Interview 2, Question 10-10: “...as I reflected and criticized what happened in the videogame, and in what I had experienced.”
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Conceptual Synthesis

What I found based on these three subjects and in Tables 2, 3, and 4 were data that I arranged as a conceptual synthesis (Table 5). In synthesizing the coding, I have identified the most salient features of the three subjects’ thinking around the three categories in the synthesis coding of Table 5. Below is the summary of the interview citations.

Subject C interview data: relationship between Memory, Skills Base, Self-Directed Learning, and Game Play, Glitch Analysis, Real Life.

	Memory	Skills Base	Self-directed learning
Game Play	<p>- Said the experience of playing SMW compelled him to think about what he did in a psychological way (I1 Q14-6).</p> <p>- Said that videogames “...help develop ... sight,</p>	<p>- Said that videogames “...help develop motor skills...such as sight, brain, part of the brains, motor skills...” (I1 Q4), also “...imagination...” (I1 Q6), and “...</p>	<p>-Said he failed several times in one place in the game and learned not to make that mistake in the same place. Learned not to go to that place in SMW (I1 Q14-5).</p> <p>- Said he did not learn</p>

	Memory	Skills Base	Self-directed learning
	brain, part of the brains,...” (I1 Q4)	<p>perception and reasoning skills in games, self-reflection and self-control...” (I1 Q13-d).</p> <p>- Said when playing a game he dealt well with controlling irritation and emotion and never threw the controller into the air (I1 Q14-5).</p> <p>- Said that creating a visual essay, journal with associating images of playing SMW “requires critical thinking, reflection, some associations between them, and that is critical thinking.” (I2 Q10-9)</p>	<p>the 1st or the 2nd time to play the game, but learned 3rd time and compared the learning to when a person touches fire and gets burned (I1 Q13-H).</p> <p>- Said to finish the level Mario needs to eat all items, catch all items to get max score and reach end of level (I1 Q14-3).</p> <p>- Said he could choose several paths and made mistakes, attempts, a process of repeating that brought variations and changes like ink blurs to reach the end of his visual essay and journal (I2 Q11).</p>
Glitch Analysis	- Said he did not know if in the water level when catching a key, if encountered glitch or not, but after thinking about it, said it cannot be a glitch (I1 Q12).	<p>- Said it’s too easy to use glitches and they can come in graphic ways or visual ways (I1 Q12).</p> <p>- Said that he could make glitch just like the machine, and believed this could bring good results and experiences in the future. He used these glitches in his visual essay, journal (I2 Q2).</p>	<p>- Said he embraced the glitch, did not throw anything in the garbage, and that all was used in his visual essay, journal. (I2 Q3)</p> <p>- Said he tried to avoid the glitch choosing an alternative path (I1 Q7).</p> <p>Said he considered himself the glitch, not the technology, that he was the printing glitch failure. Said “the error is in us,” and “I am the glitch.” (I2 Q11)</p> <p>-Said when Mario disappeared, it was a kind of glitch. He did not touch the enemies and he used this to finish the game (I1 Q12).</p>

	Memory	Skills Base	Self-directed learning
Real Life	<p>- Said that the starting point was SMW and the association of his life, a set of memories and remembrances. (I2 Q4) He emphasized that the product reflects the process and thinking, and that the process and technology is equally important when creating the visual essay, journal (I2 Q1).</p>	<p>- Said that concentration learned while playing SMW can be used in driving and exploring (I2 Q7). - Said he learned to avoid mistakes when playing SMW, compared with trial-and-error that led to end the game. Persistence and repetition necessary in process until one succeeds (I1 Q4-5). - Said the process is just as important as final product. He said that repetition, overlapping, different images from books and daily objects were used with the computer, internet scanner and printer. (I2 Q1)</p>	<p>- Said he did not learn the 1st or the 2nd time to play the game, but learned 3rd time and compared the learning to when a person touches fire and gets burned (I1 Q13-H). -// Said all persons have to fail to learn better in SMW, and in real life. (I2 Q7). - Explained that he assigned deadlines and constraints to create the visual essay and journal, since he said he was not provided rigid direction. It was the first time he did this type of activity, and decided to connect this 1h experience playing with SMW with his day-to-day experience. (I2 Q1) - Explained how he used the error while printing and printed again on top of images, said it reminded him of the ability to replay the game when the level reset (I2 Q10-3).</p>

Subject I interview data: relationship between Memory, Skills Base, Self-directed learning, and Game Play, Glitch Analysis, Real Life.

	Memory	Skills Base	Self-directed learning
Game Play	<ul style="list-style-type: none"> - Said that she may need what she experienced in SMW in the future, like “visual memory.” (I1 Q 14-6) -Said after a few days passed, details of SMW in her memories which came to her mind were “frames” and “layouts” of the game with the 2-D “doll” (Mario). (I2 Q1) - Said she remembered the music, how it was connected with what happened to the “doll” (Mario) (I2 Q2) - Said her visual essay is a reminder of her playing the SMW. (I2 Q3) - Said she need to be persistent to learn run or how to jump in the correct place or to memorize when enemies appear. (I1 Q13-f) - Said she memorized part of SMW so when the animals (enemies) appear Mario would run or jump them. (I1 Q13-f) 	<ul style="list-style-type: none"> - Said she “...learned to take more risks when I Play, and try to solve problems in different ways, and to explore various possibilities.” (I1 Q14-1) - Said that she may need what she experienced in SMW in the future, like “manual dexterity or visual memory.” (I1 Q 14-6) - Said she reflected in her journal and her drawings were childish. (I2 Q1) - Said her visual essay could be better and she criticized the process of creating it. Also related it with experience of real life. (I2 Q10-9) - Said she “...developed skills of experimenting with decals and different methods of drawings...” (I2 Q9-d), also “...developed the part of manual dexterity and problem-solving,” (I1, Q14-4), motor skills (I1 Q13-c, I1 Q13-d, I1 Q14-4) and “manual dexterity or visual memory. (I1, Q14-6) - Said that her hand-eye coordination was a problem because 	<ul style="list-style-type: none"> - Said she learned on a visual level when playing videogames, seeing visual patterns. (I1 Q6) - Said she used the music and had a problem with the keys in the game controller. Said she had an unnerving feeling when playing a part of the SMW that was problematic. However, she was able to get beyond it and reach the end. (I1 Q9) - Said playing SMW was challenging but she tried to overcome in the same way that she dealt with the experience of creating a journal and visual essay. (I2 Q5)

	Memory	Skills Base	Self-directed learning
		<p>sometimes “the doll” (Mario) would not move (I1 Q10).</p> <p>- Said she used previous skills to avoid problems. (I1 Q13-g)</p> <p>- Said while playing SMW she explored various scenery. (I1 Q14-1)</p>	
Glitch Analysis	<p>- Said on the first level she played SMW she only noticed one type of freeze glitch, like a pattern in the game. (I1 Q14-3)</p>	<p>-Said the glitch remind her going to the “shrink” and that one can choose the option of going in one direction and move on. (I1 Q10)</p> <p>-Said the machine she used to create the visual essay was scanner and printer (I2 Q 10-8) did errors that she did not use, or put in garbage.</p> <p>- Said she made mistakes and finished saying that this was her glitch, and “a mistake on my part.” Applied the word “glitch” to own actions. (I2 Q11)</p>	<p>-Said when a “bug” (glitch) happens in the game, she chooses to leave or wait for it to function again. (I1 Q7)</p> <p>- Said when Mario disappears on the top screen she needed to be attentive that he would not descend and get caught by enemies. (I1 Q13-c)</p>
Real Life		<p>-Said the game and glitch remind her going to the “shrink” (I1 Q10)</p> <p>- Said hand coordination used in playing SMW can also be used as playing the drums or piano. (I1 Q11)</p> <p>- Said we can learn mathematics while playing SMW, when we count fish that he</p>	<p>- Said playing SMW is taking the “straight path” and she compared it with going to a counselor/therapist. (I1 Q10)</p>

	Memory	Skills Base	Self-directed learning
		(Mario) eats or points gained. (I1 Q14-7) - Said she can use experience of journal in future to develop other skills at the drawing level, like creativity. (I2 Q10-6) - Said her journal could be an escape from her worries and it could “.help you to reflect things.” (I2 Q10-10)	

Subject S interview data: relationship between Memory, Skills Base, Self-directed learning, and Game Play, Glitch Analysis, Real Life.

	Memory	Skills Base	Self-directed learning
Game Play	- Said he learned basic reasoning while playing SMW (I1 Q11) - Said that “...developed my thinking...” (I2 Q10-9)	- Said he was quick with “response-reaction” while playing a videogame. (I2 Q1) - Said he reflected on SMW, thinks it’s a positive experience because one is reflecting on it. However, said it’s negative because this activity takes away from human connections, unlike playing cards. (I2 Q1) - Said he “.reflected on the role of videogames in training people.” (I2 Q2) - Related to visual essay and journal, said that he “developed reflective and critical capacities that I possess...” (I2 Q9-j)	-Said videogames are good for children because “...they learn mechanism of fighting, defending, problem-solving...” (I1 Q14-7)

	Memory	Skills Base	Self-directed learning
		since he "... reflected and criticized what happened in the videogame, and in what I had experienced." (I2 Q10-10)	
Glitch Analysis	- Said he used is memory to remember situations in the game to help him reach the end. (I1 Q9)	- Said glitch on water level of SMW was because videogame producer created a flaw in the coding. Compared that with the advantages of using the glitch and his opinion about them. Connected this with real life, that persons take advantage of others: "...people choose the easiest method to achieve their objectives. Ethics." (I1, Q14-3) - Said he learned how to reach the end of SMW on the water level using the glitch. (I1, Q12, I1 Q 13-d, I2 Q1, I2 Q5, I2 Q6, I2 Q10-1) - Said he did not know how to rotate very well in SMW, so he killed the rugby enemy with several jumps on top of him. (I1 Q13-e)	- Said when encountered a "bug" (glitch) he left the game and joined back in the game to see if the glitch disappeared (I1 Q7) - Said "...learning through trial-and-error, gaining experience..." while playing SMW. Gave the example when Mario could not catch items, so next time he played that level he made Mario ride Yoshi and caught the items. (I1 Q9) Said that when discovering an error in SMW or other games, he uses them (I1, Q14-3; I2 Q7, I2 Q10-6). - Mentioned that any person can use the glitch or choose to ignore it. (I1, Q14-3)
Real Life		- Said videogames help improve his English (I1 Q3) and resolve puzzles. (I1 Q3, I1 Q5, I1 Q6) - Said in the visual essay and journal he summarized all impressions of SMW	- Said error on the water level where Mario disappeared from the screen allowed him to not kill enemies, reach the end easily. Paralleled this with real life experience and giving

	Memory	Skills Base	Self-directed learning
		and how they can help a person "...in real life, it helps the response-reaction skills, which is the reflex to react quickly in situations in real life." (I2 Q1)	two options: the hard and easy way. Reflected on the positive and negative of these two options. (I2 Q1) -Said he learned to "... find something in the game and transcribe it." (I2 Q9) - Said he learned to create parallels between videogames and real life (I2 Q10-1).