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# Intertextual design: the hidden stories of Atari women

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KEYWORDS Gender equity; research through design; intertextuality; computer science; games; HCI design approach; critical design

# 1. Introduction

"Are they all mostly Dave? I'll just call everybody Dave" (Dona Bailey voice in cut scene no. 1, Remixed Pac-man, AtariWomen.org)

Public narratives of computing often render its gender problems inevitable, with recent projections suggesting gender equity unreachable by even the year 2200 (Metz, 2019). Over the past decade, historians of technology have documented the vastly differential participation of women and other gender minorities in computing fields, focusing particularly on the U.S. and Europe (Ensmenger, 2010; Hicks, 2017). By gender minorities we refer to anyone whose gender identity is under-represented within computing fields.<sup>1</sup> Historians of technology have shown that computer scientists and engineers in the past were neither predominantly white nor nondisabled – they were neither CIS-gender men nor did they work on their own (Benjamin, 2019; Broussard, 2018; Hicks, 2017; Rankin, 2018), and it is evident that the accomplishments of many under-recognized people have been neglected despite being essential to the success of computing industries (Bjørn & Menendez-Blanco, 2019; Matthiesen et al., 2020; Rosner et al., 2018).

We present Atari Women, a research project investigating historical contributions of gender minorities within the computer gaming field during the 1970s and 80s. According to National Public Radio (NPR), the 1980s represents a crucial period of change for women's participation in computing in the U.S. and data collected from that period show that while women's participation in fields such as engineering and mathematics increased during those years, women's participation in computer science made a dramatic drop (Radio, 2014). The establishment of the computer game industry was closely related to the establishment of computer science as an academic field and engineering researchers used computer games such as Spacewar, Pong, Breakout, and Space Invaders to verify the performance of the engineered hardware while demonstrating their technical mastery as programmers (Lowood, 2009; Mnih et al., 2013).

Gender minorities contributed to computer game development in the 70s and 80s, yet the vast majority of documentary material (e.g., films, books, articles, news media) charting the rise of the industry overlooks these contributions, allowing important stories to go missing from historical records. Computer games have been a part of human-computer interaction (HCI) research for decades (Bernhaupt et al., 2015; Iacovides et al., 2015), and HCI scholarship has increasingly taken stock of this uneven gender representation (S. Bardzell et al., 2011; Bellini et al., 2018; Muller, 2011) so much so that gender has emerged as a core topic of HCI research (Bardzell, 2010; Keyes, 2018; Rode, 2011), including vital intersectional feminist contributions that consider multiple and overlapping hierarchies of difference (Rankin & Thomas, 2019). Previous HCI research has deployed counter-storytelling techniques to highlight the central role of women such as Grace Hopper (Menendez-Blanco et al., 2018) and recent work has built on these efforts to develop critical making

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<sup>&</sup>lt;sup>1</sup>We use the phrase "gender minorities" to recognize the range of gender identities that are also under-represented within computer gaming fields but that are not contained by the category "women" (e.g., not non-binary, gender fluid, or, trans men).

practices that highlight under-examined gendered practices and concerns such as menopausal health within the HCI field (J. Bardzell et al., 2019; Tutia et al., 2019).

With Atari Women, we seek to extend existing HCI design research by utilizing design as a way to make both speculative and historical interventions. Treating design as a political endeavor (Bødker, 2015; Dantec & DiSalvo, 2013; Disalvo, 2012; Dourish, 2018; Møller et al., 2019; Nielsen & Møller, 2020; Zimmerman et al., 2010), we seek to challenge the contemporary predominantly masculine representation of computer game development through design encounters; and we do this by re-working current historical ("retro") celebratory memories of gaming to include hidden stories about women's contributions. Our aim is to shape current narratives about computing by re-writing the history of gaming through design activities. With this work we ask: *How can design encounters challenge historical and contemporary understandings of gaming culture by amplifying the historical contributions made by women and gender minorities*?

Atari Women comprises a series of digital-analogue artifacts that use features of "retro" Atari games to depict the historical narratives that we collected through extended interviews about individual lives and through historical studies. The artifacts manifest stories of contribution that assert women are not new to computer gaming; instead, they illustrate that they have been fundamental to the establishment of a core computing industry, namely computer gaming. Through varied engagements, events, and artifacts, we use Atari Women to celebrate the important contributions made by women, who are otherwise written out of recorded computing histories and thus our aim is to shape the contemporary history of the field today.

In this paper, we use Atari Women to propose *intertextual design*: an HCI approach for technological prototyping that uses esthetic and discursive material from a particular historical era as design inspiration for a contemporary design practice, seeking to change the future by re-working the past.

The contributions in this paper to HCI research are two-fold. First, we introduce stories about the hidden women who made important contributions to Atari game development in the 70s and 80s, and thus join other HCI researchers (J. Bardzell et al., 2019; Bjørn & Boulus-Rødje, 2018; Rosner et al., 2018) in amplifying hidden voices in technology development. Computer gaming and computer science have grown in parallel and thus we use the gaming industry as an exemplar case to explore design interventions that prompt changes in gender perception within computing fields. Thus, we contribute to historical accounts of computing by materializing the stories of twelve underrecognized contributors to Atari games. Second, we introduce and demonstrate *intertextual design* as an HCI approach based on counter-history techniques designed to unseat contemporary design narratives. *Intertextual design* is an HCI approach that 1) uses design to create new historical and fame to amplify the impacts of those referents on computing cultures today and in the years to come.

Building on prior work designing with pasts – specifically, projects that use historical retellings to inspire design of artifacts that materialize counter-histories in the present (Briscoe, 2019; Nooney & Brain, 2019; Pow, 2019; Roberts, 2020; Stine, 2019) – we harness nostalgia and fame (here, associated with Atari) to shape conversations on gender and other hierarchies of difference in the gaming industry. Our project does not introduce the partially filling of gaps in scholarly archives. Many others have done this work of attending to elisions with more precision and care (Campt, 2017; Hartman, 2019). With our approach, we sought to examine elisions, but also something more. We hoped to use nostalgia for Atari and our proximity to Atari's fame to change dominant gaming narratives.

This hope then presented us with a tension when it came to the material we collected. The stories of and by women typically told within Atari books contain few notes on achievement and elevated reflections on misogyny and gender-related exploitation and abuse. Rather than bury our historical referents in academic worlds, we sought to explicitly make those referents public and publicly celebrated. We wanted to make them known and knowable to the Atari audience writ large. Yet, by telling these stories with fame on the horizon, we risked exposing our interlocutors to further harm. We took care to speak of difficulties the women encountered, but we also worked hard *not* to stage those elisions and violence as traumatic spectacles for various audiences to consume and spread. Instead, we wanted to use our easy-access to Atari fame to rethink the systems of value that shape it.

The paper is structured as follows. First, we introduce our methods and design inquiry, dividing the latter into three main sections: Atari historical accounts, Atari Women Stories, Atari Women design encounters. We follow this with a discussion section of intertextual design and its development within our project. We then reflect on our emerging methods and associate theoretical developments. We conclude with a reflection on the nature of harnessing fame for the work of designing different pasts.

#### 2. Method

The empirical work underpinning this paper is based on three main research activities 1) historical research on Atari gaming culture; 2) applied ethnographic interviews focused on identifying the historical contributions to Atari made by women and other gender minorities in the 70s and 80s; and 3) performing design encounters with the aim of challenging the historical and contemporary understandings of gaming culture by amplifying the historical contributions made by gender minorities. For each activity, we collected data that we iteratively analyzed to inform our subsequent design activities. Across our activities, we took core inspiration from multi-sited approaches (Bjørn & Boulus-Rødje, 2015, 2018; Bjørn et al., 2017; Blomberg & Karasti, 2013; Hine, 2007; Williams et al., 2014), as a way to engage with the material as relational, interrelated, and co-constituted (Bjørn & Østerlund, 2014). Our approach to data collection, analysis, and design reflects our feminist commitment to situating knowledge, a process of telling stories that foreground contingency and embodied engagement (Hooks, 2000; Star, 1990). This approach on the one hand aligns with existing qualitative approaches in HCI (Button & Dourish, 1996; Gärtner & Wagner, 1996) and yet contrasts with traditional HCI design research (Hult et al., 2006; Kaptelinin & Bannon, 2012; Klemmer & Carroll, 2014; Zimmerman et al., 2010) in that it de-prioritizes reflections on the design and use of technology in order to highlight our encounters with historical resources, workshop attendees, and the artifacts themselves, thus following contemporary HCI design research (Disalvo et al., 2016; Menendez-Blanco & Bjørn, 2019; Rosner et al., 2018; Stolterman & Wiberg, 2010; Wakkary et al., 2013) while building on feminist and critical research (Bardzell, 2010; Kaziunas et al., 2018).

Concretely, we build our design interventions based upon conceptual understandings arriving from the results of our historical resources in combination with contemporary historic reflections emerging in life story interviews (Atkinson, 2007). The conceptual understanding was thus both relationally and historically grounded, while manifested the theoretical idea of intertextual design as a strategy for impacting contemporary technology development through historical referencing. The artifacts we created are thus produced as demonstrations of intertextual design in practice. In this way, intertextual design is similar to concept-driven design (Stolterman & Wiberg, 2010), since both approaches demonstrate underlying ideas through design practices. Intertextual design is about carefully crafting the intended theoretical argument through digital and analogue materials, and consider the resulting impacts of the artifacts for the proposed agenda.

Across this work, our project grappled with the challenges of representing "women" across multiple hierarchies of difference (race, class, disability, etc.). The majority of the women we were able to identify and locate were white passing and non-disabled and the majority also came from well-educated, middle-class backgrounds. What is more, the category of "women" with which we began proved limiting to our gender inclusivity. While we sought to highlight people other than the cisgender men typically valorized in Atari accounts, the category "women" also might have turned away or excluded queer, feme, or transgender people who do not identify as women. As HCI scholars have demonstrated, the work of including those who do not identify as women under the

category of women (here, Atari Women) may do a form of structural violence (Hamidi et al., 2018) by perpetuating a label that many have fought hard against. We return to these potential harms and blind spots in the discussion.

#### 2.1. Historical research

To better understand and reflect upon the representation of women and gender minorities in the computer gaming field, we began our work by exploring the history of the Atari company through both primary and secondary documents. This material included popular monographs such as *Business is fun* (Goldberg & Wendel, 2012), movies such as *Once upon Atari* (Warshaw, 2003), social media groups such as "Atari Museum," and specific digital archives such as "Atari Age." During this early investigation, we noticed a profound lack of discussion concerning gender, making it difficult for us to identify the role women and other gender minorities played in those early formative years of computer gaming. We found gender minorities were often missing in these accounts. In the rare mentions that we managed to dig up, the accounts made little information about the contributors available. For example, people such as Dawn Epstein and Betty Ryan (Tylko) were mentioned by name on "Atari Age" when listing different Atari games, but without additional contextual information. The historical materials ignored other contributors such as Carol Thomas and Lucy Gilbert, effectively erasing their stories from the historical record. Core challenges included not only identifying names, but also finding contact information that would allow us to reach out to the contributors.

#### 2.2. Atari women interviews

In response to the gaps, we added to the historical research comprehensive searches and detailed readings of message board and discussion forums, as well as searches on social media sites such as Facebook and Twitter. Through this work, we were able to identify the names of women (including CIS and transgender women) who were mentioned in different sources as having made contributions to Atari games. Collecting all the possible information we could about each of the women as well as potential contact information, we began planning detailed interviews to learn about their backgrounds, their contributions for Atari games, and also what they did afterward. Initially, we had little contact information; however, by the end of each interview, we asked if the person would know of other names and contact information to reach additional women. In most cases, this was the only viable strategy to gain contact information. The interviews took the form of life story interviews (Atkinson, 2007), inspired by reflective conversations (Bjørn & Boulus, 2011), and all interviews were conducted by the first author. A core part when conducting these interviews was the full disclosure on research agenda and interest, and how we as researchers, as women in computer science and engineering, had an invested interest in amplifying historic contributions of women in technology as a transformation vehicle of gender perceptions in contemporary computer science.

In total, we identified 29 women and we retrieved contact information on 14. Thirteen of the 14 agreed to be interviewed. In addition, we interviewed and interacted with four people who had knowledge and information about women's contribution to Atari that was missing from public records. All interviews were audio recorded and fully transcribed. Interviews took between 1 and 4 hours (typically 1 hour), and some participants were interviewed several times. Informed by the interviews, we collected additional historical data. The women we interviewed pointed us to particular articles, social media posts, and YouTube videos documenting (or mischaracterizing) their experiences. In a rare and exciting moment, one of the women told us about a complete film manuscript that she wrote about her experiences working at Atari and she decided to give us a copy. We read through the manuscript as part of our data analysis process and discussed the events with the author.

To analyze our data, we drew on inductive techniques of thematic analysis to closely examine and group data based on their relevance to under-examined stories of contribution. Specifically, we identified themes such as motherhood, interdisciplinarity, contributions other than game design, creativity, masculine culture, etc., through close readings of the data, meeting frequently as a team to revise and iteratively adapt our thematic concerns.

### 2.3. Atari women design encounters

The insights gained through our analysis of the historical and interview data served as the foundation for our design activities. Based on our data, we created five main Atari Women artifacts: website (including logos), re-mixed Pac-man game, collectible game tokens, cosplay outfit, and 3D-printed frames for Atari games (all artifacts are presented in detail in the *Results section*). To create the design encounters, we planned and executed six Atari Women events between March–June 2019 as a way to engage with the gaming and computer science community amplifying the Atari Women stories. These events took place at Emerald City Comic Con, Seattle, March 2019; Living Computer Museum+Labs, Seattle, May 2019; Hypnotica Tech fashion show, Pioneer Square, Seattle, June 2019; Google, San Francisco, June 2019; Seattle Retro gaming Expo, Fisher Pavilion, June 2019; and Microsoft, Redmond Seattle, June 2019. We also created the atariwomen.org website with all material as well as an Instagram profile, which allowed people to continue following the project after events. In total, our website received 8572 views (March 2019-April 2020) with the top visited page being Atari Women stories (1332 views) and our Instagram profile has 127 followers. We also shared information on Twitter, Facebook, and LinkedIn. Finally, we initiated a Wikipedia edit-thon in collaboration with Women in Red, to add the stories of Atari Women to Wikipedia.

# 3. Design inquiry

This section is divided into three main parts: first, we present the results of our historical and archival analysis; second, we present the results of our interviews with Atari Women; and third, we present our Atari Women design interventions. The purpose of this structure is to demonstrate the relationship between historical documentation and our design artifacts, which serve as the foundation for intertextual design.

# 3.1. Atari historical documentation

The tremendous financial success of Atari made a space for Atari in the history books. As the first corporation in the world to introduce and produce a programmable home video game console, the Atari cooperation dominated the home video game market from 1976 to 1983. After 1983, sales began to decline, leading the firm to collapse in '84. Multiple books and movies have documented its pioneering status (Goldberg & Wendel, 2012; Lapetino & Conte, 2016; Montford & Bogost, 2009; Sutton et al., 1986; Warshaw, 2003), illustrating the huge impact the company had on the gaming industry's evolution and financial success. While the firm initially directed its Atari console at families, marketing across gender and age, as we see in early advertisements, the marketing soon converged on a narrower demographic: Young boys and men reflecting in the work environment where the games were made and also evident in the design of the games themselves. As Newman explains: "*This effort to sell the new medium to families emphasized an inclusive gender and class appeal. But the forms and genres of the games themselves, and many advertisements, present a rather contradictory appeal to young boys in particular, emphasizing youth and masculinity" (Newman, 2017, p. 16).* 

Historical accounts of the Atari, Inc organization and workplace also demonstrate the appeal and focus on the 'playful youth' and 'masculine performances.' This overly masculine representation is evident in who journalists and scholars ask to tell their stories, who they valorize as carriers of the

history, and who they erase from these accounts. Many historical accounts include no women at all. When women do appear, authors often mention their roles from a male perspective, as the example below demonstrate:

"David Crane told the story of one such discussion: Carol Shaw was hard at work on River Raid, which would become an influential vertical scrolling shooter. In the game, the player has to maintain the plane's fuel supply, flying it over canisters in the river. There is a detailed fuel gauge at the bottom of the screen, but Shaw wanted to include audio feedback as well. She was programming alongside several other Activision developers, and she asked for advice on an appropriate klaxon-style sound to warn the player when the fuel level became dangerously low. According to Crane, he rolled back in his chair, looked up in thought for a moment, and recited a few lines of assembly code that created the effect perfectly" (Montford & Bogost, 2009, p. 104).

In 2017, Carol Shaw won the Game Awards Industry Icon 30 years after she made the famous Atari game River Raid published by Activision in 1982 and she is known as the first professional women game developer. Still, the above snapshot gives the impression that Carol Shaw had to ask for advice from her male colleagues and that one male colleague had to simply 'recite assembly code' to help her out. Instead of giving voice to women game developers and celebrating their work, those writing about Atari often absent their stories and voices. The Montford and Bogost book from 2009, which we extracted the above quotation from, is a book of nearly 200 pages based upon interviews conducted with Atari employees and founders, and in the complete book not one woman interviewee appears. The above quotation is the single place where women are mentioned.

Beyond its attention within books and scholarship, Atari gained wider notoriety in popular culture. Atari games are displayed in popular films such as Blade Runner from 1982, as well as contemporary movies and TV-series such as Halt & Catch Fire 2014–2017 and Captain Marvel 2019 wherein media celebrate Atari games as retro icons. For example, the virtual reality movie Ready Player One from 2018, directed by Steven Spielberg based on a book by Ernest Cline from 2011, depicts a futuristic dystopic world where the protagonist has extraordinary knowledge about computing gaming trivia, and where the Atari 2600 game Adventure plays a central role in the plot. Adventure is known for being the first game with an Easter Egg, which is a message, feature, or image hidden within the programming of the game by the developer. Warren Robinett, the developer of Adventure, had wanted visible credit for his game, and thus hid his name within the game. The Easter Egg, which solves the riddle in the contemporary Ready Player One film, is exactly about finding the developers name rather than winning the game. In this way, Ready Player One enables Atari myths and trivia to endure in contemporary gaming culture.

Celebration of the working environment at Atari is also documented in movies such as 'Once upon Atari' where developers tell stories about their experiences working at Atari (Warshaw, 2003). This movie is a rare example where two women Atari game developers are included, namely Carla Meninsky and Suki Lee. The creator of this movie is Howard Warshaw - a well-celebrated Atari game developer, who also happens to be the person behind the Atari E.T game. The E.T. game was released in 1983 based upon the movie by Stephen Spielberg and often it is referred to as the worst game in the world (Brumfiel, 2017), and the failure of the E.T. game is often used as the representation of the collapse of the gaming industry in 1984 (Jary, 2011; Lien, 2014), and is the first example where technology failures became landfill. The landfill tale is an urban legend known as 'The great video game burial of 1983' (Penn, 2014) where millions of unsold cartridge of the E. T. game were buried in Alamogordo, New Mexico due to the overwhelming negative reviews of the game. Reenacting the myth, Zak Penn produce the movie "Atari: Game Over" (Penn, 2014) where Howard Scott Warshaw (the game developer of E.T.) as well as Ernest Cline (the author of Ready Player One) joins the attempt to dig up the Atari E.T. cartridges. In this film, the excavation work of game cartridges is aligned with storytelling of the game industry combined with retro pop culture, e.g., Ernest Cline is driving the DeLorean from the 80s movie Back-to-the-future to the burial ground. While "Atari: Game Over" is an entertaining movie, it also reenacts the burial place of the Atari games without any account for the women, thus reproducing gaming culture, myths, and pop

culture as masculine. A Comic Con panel in 2014 made this movie their focus, discussing their experience "behind the scenes." In this way, the past of Atari is very much still shaping the contemporary celebrated gaming culture, due to the multiple interlinked historical connections.

In addition to books, movies, and events, online digital archives created by communities of fans or by formal historic conservations of material like online museums circulate imagery and stories of Atari. Community-driven archives include Atari Age and the Atari museum, both dedicated to discussing and celebrating retro gaming through discussion forums, blogs, contests, magazines, comics, and all sorts of trivia. During our research, we came across numerous articles and resources about Atari games on these sites. Searching for specific games which we already knew had been made by women game developers resulted in helpful information as well as their names. However, at this time of writing, we found no contextual information on these sites featuring women. In formal digital archives documenting Atari such as The Strong: National museum of Play, we did find women; however, most were in terms of speakers on panels discussing women in gaming, and few of the women were mentioned in relation to general information about games on their sites. For example, one article on the Strong's website describes a collection of Atari coin-up arcade games that included the Arcade game Centipede from 1981, but it makes no mention of the Centipede's programmer Dona Bailey. Instead, it mentions her project manager's name as a co-creator. Looking through digital archives, we found a few mentions of women in gaming. The vast majority of documents focus on one person (Carol Shaw), unless the articles report on a special event such as a Women in Gaming panel where Dona Bailey, Brenda Laurel, and Amy Hennig are each mentioned. However, in the majority of historical material we reviewed, the contributions of these women were no-where to be found. Online museum collections such as those at the Computer History Museum make similar mention of Atari history but do not mention women contributors. The few stories we found continued to appear within specific women stories rather than general entries on Atari. Across this range of digital and non-digital archives about Atari, women's names are either hidden or simply not existing.

#### 3.2. Atari women stories

Given that digital archives largely erase the existence of women who made important contribution to Atari, we decided to begin our design process by reckoning with this erasure and collecting stories of women and other gender minorities that were currently missing. We hoped to use these stores to inform design artifacts that might challenge existing historical and contemporary understandings of gaming culture. To collect these stories, we conducted interviews with the missing contributors.

We quickly found that defining contributions to Atari could be a challenge. The Atari organization produced Atari games across the 1970s and 80s, but other organizations also created and produced Atari games such as GCC and Parker Brothers. The Atari cooperation was located in Sunnyvale California and had close connections to Stanford University, where Atari game developers such as Carla Meninsky were educated. Carla Meninsky was a math major but also had a degree in psychology from Stanford in 1977, and she created popular Atari 2600 games such as Star Raiders, Dodge'em, and Warlords. At the time, with simpler graphics and tools, most games were created by a single person who designed the game play, the graphics, the music, and did all the programming. As Laura Nikolich, who worked for Parker Brothers and created the first Spiderman game explained: "Spiderman is written on 4 K, which is nothing compared with todays standards. So you had to do tight programming" (Laura Nikolich). Carla Meninsky was one of the core game developers at Atari and - together with Suki Lee and Carol Shaw - she was one of the few women game developers working for Atari during the 1970s and early 80s. During an interview with us, she recalls Steven Spielberg visiting Atari to talk about creating the E.T. game. A historic picture of the event depicts Steven Spielberg beside Carla Meninsky as well as game developer Suki Lee. Due to her central position as a core game developer at Atari, Carla Meninsky was particularly annoyed when the Stanford alumni magazine wrote an article on Stanford faculty, students, and alumni who contributed to Atari, and left her out. Further, Carla Meninsky explains to us that her Wikipedia page included false information, e.g., the picture displayed on the profile was a different mathematician called Meninsky from Stanford, causing Google searches to display the wrong picture. Carla Meninsky tells us how she herself had tried to contact Wikipedia to correct the mistakes, but that they told her that she needed an official record of reference if she was to change the information, which she did not have. After leaving Atari, Carla Meninsky began developing the early tools for high-end computer graphics, and later she went into hardware design. Eventually she needed a new challenge, and in 2004 she graduated from Law School and today she works as an attorney.

Exceptional educational backgrounds are not unusual among the early Atari game developers we interviewed. Those working on the East coast at GCC came from MIT or Harvard. Betty (Elizabeth) Ryan (former Tylko) started as the ninth employee and first women game developer at GCC in 1982. Betty Ryan had a degree from Harvard in Engineering and Applied Sciences, as there was no computer science major available at the time. While at GCC, Betty Ryan worked on the two-person programming teams for Atari 5200 and 7800 Pole Position, 7800 Dig Dug and AtariLab for the Atari Home Computer. During an interview, Betty Ryan explains how she still has the first prototype of her arcade game, Quantum, in her basement. The Quantum game was the first game using vector graphics, and she programmed the game to allow users of new high score to write their name in cursive letters using the track ball (see Figure 1).

Betty Ryan tells us that she took on different roles within GCC but that most of them were in engineering, up until a few hours before giving birth to her first child. Betty Ryan remembers:



Figure 1. Betty Ryan with her Arcade Game Quantum, approximately 1982 (printed with permission by Douglas Macrae).

"I worked until 7 o'clock that night, went home and at 8:30 it was time to go to the hospital. That was the end of my career at GCC" (Betty Ryan). Betty Ryan had four children, and her story of leaving the game industry (and the work force altogether) after becoming a mother is not unique. While being proud of their achievements, former Atari game developers becoming mothers describe experiencing surprise when telling others about their former work. For instance, Laura Nikolich explains the types of reactions her son received when he told friends that his mother made the first Spiderman game: "No way, did your mom really do that – YOUR MOM" (Laura Nikolich).

Working in a male-dominated environment, the women game developers we spoke with often describe experiencing bias based on stereotypical perceptions of what a game developer entails. This could take place during game conventions where they would be mistaken for 'booth babes' rather than engineers (Betty Ryan), or be asked if they were lost in a programming event, when in fact they were highly skilled to do real-time programming and looking for a new job opportunity (Laura Nikolich). In general, working at a place where few other women worked struck them as a special kind of experience, as Dona Bailey, the programmer in the four-person development team behind the arcade game Centipede and the first woman hired in the coin-up department at Atari, explains: "At my first day at work at coin-up Atari, I was introduced to maybe 30 people – 30 guys in less than one hour. My summary, my comment after meeting those guys so quickly was, I won't remember any names. How many Daves are there, are the all mostly Dave. What is the deal? That's crazy. I'll just call everyone Dave" (Done Bailey).

Early on we identified Suki Lee as an important Atari game developer. Given the large number of people with the name Suki Lee, we initially found it difficult to locate her or get any contact information for anyone who might point us to her. However, while finishing up an interview with Carla Meninsky, she told us that she saw Suki Lee once a year and offered to put us in touch. Suki Lee is a first-generation Chinese immigrant, who grew up on the West Coast and worked for Atari right out of college at San Jose State University. Suki Lee created the Atari 2600 games Math Gran Prix, Obelix, and Donald Duck speedboat, and she is still working in the tech business today. Working for Atari made it possible for her to buy a house early in her career and gave her a path to continuing work in Silicon Valley. In an interview, Suki Lee tells us she is surprised about the attention and that people so many years later still show interest in her work. As she said, "Someone recognized my work after all these years – I never thought about it, but now, being recognized as a pioneer, one of just a few women programmers at Atari in the early days, simply blows my mind" (Suki Lee).

Appreciating that creating and building games is not all about software, we were able to identify and find one of the women who worked in Atari manufacturing, namely Chris Bush Maddox. Chris Bush Maddox explains how being quick and accurate was crucial for the work, and how she took pride in soldering correctly the first time: "*It might take a little longer to do, but I never got it back. So do it right the first time, even if it takes a little longer*" (Chris Maddox). Her story illustrates the importance of remembering that game production includes manufacturing hardware – especially today, when game distribution has become increasingly digital and the majority of gaming console manufacturing has moved to countries where wages can remain low and thus often forgotten by those involved in other aspects of game development.

While a complete compilation of stories collected from the interviews is out of scope for this paper, we hope the above extracts provide some insight into the in-depth conversations and encounters we engaged in as part of the research project, and that serve as the foundation for our design interventions. Below we provide additional insight into the different stories and how they shaped our design interventions.

#### 3.3. Atari women design interventions

We aimed to do more than learn about Atari Women contributors through historical research and applied ethnographic interviews. We also wanted to create design encounters that would challenge existing historical and contemporary understandings of gaming culture by amplifying the historical contributions made by women and other gender minorities who had been hidden or neglected. To do so, we first considered the audiences for our work, and identified specific venues and groups who take pride in carrying forward gaming histories. These included people who enjoyed watching the excavation of E.T. in the desert, and who excel at Atari trivia – since these are the people, who constantly re-produce the past, by telling and re-telling the stories – and if we could get the stories of Atari Women to be included into the cannon of the Atari history, we would potentially impact the contemporary story telling about games today. Thus, we began our design intervention and took the starting point in the stories we had collected from the interviews and then organized those stories around four design encounters: (1) Imagery and tokens, (2) Remixing Pac-man, (3) Game Cartridges as Museum Art Pieces, and (4) Costume and panel.

Below we present the four design encounters, including the design artifacts we created, which illustrate how Atari Women helped us develop a design practice directed at re-producing gaming history in new ways. We emphasize the forms of referencing to retro gaming discourse which were designed to encourage deliberation and discussion on gender representation within contemporary gaming communities in particular – and in computer science more generally.

#### 3.3.1. Imagery and tokens

We first wanted to find a focus that could draw people's attention, while reclaiming and reinterpreting the existing imagery of Atari. Within this context, the Atari imagery remains nostalgic and iconic – appearing across a number of contemporary platforms and media. We thus sought to use the Atari logo as a means of vocalizing the central role of women in gaming, by concretely redesigning Atari's imagery into the Atari Women imagery.

The first design encounter we created thus seeks to link the histories of Atari branding with the contributions of Atari Women. This encounter of visual communication resulted in the Atari Women brand identity (see Figure 2).

The red and white color scheme and SF Atarian System Bold typeface directly reference the original Atari brand. We sought to keep the imagery minimal so it could be easily recognizable and reusable while engaging explicitly with the original Atari logo which has been used in multiple popular films since the 1980s – undergirding and extending a widely circulated futuristic vision of popular culture, e.g., in the futuristic urban cityscape we see in Ridley Scott's 1982 *Blade Runner*.

To inform our design process, we analyzed the existing logo and brand material connected with the 1980s Atari company. Attending to the curves, the color, the symbolic references made within the original logo, we combined a reference to the first letter of the brand ("A") with a woman's silhouette (Figure 2). The logo depicts a face looking upward and to the right, as if to say: "I'm here." Her position marks a sense of courage and pride. The graphic style is bold and minimal, which reproduces the form of the original logo but centers the presence and power of women.

This imagery – particularly the logo – reappears across our design work and helps unite the multiple media, materials, and artifacts that we created. For example, the logo has strong presence on the Atari Women website, in the Atari Women Instagram account. We also made Atari Women



Figure 2. Atari Women logo and Atari Logo.

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laptop stickers, as well as collectible laser-cut tokens which all feature the Atari Women logo as a single or repeated image (Figures 2 and 4).

Taking inspiration from our Atari Women logo, we also designed an 8-bit logo for each woman we interviewed and featured on the website. The icons are unique yet connect in form and concept; depicting a simplified low-resolution representation of a central character or mark within a particular game. For example, we celebrate Dona Bailey's story by devising an image of the Centipede, the iconic protagonist in her popular arcade game, thus making connections to the contemporary pop culture using the Centipede, e.g., 2014–2017 HBO series *Halt and Catch Fire* and 2019 motion picture *Captain Marvel*.

Figures 3: 8-bit (as the Atari2600 processor) logos for nine of the Atari Women (from the left: Rebecca Heineman, Carla Meninsky, Carol Ryan Thomas, Suki Lee, Chris Maddox, Betty Ryan, Patricia Goodson, Laura Nikolich, Dona Bailey)

Other icons represent the different types of contributions integral to the individual Atari woman story. For instance, the icon we created for Chris Maddox celebrates her work in manufacturing (being an arcade game box); the icon we created for Patricia Goodson honors her work in making music for games (musical node); and the icon made for Rebecca Heineman exalt her victory as the world's first e-sports game champion winner in 1980 playing Space Invader (space invader figure with a crown) (Figures 3).

Throughout the 1970s-80s, computer gaming gained currency through the arcades: large indoor spaces, often as part of bars, where people could pay to play different coin-operated games such as Atari Pong or the famous Mrs Pac-man. Materializing our logo and icons into concrete tangible artifacts that could prompt reflection, and still referencing the gaming culture, we created Atari Women gaming tokens. The game tokens are laser-cut 1.5-inch token made out of wood. As double-sided coins, one side displayed the Atari Women logo and the other side displayed the individual icons of particular Atari Women.

With the form of a token, we draw from the nostalgia associated with a coin-operated arcade context to complicate its monetization. During several of our interviews, people mentioned this industry made it possible for young programmers to buy a house and live comfortably while people (often women and other minorities) working in manufacturing earned much less and faced more livelihood precarity. The women repeatedly told us about the nontransparent and opaque processes for distributing money. While the gaming industry allowed the women financial independence at a young age, we heard stories about women being cheated from their bonuses, or simply earning less than their male counterparts. By placing the women's stories on the "coins," we hoped to intervene



Figure 3. Collectible tokens.



Figure 4. On the left: remixing Pac-man & on the right: original Pac-man game for comparison

in the conceptualization of computer gaming as tied to monetization, opening space for storytelling to take hold alongside it and against it. We also sought to challenge the very notion of "use value" in the capitalistic sense, and instead emphasize valuation as an effortful process that unfolds through engagement (Houston et al., 2016).

We were surprised how well people took to the tokens. Several participants during our events expressed an interest in getting the whole collection of tokens. To us, this interest in "collecting them all" recalled the importance of collectibles that scholars have analyzed within gamer fandom communities (Jenkins, 2006), often as a way to incentivize continued engagement. We experienced that our collectible tokens encouraged engagement beyond our curated events, as people contacted us through social media asking about the cost of buying tokens and shipping them to their address. The tokens thus served as a reminder of the Atari Women contributions for the people producing future by re-telling the past stories. In practice, we also found that the tokens allowed people to appropriate the Atari Women stories in different ways (e.g., using a particular token as a key chain or repurposing two stories as a pair of earrings).

In this sense, the tokens emerged as more than a simple reminder of our events, but also as nostalgic mementos. For example, people frequently referred to the tokens in terms of the games they remembered playing as children. One participant during the event at the Living Computer museum explains how he loved the game River Raid, and thus how excited he was to have the Carol Shaw token. Other participants mentioned the tokens while telling us (in person or in the qualitative statements) that they would tell others about Atari Women. Explaining that they would use the tokens while telling the stories, one person wrote:

#### 3.4. "I'll show my niece the tokens" (Living Computers Museum)

The tokens thus seemed to materialize personal stories that exceeded those of the Atari Women. In this combination of logo, imagery, and collectibles, the tokens produced another recursive material practice. This practice both (1) engaged the material nature and language of the community we sought to address (gamers), and (2) used that mimicry to reference the Atari games, the women who made them, and participants' own childhood memories – ultimately supporting a dialogue on who can belong and make contribution to gaming and game communities.

#### 3.4.1. Remixing Pac-man

To further connect with the Atari community and gamers, we wanted to speak their material language and create a game with strong links to the original Atari products. We made these links by creating a remixed version of the famous Atari game Pac-man.

During our design process, we considered working with the widely recognized Mrs. Pac-man game. In part due to its popularity among women, the game has been attributed to an increase in women's interest in gaming (Newman, 2017). However, it is important to note that Mrs. Pacman as a character only appears in the game during the cut scene between levels. Within those cut scenes, players watch a visual animation of Mrs. Pac-man getting married to the protagonist Pac-man. The Mrs. Pac-man's icon replicates the Pac-man figure with the exception of an added bow. Thus, the design of graphics and cut scenes reinforces a patriarchal view of the "man" as the default, and the "woman" as the side character (wearing a bow and marrying her male protagonist). Inverting this narrative, we made the protagonist in our remixed Pac-man a feme game developer. In addition to the Pac-man protagonist, we replaced the visual features of the original game (see Figure 5). First, rather than fighting ghosts, the protagonist fights bugs, represented by the origami bugs and the story of Grace Hopper (Menendez-Blanco et al., 2018). Second, the names of the bugs reference the logic gates within a computer: AND, OR, NOR, XOR ("not or"). Third, we removed the "power pills" from the original game and put the Atari Women logo in their place, so that the Atari Women logo must empower the game developer in order for the character to fight bugs. Fourth, instead of eating "dots" the protagonist software developer eats "0s" and "1s" - a reference to eating code and making programs. Fifth, we replaced the fruit icons that provide extra points, with the individual logos of the Atari Women (see Figures 3). Altogether, these alterations to the graphic elements produced new significations with 1980s gaming culture..

Alongside these graphical changes, we created new cut scenes between each level (also accessible through the main menu). These cut scenes replace the original story about Mrs. Pac-man getting married with a story about a woman's experiences of working in the gaming industry. We conceptually think about the cut scenes as Easter Eggs telling stories about the creators of games and thus given credit to otherwise hidden figures. We directly based these cutscenes on the film manuscript written by Dona Bailey. As you watch the scene, you hear Dona Bailey's recorded voice over the animated imagery. The animations in the cutscenes use the individual icons for the different Atari Women. We also replaced the music in the game with the original Atari Pac-man Jr. soundtrack composed by Patricia Goodson. Thus, both the plot and soundtrack of our remixed Pac-man game makes direct reference to important contributions made by women.

We published the Remixing Pac-man game on our website and made it free to play. By posting the game online, and in sharing the link widely, we reached beyond local events to a broader public and our game materializes a form of counter storytelling that can be widely circulated and performed as a mundane playful object.



Figure 5. Atari Women signed and framed games.

When demonstrating and introducing the remixed Pac-man game during events, people were particularly impressed with the use of real music created by Patricia Goodson, as well as hearing the voice of Dona Bailey expressing her surprise of how many Daves work in the gaming industry. This sense of surprise was shared by participants in their qualitative statements that we collected at several of the events. Other participants responded:

"I will just call all of them DAVE" (Living Computers)

"I will call them all Dave" (Seattle RetroExpo)

Further, when we asked what in the Atari Women stories reminded them of in their own life and experiences, participants often mentioned the game and voice of Dona Bailey. One person explained:

#### 3.5. "Being in a room full Of 'Dave's" (Living Computers)

To further encourage curiosity, we extended the online game design with a tangible interaction that we created for up to four people to play our Remixing Pac-man game. We created the device by hacking an original Atari 2600 container transforming it into tangible game, while basing the visual look on the Atari design expression. The design stimulate a retro experience utilizing the Atari 2600 consult as part of the play experience when remixing historic games. The interactive buttons were created by lasercutting our remixed Pac-woman figure in different mobility positions. Each was painted in conductive ink and connected to the Internet using a Raspberry Pi and a MakeyMakey in combination with a projector. We thus connected the digital and the analogue experience playing retro game using bodily interaction, while pointing to the future of gaming where the bodily interaction is a core type of control mechanism (like Wii, Virtual Reality).

The remixing Pac-man game manifests a recursive material practice: using existing game esthetics through references to the retro Atari 2600 container as well as the widespread popularity of the original Pac-man game in order to garner attention and interest. This recursive material practice involves 1) historic storytelling about games through the game medium; 2) mimicking and remixing gameplay and esthetics of the past and the future by combining the historic Atari game console with current gaming interaction and play, and 3) making the game browser-based and thus available for people to access on the Internet, beyond the context of single events supporting long-term recognition of women in gaming.

#### 3.5.1. Game cartridges become museum art pieces

Historical archives about Atari miss information and lack important details about the creation of games made by women. Depending on the source, articles, public accounts, and even the game credits themselves might mention the male creators of a game but leave out the name of the women and gender minorities who made important contributions alongside them. One concrete example is an article from *Time* magazine in 2012, where one of the men from the Centipede team took full credit for the successful arcade game without mentioning Dona Bailey, the original software developer, programmer, and designer of the Centipede game. During one of our conversations with Dona Bailey, she explained how she was angry when she saw the article in 2012, and she stated: *"shame on him for taking the credit for Centipede"* (Interview transcript, Dona Bailey, 2018). A lack of recognition for the work that Dona Bailey did during the 1980s built up over time, informed historical records, and eventually enabled *Time* to delete her contributions to Atari and overlook her important work.

Yet, Dona Bailey's story is far from unusual. We found other examples of how the online archives had wrong information about women who made important contributions to Atari. Like when Carla Meninsky was left out of the Stanford alumni magazine or had the wrong information on her Wikipedia profile. During our interview with Suki Lee, we learned how one of her current colleagues Jim Turner, who is an avid Atari fan, recently discovered that Suki Lee was the creator of the Atari Math Gran Prix game. He asked her to sign her games which he then displayed in a frame. He later shared the picture of Suki Lee with her signed game on social media with the text: 384 🕒 P. BJØRN AND D. K. ROSNER

"Bought a bunch of Atari games today and while I was reading up on them, I found this one was written by my team's current EPM. It's like I've been working next to royalty without even knowing it!" (Jim Turner, 2016, Facebook).

Inspired by this story, we decided to collect the retro cartridges of games, where women had made important contributions. We sent each game we were able to collect to the woman involved with the game, asking them to sign their own games and return them to us. We then designed and manufactured 3-D printed displays in colorful frames – one for each game. Each frame is labeled with the name of the Atari women, the year it was published, a description of the game play, and her contribution. By framing the signed games, we made the retro cartridge into valuable artifacts resembling art pieces in a gallery. We transformed the retro game cartridges into museum artifacts.

Our collection includes 12 games and one miniature arcade which were displayed at the Seattle Living Computer Museum celebrating the contribution of the Atari Women while speaking the material language of the museum (Figure 6).

Displaying the signed cartridges received praise from many of the Atari fans, and several people asked about the 3D-printed files because they wanted to fabricate such frames for their own games. By mixing up and mimicking the material language of the art gallery with the fan culture in gaming, we experienced how people saw these signed cartridges as extremely valuable. Further people were surprised when they experienced the physical manifestation of the games made by women:

"I didn't realize there were so few women in programming, but I was surprised to learn women were at the forefront in developing games. I thought women only recently became involved." (Living computer Museum)

The assumption that women only recently became involved in gaming was prevalent among the audience members we met at the different events. Further, the interest in what happened after Atari and why they would leave the gaming industry came as a shock to many:

"it was surprising to me how few women continued in their careers in game development. I would be curious to know which struggles lead them to stop making games." (Living Computer Museum)



Figure 6. Atari Women signed and framed games

We not only displayed the cartridge in the museum, we also brought them to our talks at Google, Microsoft, and Seattle Retro Expo. In each situation participants engaged with the artifacts, afterward stating how they were surprised that the women had done this work without anyone knowing about it:

"[I was surprised to learn t]hat they worked without mainstream credit on very popular Atari games (Seattle RetroExpo)

By placing the signed cartridges into "museum" frames, we emphasized the value and importance of the women's contributions. The historic Atari game cartridges signed by their original creator intertwine pop culture, museum artifacts, and their contributors. Artifacts in museums connotate authenticity, appreciation, and admiration. Museum artifacts are marked, tagged, and signed. The recursive material practice combining games and art spaces celebrate fandom in the pop-culture society within mundane and sophisticated venue of the museum bringing value and recognition to the Atari Women.

#### 3.5.2. Costume and panel

To engage people already interested in computer gaming, and to connect to the former panel discussing the excavation of E.T. at Comic Con in San Diego, we decided to submit the Atari Women project to be presented at a panel at the Emerald City Comic Con 2019. Aligning our efforts with Comic Con, we created an artifact that spoke the language of cosplay, since cosplay is a large part of the experiences and performances at Comic Con events. Cosplay refers to a performance art where people create costumes and dress up as their favorite characters from games, movies, comics, or other type of popular culture. Speaking the language of cosplay and telling the story about Atari Women, we created an 8-bit Atari super-heroine costume. The costume is an altered full bodysuit appropriating a black construction worker uniform. The front of the costume has the original Atari logo wired up by multi-colored LED strips utilizing e-textile to create a blinking rainbow. The rainbow refers to the sense of gender identity diversity and LGBTQ pride entangled with the Atari logo. On the shoulders of the outfit, there are eight white textile boxes wired up with LED lamps representing 8-bit pixelated representations of eight individual logos of Atari Women. Each of the white pixels is created by textile placed around 3D printed joints and sticks (see

The outfit is meant to be a bulky and industrial design since we wanted to characterize the women as capable of any number of super-heroine jobs. We also sought to manifest the idea anyone can become an Atari woman. It was important that whoever is wearing the outfit does not feel as if they were on display as a woman but instead as a carrier of the legacy of the contribution women made to gaming. By wearing the outfit at Emerald City Comic Con we were able to make participants curious about which character the cosplay represented and thus create opportunities to talk about Atari Women.

The outfit allowed us to interact with people at Comic Con and promote the discussions in the panel we organized at the event. The purpose of the panel was to tell the story of the Atari Women, celebrate their contribution, and discuss women's role in gaming. The panel participants manifested the diversity and strength of women both in the past and current gaming community and the panel proposal included both Atari woman Dona Bailey (unfortunately she was not able to make the event in person) and Rebecca Heinemann, as well as prominent current women figures and successful game developers, such as Kate Edwards, Katherine Cross, and Evie Powell.

The panel was structured in a way that allows us to tell a snapshot of the stories of Atari Women as a starting point for the panelists to discuss the importance of recognition, diversity, and contribution for women in gaming. Further, we advertised the panel on social media encouraging people to ask questions or suggest topics that they wanted the panel to discuss. During the panel, we made it possible for the audience to propose questions and topics directly. It is widely known that women in gaming often experience online harassment (Massanari, 2017) and thus we used online technologies to ensure the tone and interaction with the audience was moderated and curated. We also asked the audience to reflect upon similar experiences in their own lives which remind them of the experiences of Atari Women. One participant wrote: 386 🕒 P. BJØRN AND D. K. ROSNER

"I work in IT. I wish we had more women involved along with more nonwhite people in general. The additional perspectives a greater mix of backgrounds bring can be very valuable. I feel like it's getting better, but I have witnessed women being treated differently in tech than men. The latent misogyny present in my industry is disturbing to see and I have the privilege of insulation of being white, male and CIS." (Emerald City Comic Con)

Participants did not only reflect upon the culture of the gaming industry, but also on the structure of the society in general, as we see below:

"A lot of women help get children to adult stage (primary school teachers and librarians very much tend to be women), but when profiled because they get famous, a lot of those women fade into the background in favor of one man who might have provided the spark to the fire that all the women have been laying right from the beginning of their lives. Those uncredited people are taken for granted without recognition of their contributions. Then later on, the assistants to the "great men" often coordinate schedules, make sure reports arrive in the right place, and sometimes are doing the actual work themselves, but they are also absent in the profiles of the "great men" that make it to the magazines." (Emerald City Comic Con)

While the above quote emphasis the contribution of women and how it is often overlooked – it is even more important to state that women were the primary actors for some of these famous Atari games – they were more than simply contributors, women such as Suki Lee and Dona Bailey were the main actors behind games such as 'Math Grand Prix' and 'Centipede.' The material language of our cosplay allowed us to celebrate Atari Women by referencing the 8-bit processor of the Atari 2600 while focusing on the collective efforts of the women rather than just focusing on individual stories.

#### 4. Discussion

We have so far illustrated an approach to intertextual design that opened opportunities for computer game enthusiasts to reimagine canonical Atari narratives. Now we consider how our approach extends three main strands of work: literary theory on intertextuality, critical historical and designerly thought on erasure, and design inquiry leveraging humor and parody. We review our insights in light of each of these areas and describe how our approach deepens existing work with nostalgic interventions.

#### 4.1. Literary theory on intertextuality

Borrowing from literary theory, and particularly the work of James Porter (Porter, 1986), our Atari Women project uses the term intertextuality to describe its practices of referencing. Referencing within our work threaded across practices of typographic design (the Atari Women logo), tangible design (the tokens and game councils), costume design (the cosplay outfit), and interaction design (the Remix Pac-man game). In Porter's reading, intertextuality takes these activities beyond mere citation to include references to both meaning and structure (Porter, 1986), which others describe as reference interpretations (Marcoux & Rizkallah, 2009). For example, by playing Patricia Goodson's music over the Remix Pac-man game, we referenced an experience of play shaped by women as well as referenced the importance of her under-recognized contribution.

By materializing the process of intertextual referencing, we expand an idea rooted in language, a version of intertextuality as a system of signs and meanings folded into textual representations. "*Intertext is a Text – a great seamless textual fabric*," Porter observes (Porter, 1986, p. 34). From this perspective, all textual interactions work as responses to previous texts. They reflect existing patterns of meaning that help people anticipate and promote future responses and fundamentally inform them (Christensen & Bjørn, 2014). With Atari Women, we saw how thinking through design as an intertextual practice meant interpreting design artifacts as interventionist tools. Those tools could not be comprehended in isolation, but only in terms of their relationships to the past. Intertextual design practice thus uses acts of referencing the past as heuristics for transforming material surroundings in the here and now.

In attending to the referent, Atari Women further drew our attention to what Speiser calls a "reference key" or "shibboleth": a custom, practice, or tradition that distinguishes one group of people from others. Shibboleth marks a sign, word, or pronunciation demonstrating insider knowledge, while exposing outsiders. Shibboleth originates from a biblical story situated in the 11th century B.C. wherein pronouncing the word 'shibboleth' functioned as a marker in the genocide of the Ephraimites by the Gileadites. The Ephraimites' phonetic dialect made it impossible for them to recognizable pronounce the word 'shibboleth' and resulted in limiting their ability to pretend to be natives of Gilead - an act with real and deadly consequences for the Ephraimites as they attempted to flee the Gileadites (Speiser, 1942). With Atari Women, we saw a more subtle separation between insiders and outsiders. A reference key such as the Atari Women logo or Patricia Goodman's music worked as an "Easter Egg" buried in the Remix Pac-man game, and thus provided a subtle acknowledgment using the correct pronunciation of the gaming lingo. The audience needed to know the historical reference (the retro gaming graphics, the story about Easter Eggs or E.T. Atari burial) which was hinted in our designs displaying the significance of particular under-recognized gaming accomplishments. Like the difficult-to-pronounce word, the logo or sound track (as reference key) did not remain fixed nor an act in itself; instead, people enacted (or failed to enact) a reference key in their Atari Women engagements. This act of referencing turned an otherwise insignificant or arbitrary mark into a discriminatory, decisive, and divisive connection (Derrida, 1992). Intertextual design extended a linguistic process by adopting the codified signs of a cultural brand (in our case, retro gaming) as a mode of referencing and earnest connection with the community.

#### 4.2. Critical historical and designerly thought on erasure

Alongside this work, critical historical scholarship on gaps and elisions in archives has made important methodological contributions in revisioning of dominant narratives. Our work takes particular inspiration from Black feminist thought such as the groundbreaking work Saidiya Hartman (2019), Tina Campt (2017), and Christina Sharpe (2016). Setting the stage for a wider grappling with archival silences, this work has examined what remains undocumented and unknown using conventional historical methods. They illustrate how experiences from the past produce historic residues that continually haunt and shape contemporary society. Their methodological and theoretical insights into materializing a non-presence (elisions in existing records of the past) offer a vital form of counter-historical inquiry that may be amplified through design.

In parallel, design scholars have explored such amplifications with interventions into technology and computing histories. Variously called prototyping pasts and speculative pasts, proposed techniques open avenues for pedagogy and reflection (Hopkinson and Nelson, Benjamin, 2016; Zewde, 2016; Chan et al., 2018; Kurbak, 2018, Morehshin Allahyari, 2019; Nooney & Brain, 2019). Mimi Onuoha's (2016) mix media installation A Library of Missing Data Sets, for example, materializes "that which we ignore" in order to reveal "cultural and colloquial hints of what is deemed important" as well as "hidden social biases and indifferences." Taking these concerns for elision to interaction design, textile artists Ebru Kurbak contests the "possibilities cone" discussed by design scholars as a way of mapping a trajectory from present to future. She writes: "For me, the word possibility connotes an object category of what may happen, regardless of what the subject is capable of imagining [...] the imaginable possible futures is a highly political category [... with] a direct relationship between how deeply embedded our assumptions are and how vulnerable they are to being disrupted" [Ibid, p.116–7]. As a map of the design process, the possibility cone neglects the influence of the past, and what which might be. Rather than simply "fill" a historical gap or "reassert" an erased historical telling, Atari Women expanded this approach by using nostalgia to design with past trajectories in the present. For example, we saw how nostalgia associated with a coin-operated arcade prompted

people to try to collect a complete set of Atari Women tokens. By centering the nostalgic, we saw references give way to heightened affective encounters, inviting attention from new audiences.

#### 4.3. Design inquiry leveraging humor and parody

Beyond historical inquiry, specific traditions of design research have made strong use of nostalgia as and for intervention (Bell et al., 2005; Lindström & Ståhl, 2019; Treusch, 2019; Treusch et al., 2020). For example, with DorkMaps (Fox et al., 2018) Fox, et al. use design humor and parody to bring designers from large technology companies and collectively reflect on the socio-spatial injustices that the companies' products may further entrench. Building a fake website, company logo, and merchandise, their project appropriated the sleek Seattle-neighborhoods map design of a popular poster company in order to expose the stereotypes and unevenness (re)produced by data-driven maps such as Yelp, Car2Go, and Zillow. By foregrounding humor and surprise in the maps' construction, the team was able to draw the attention of designers, who they hoped to engage in conversation about socio-spatial exclusions. In other work, Menendez-Blanco et al. show how critical design artifacts can be used to engage the public pushing political agendas of changing the narrative of dyslexia (Menéndez, Menéndez et al., 2017), and how matters of concern can become design opportunities (Menendez-Blanco and Angeli 2016).

While intertextual forms of referencing have informed many of these existing design forms, Atari Women exposes specific characteristics that diverge from such work. For example, where design parody uses humiliation, magic, or comedy to draw attention or ridicule a specific issue, our project illustrated how intertextual design foregrounds nostalgia and candor – taking an honest and dedicated interest in retro gaming as a way to scaffold engaged interactions.

#### 5. Intertextual design beyond Atari women

Gaming has long played an integral role in popular culture (Nooney, 2013), and continues to do so. Platforms such as Twitch are among the top five internet traffic generators in the U.S. providing streaming services, which allow gamers to reach increasingly large audiences when they discuss the gameplay as well as watch each other play games (Lessel et al., 2017; Ruberg, 2019). Gaming culture take part in defining the perception of gender in pop culture, which again matters for the perception of gender in computing. At the beginning of this paper, we asked: How can design encounters change historical and contemporary understandings of gaming culture by amplifying the historical contributions made by women and gender minorities to gaming?

When we re-tell Atari stories through design encounters, we enact a reference key (Speiser, 1942) that opens the door to what might be seen as arbitrary or insignificant memories from the outside, but what is also tremendously important and valued from the inside. For example, we reference the language of collectibles through the tokens and signed game cartridges and thus celebrate the collectible activities of gamer fandom communities (Jenkins, 2006). This collectible language in Atari Women was appreciated on several occasions, e.g., the panel, the museums, but also online in our interaction with Atari gamers who asked for our token series or help us to identify rare game cartridges for signatures by Atari Women. While our artifacts served as reference key, they also went beyond citation, as the design encounters served as responses to previous texts (Porter, 1986) – e.g., existing Atari stories – and then added on top contextual knowledge which would link the Atari Women to existing historical situations. Example of such responses was when we told the stories about E.T. and excavation work in the dessert linking it to the excavation work of Atari Women while showing the historic photo of Steven Spielberg, Carla Meninsky, and Suki Lee - thus situating and positioning women game developers at the center of a much celebrated urban legend in contemporary gaming and pop culture. Each Atari Women artifact cannot be interpreted and understood in isolation - instead, each artifact is produced as relational and intertwined with the past, which serve as heuristics for transforming the future. The meaning of intertextual design artifacts is produced as responses to the past, assisting people to anticipate and promote responses in the years ahead (Christensen & Bjørn, 2014).

This revisiting of historical accounts thus participates in the ongoing enactment of the gaming community. The agency of these records serve as durable and persistent forms of gaming heritage – the documents become material-discursive practices not just reminiscing old war stories, but actually reenacting the war stories which also shapes current gaming culture (Piccini, 2015). With Atari Women, we propose intertextual design as the underlying approach for creating design encounters which seek to impact historical and contemporary culture of gaming. The Atari Women artifacts such as the signed cartridges enacted a particular material and discursive practice drawing on intertextual referencing, while celebrating existing values with the gaming community – such as collectible and rare items being signed by creators such as Suki Lee.

Each of our design encounters and artifacts offers new ways for the gaming community to engage in dedicated inquiry finding new stories and trivia which can be celebrated. The Atari Women artifacts are both references in the form and structure of the cultural scene, simultaneously performing solidarity and connection with invisible voices which have otherwise been neglected. In this work of referencing, we as researchers enter into our research field not only as participants in the Atari gaming community, but also co-producers of its material culture. While contemporary gaming culture is often seen as a digital culture, past gaming culture is very much integrated with the artefactual hardware (physical cartridges), and we use the tangible and physically of the Atari Women artifacts to perform and manifest the historic material nature in our contemporary artifacts. While we celebrate the physicality of gaming, we also use digital means to transform our physical encounters into digital experiences (through the website and the Atari Women Instagram) thus speaking the language of the gaming culture. The nostalgic nature of Atari celebrations combines individual and collective memory, manifesting aspects of past gaming culture in order to shape contemporary and future gaming culture.

Intertextual design directs us in designing futures by collaboratively re-working the past. In our development of Atari Women, intertextual design involved not only the act of referencing, but also the *performance of referencing*: the parsing of material expressions as a way of opening opportunities for us as designers to engage with contemporary persons, groups, and communities and work together to inform our conceptions of contribution in the present. While the act of referencing includes explicit concerns about the ways in which the reference at all; the performance of referencing includes involved in referencing (the performance) shape the conditions for which others might accept or reject the additional historical reference. Thinking through our artifacts and the stories they represent, we observed participants across our events engage in meaningful reflections on shared historical moments while changing that very history.

Intertextual design thus uses cultural markers from the past as material to prompt conversation and reflection within a contemporary setting. Extending Rosner et al.'s (2018) definitions of design fabulations, which "open different understandings of the past that reconfigure the present, creating new opportunities for a just future," we look to the particular work of referencing (Hartman, 2008; Shorey & Rosner, 2019). This referencing works as a mode of revisiting historical encounters through personal stories, often with mimicry and nostalgia. While work in design parody (see, e.g., (Fox et al., 2018)) shares intertextual design's fabulatory concern with re-materializing a past or existing phenomenon, our approach does not rely on humor or sarcasm. Instead, intertextual design forges earnest connections with historical figures in order to demonstrate a commitment to the material and discursive language of a cultural past. Through this form of referencing, we saw how participants not only extend their perception of who contributed to computer games of the 70s and 80s, but also related these insights back to their own nostalgic experiences, entangling new Atari moments with the Atari experiences of their childhood.

Intertextual design requires a commitment to enacting humility in collaboration, a process that asks us to seek partnerships in imagining the design encounter rather than seeking to represent other people's experiences. The intertextual design activities served as cultural and discursive engagements (Dourish, 2018), where we treated the interviews, stories, and artifacts as a joint production between us as researchers, the women we interviewed, and the gaming community with which we engaged. All the stories we materialized through design interventions were based on the stories our interviewees wanted to share, re-produced as a retro-gaming trivia referencing game, and celebrating and aligning with existing systems of value within the community. Across our events, artifacts, and digital material, the women we interviewed took part in shaping the text, the stories, the audio, the sounds, which produced our design encounters in personal and dedicated interests. We developed close relationships with several of the women, and these relationships continue beyond our research project.

Crucially, while we sought to use intertextual design to enable more equitable conversations around computer gaming contributions, our approach is necessarily non-innocent. Nothing prevents scholars from taking up these same methods to perpetuate hateful ideas or further systemic harms. In forging relationships across difference, intertextual designers may also coerce, compel, co-opt, or otherwise exploit those whose stories they seek to elevate. In order to take up the method responsibly, we seek to reckon with these potentials. Our approach might have enabled us to create our own erasures. Exposing how elisions work across not just along gender, but along multiple (intersectional) lines of inequality, our approach risks exacerbating the very injustices we seek to upend. From popular books on Atari, we found a few videos and photographs that depicted people employed in the manufacturing department at Atari who appeared to be women of color. They were assembling circuit boards, soldering game consoles, and constructing various other electronic and mechanical parts. However, aside from line worker Chris Bush Maddox, we found no names or connections associated with those women, and we continue to search to this day. Such continued erasures reveal how this process of intertextual design does not lead inevitably to self-evident liberatory ends. Inclusion necessarily involves exclusions as well as positions of privilege and power (Ahmed 2012). With intertextual design, we must continually grapple with the possibility of excluding people along lines of existing lines of inequality.

Intertextual design thus has a certain commitment toward the people who stories it tells, and that commitment involves an ethic of care and ongoing attunement (Bennett et al., 2019). This attunement goes beyond simply gaining an understanding of the field within the design moment. Instead, it involves ongoing and sustained ethic of care. This ethic meant that while the project is formally complete (we have no dedicated funding to continue), we continuously add to our digital archive through the new people who contact us, and the additional knowledge, stories, and resources they share. When the women tell us their stories, require us to recognize and work with the asymmetry which is fundamentally part of such a relationship, rather than attempting to reach symmetry.

Summarizing, Intertextual Design as an HCI design approach exploring gender equity in computing seeks to 1) create connections to people in the present who are carriers of the contemporary stories for the past with the aim of shaping the future; 2) make design interventions that speak the language of historical referencing, allowing design interventions to be taken up by people in the present reminiscing; and 3) connect historic accounts manifesting reference keys situating past events in new ways shaping contemporary and future cultures of gender perceptions in computing. It is the tension – between presence and absence, felt but unknown, recognizable but unknowable – that our project builds upon with the nostalgia of Atari. We use design artifacts to further illuminate the often-unacknowledged way in which people look forward by looking backward, in which looking backward may happen differently, and in which the conditions for technological possibility depend on those differences.

#### 6. Conclusion

Initially, we asked: How can design encounters challenge historical and contemporary understandings of gaming culture by amplifying the historical contributions made by women and gender minorities? Drawing from our project Atari Women, we introduced and demonstrated how the intertextual design approach may create design encounters that challenge the historical and contemporary understanding of gaming culture. With a focus on Atari, we demonstrated how our intertextual design interventions may amplify historical contributions of under-represented groups who made important contributions to early computing developments. We further illustrated how nostalgia can be harnessed to design artifacts that shape ideas of contributions in the present. We propose the distinction between the *act of* referencing and the *performance of* referencing. The act of referencing only concerns whether or not any referencing is taking place at all and is off cause an important first step. However, to have an impact on the *performance* of references will be accepted into the canonical narrative, or risk being rejected and neglected. Through the performance of referencing for Atari women, we were able to connect the retro gaming esthetics with contemporary events as a means for prompting conversations about gender equity in computing.

Intertextuality around nostalgia offers thus one such approach for creating new, contextual understandings in design. It is this sense of historical speculation that our project reveals important tensions between what people know and what people *think* they know about their inheritances. As Kathrine Cross so eloquently formulated during our Comic Con panel: "*The presence of women, queer people, and people of color in gaming isn't novel. The discussion shouldn't be about "letting us in," instead it should be driven by the recognition that we have always been here and always will be."* (Kathrine Cross, Comic Con, 2019).

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