

Sound and the Reading Experience: Examining the Effects of Sound on Reading a Digital Graphic Narrative

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Faculty Introduction

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Kiara's honors thesis research engages the relationship between the experience of reading and the effects of sound and animation on that experience. Researchers have investigated psychological engagement with reading, sound, and animation individually in past studies, but Kiara's research is unique in that she examines their combined effects through the lens of the user experience (UX). A mixed-methods approach, UX research is often conducted on products to discover user preferences and errors in interfaces; however, in exploratory, formative studies, such as this one, UX research can reveal insights and potential relationships between products, confounding variables, and the users themselves that might otherwise go unnoticed. Using a digital graphic narrative titled *The Boat* as the artifact of this research, Kiara designs and conducts a sound UX study that offers interesting insights about how sound can emotionally affect reading and potential future considerations for usability issues with digital storytelling interfaces.

Abstract

This case study investigates the effects of corresponding sounds on reading comprehension, specifically in an online graphic narrative titled *The Boat*, which details the journey of a young Vietnamese girl immigrating alone to Australia after the fall of Saigon. Throughout the narrative, sound is used to match the story's narrative. Through a small usability study of *The Boat*, I investigate sound as a medium and influence on storytelling. The results of the study, though limited by sample size, introduce interesting insights into various confounding factors related to sound that negatively and positively affect the reading experience. This essay reviews my research, its methods and findings, and offers discussion for future considerations of sound and reading.

This essay reviews a small, formative usability study that investigated the influence of sound on the reading experience of ten participants. These participants read a historical, partially animated, graphic narrative with various configurations of sound accompanying the reading. Prior to the study, I hypothesized the corresponding sounds enhance storytelling by centralizing such sounds to the reading, thereby enforcing the narrative's relevance and allowing readers to consciously listen and establish more impactful meaning in the reading. Based on this hypothesis, I found my thesis to be partially correct. To evaluate the effects of the corresponding sounds of the visual narrative, I conducted a formative usability test. Participants ($N = 10$) were randomly separated into two groups: a self-paced group starting with no audio or auto-scroll, and a group starting with audio and auto-scroll. The non-audio group read the graphic narrative silently, without the audio and auto-scroll features until the designated midway point; they then finished the narrative with audio and auto-scroll features. The other group followed the same process, but started with the audio and auto-scroll features and ended with silent, self-paced reading. I compared the participants' self-reported experiences with each other. I hypothesized that sound establishes an extrasensory engagement to the reading that makes the experience more memorable and captivating for the reader.

Further, upon completing the study, I found several unanticipated but interesting confounding variables affected the reading experience for my participants, including the significant impact of the auto-scroll feature, eye and reading fatigue, and reading background. I did initially consider several of these variables, but I assumed that the participant sample would have similar backgrounds and experience with reading, so I did not consider their individual contexts closely. Though my findings are not generalizable because of my study's small sample size, the novelty of this research makes the findings and insights potentially useful as a case study. In this essay, I review the components of this usability study, including the topic, methods and procedures, results, discussion, and takeaways.

The Story of The Boat

The Boat details the journey of a young Vietnamese girl, Mai, immigrating alone to Australia after the fall of Saigon in the 1970s during the Vietnam War. Among hundreds of passengers, she was placed on this

devastatingly dangerous trek—from the endlessly thrashing sea to infections and starvation—by her parents who seek a better life for her. As Mai is on the boat smuggling her to Australia, she reflects on the suffering of her family during the war and how she ended up on the boat. The narrative follows Mai witnessing the extreme physical stress and trauma of the era on her father and mother sending her off through an underground system of smugglers to the boat.

On the boat, Mai witnesses and experiences perpetual waves of sickness, starvation, and death. The extreme conditions of the boat are due to engine troubles that significantly slow down the journey and lead to sanitary complications. During this traumatic venture, Mai establishes a relationship with a woman and her son, whom she likens to her father. Throughout the narrative, both Mai and the boy struggle with severe illness due to the conditions they endure.

The story concludes with the boy succumbing to his sickness. At the end of the graphic narrative, there is a film that illustrates the historical documentation of Vietnamese migrants after the fall of Saigon for narrative context. Although the narrative is based on the consequences of the fall of Saigon during the Vietnam War, the story focuses on the journey as it reflects the trials thousands of Vietnamese immigrants encountered on this voyage.

The Orchestration of The Boat

Storytelling is an aptitude that can be possessed and traded by anyone, at any time, regardless of socioeconomic status or demographic. Storytelling exists across media, but for the purposes of this analysis, a combination of audio, visual, and silent reading is investigated as *The Boat's* historical narrative is delivered as a digital comic book with continuous animations and correlating sound shots and effects. The structure of the graphic narrative illustrates panels and text, as any other graphic novel, but the text is not always hovering directly over the image panels. Occasionally, the text floats on its own with the constant animated graphics in the background. With the auto-scroll features or the self-paced movement of the graphic narrative during the reading, the panels frequently move from side to side or in accordance with the accompanying sounds (see figure 1).

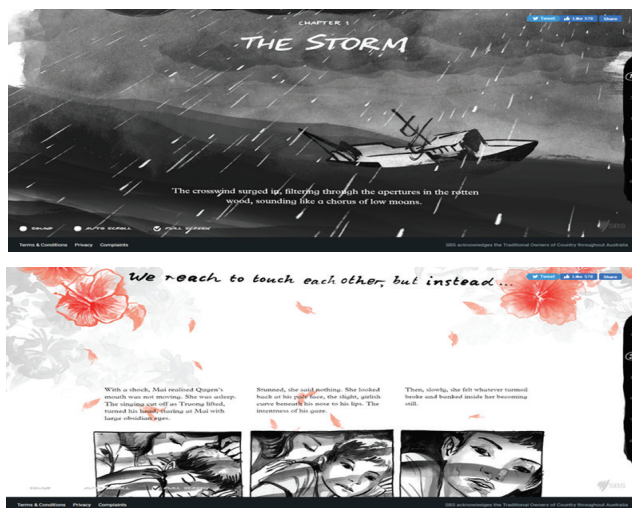


Figure 1. Screenshots from *The Boat*

The graphic narrative begins in the middle of the story and proceeds to flashback to how the story begins. During this section, the graphics are thrashing side to side and the sound effects and shots are loud and crass, intimating an actual storm, as the first section begins during a violent storm. This format is intended to induce confusion in the beginning with gradual understanding of the main character's plight. In the conclusion of the narrative, a brief historical frame is added to provide background of the story, as well as a full understanding of the scenario. The visuals, sounds, and order of the narrative are used to reflect the plight of an immigrant of war from a direct perspective. Thus, the educational aspect of the story is understood when a full view of the scenario is evaluated, especially for those ignorant of the circumstances of these individuals. As more authors create multimodal works online, it is important for researchers to study the effects such digital variables have on readers. This study investigates the effects that sound, in conjunction with the graphic narrative's animation and online medium, plays in the reading experience.

Literature Review

Prior to conducting a usability test with *The Boat*, I reviewed several topics that could potentially affect how individuals respond to sound and reading, including auditory stimuli, the brain and information processing, and reading and comprehension.

Sound and Reading

The subjective pleasantness of auditory stimuli, specifically music or orchestrated sounds, has a significant effect on the body by the various responsive chemical waves formulated by the brain: changing mood, emotions, behavior, physical health/well-being, and brain activity (Kučikienė & Praninskienė, 2018). When the brain responds to a sound, it depends on the meaning and relevance of the sound. Thus, meaningful sounds get specific responses from the brain that indicate a specific level of engagement when reading.

Information Processing

It is important to understand how humans process interpersonal communication even when it is indirect and one-sided, as in reading a visual graphic narrative. Weiten et al. (2017) list the components of this process, which includes the sender, the receiver, the message, the channel, noise, and context. The sender (the initiator of the intended message) and the receiver are the participants involved in interpersonal communication, the groups that interact. If the communication is a simple two-way track, both individuals are senders and receivers. The message goes through a process of encoding by the sender and decoding by the receiver. The channel is the medium through which the message is sent: sound, writing, facial expressions, physical/body gestures, or visual channels. However, irrelevant or excessive noise and interference can disrupt the effective sending and receiving of a message, causing inefficient communication. Thus, for an individual to properly formulate an understanding of the information they receive, it goes through the encoding and decoding processes.

O'Kelly et al. (2013), quoted in Kučikienė and Praninskienė (2018), indicate that on a global scale, personally preferred music enhances electroencephalogram power spectra across bandwidths. The activation of frequencies of personally preferred music are best illustrated in the right frontal and temporal regions of the brain by alpha and beta frequencies. However, O'Kelly et al. (2013) also indicate disliked music, white noise, and musical improvisations do not produce a similar effect. This dissonance is likely due to the emotional connections established with the music or noise presented. Nakamura et al. (1999) conducted a study on the effect of music on eight participants; their findings

indicate listening to music activates “new” areas of the brain (brain processes) and increases cerebral blood flow. They also found these effects of music are not objectively based on genre; rather, the music merely needs to be appealing to the user. Looking into audio-visual stimuli, Zak (2015) found emotional scenes in short video clips induce 47% more neurochemical oxytocin than those participants for the unemotional scene.

Cuadrado et al. (2020) demonstrate the relatability of the material—through sound or vision—to the receiver can cause unconscious/unintentional emotional effects. Those who established a relatability toward the material were likely to experience a physiological arousal, a self-reported effect in emotional state, and/or a self-reported effect in immersion level. Therefore, if any of my study participants can personally relate to the narrative, it is likely there would be an increase in emotional engagement.

Reading and Comprehension

Du et al. (2020) illustrate that background music often has no general effect on reading comprehension or can even interfere with adequate comprehension because background music, depending on the intensity of arousal level in neural responses associated with such background music or noise, can be a distraction. This finding is interesting but leaves open a gap for my study to fill in seeking how non-background, intentional sound affects comprehension and experience.

The primary focus of my study is the effect of sound (sound shots and effects) on reading engagement and comprehension. Therefore, the intentionality of sound alongside reading is as important as the effects sound has on the brain. Wingstedt et al. (2010) evaluate narrative music’s effect on visuals and vice versa. Their findings indicate visuals have as much of an effect on the music as the music does on visuals.

Rodero (2010) found participants reported paying better attention and increased mental imagery when sound effects were associated with the story. Findings indicate descriptive sound effects regarding the sound shots in the study’s fictional radio drama positively increase mental imagery and listener attention.

This research illustrates the varied effects researchers have observed

when studying sound. From attention-grabbing, relevant sounds to meaningful effects and associations, it is clear that sound has a role to play in comprehension during a reading experience. This seems especially true when combining it with other forms of stimuli, like animations. Based on this review of the literature, I believe the use of stimuli, such as sound effects (audio stimuli), can stimulate a reader's attention after the initial attention-grabbing process. Sound further maintains attention depending on the impact of the stimuli if it arouses interest.

Procedure and Methods

Methods

I designed a study for ten participants to investigate their experiences reading the graphic narrative *The Boat* with and without sound. This study most resembles what is known as a formative usability study; this study is an experimental pilot test that determines the preliminary *why* and *how* components of what is being evaluated. Therefore, according to Six and Macefield (2016), a small sample is appropriate, feasible, and effective in this case. Conducting this experiment as a case study is useful in providing a foundation for future studies to build upon in various contexts, with differing focal points.

At this stage of research, my goal was to discover insights about this topic that helped identify more nuanced directions to pursue in the future. To that end, I was not concerned about a systems-based problem discoverability goal (Bojko, 2013) or statistically significant comparative analysis results. Six and Macefield (2016) also discuss the common practice of punctuated testing at different stages of research and/or product testing. In this vein, my study is closer to an initial discovery test, which might require as few as five individuals. I opted to recruit ten participants for my study.

Convenience sampling was used to recruit the participants for the study, because this study is an initial discovery evaluation of this topic. Participants took part in the study individually at different times. The first participant of the pilot test (of which there were two) was randomly separated into one of two groups: Group 1 began reading *The Boat* with sound and auto-scroll until reaching the midway point of the narrative and then proceeded to read the narrative without sound and auto-scroll; Group 2 began reading *The Boat* without sound and auto-scroll first

and then proceeded to read with sound after reaching the determined midway point. Each individual was evaluated according to their group but conducted the reading in the designated area alone. This version of the procedure was conceived to be the best avenue of methodology to combat reading fatigue, which will be elaborated later in the analysis. The study was conducted in a media suite on the campus of a medium-large university in the southern United States.

Prior to reading, participants were asked a series of pre-test questions about demographics and their experience reading in general. After their designated reading session, participants were asked a series of post-test questions about their reading experience. The post-test survey included questions with answers arranged on a scale and analyzed by a rudimentary evaluation model based on the narrative engagement scale developed by Busselle and Bilandzic (2009) (see figure 2). This analysis was the basis for organizing the data and establishing the discovery test conclusions.

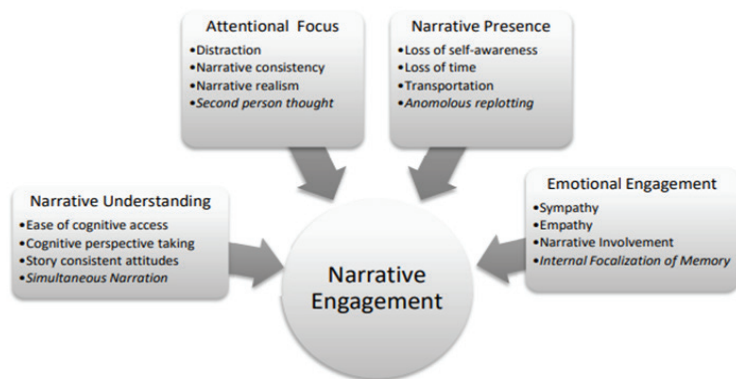


Figure 2. Narrative engagement scale developed by Busselle and Bilandzic (2009)

Pilot Tests

The initial pilot test helped me evaluate the methodology and adjust the final methods to eliminate reading fatigue. These findings showed me how to revise my method.

I initially intended to have the participant read the entire narrative without sound shots/effects and auto-scroll and then read *The Boat*

again with these effects or read the entire narrative with such effects and then read it again without. This method was used for the initial pilot test. Reading fatigue immediately became a variable that negatively affected the experience in the pilot test.

During the study, the pilot test participant began experiencing reading fatigue during the auto-scroll portion of the test. Due to the structure of the first model of the experiment, this fatigue negatively affected the focal results of the reading. The participant also felt like the usability of the narrative made the reading difficult in the beginning, primarily the varying auto-scroll speeds in certain sections of the text. The participant indicated that, although they liked the main character, they were confused by her experience.

The first pilot test showed that despite the initial engagement and attention presented by the reader, after some time, interest will be lost if the process exceeds their threshold of attention. I revised the study procedure to account for reading fatigue. The structure of the second pilot test significantly reduced the time of the study. Instruction, the reading, and the survey questions lasted 40 minutes for the second pilot test, as opposed to nearly two hours for the first pilot test.

Results and Discussion

Results

This study produced interesting and unexpected results, namely, the confounding impacts of auto-scroll, eye fatigue, and the partially animated graphic visuals. I did not initially believe such components of the reading would have a noticeable or impressionable effect on the study results. After conducting the experiment, I conducted further research to better grasp their effects.

Engagement and attention. In the official testing portion of the study, engagement, attention, and interest were determined on a self-reported, five-point scale; whereas comprehension, auto-scroll, and sound were evaluated by the facilitator based on participant responses. I determined participant engagement by aggregating Likert responses from 15 questions that examined attention, focus, and interest in the readings. Based on the study results, I determined the participants were at least 70% engaged in the reading. However, this determination

did not specify which component of the study the participants were engaged in (focus could be on sound, reading, graphics, etc.). One participant demonstrated significant engagement in the reading due to their ancestral connection to the story’s history (the only individual that expressed 100% engagement throughout the experiment and had the longest study duration). Table 1 shows the evaluation section, which provides a layered expression of the overall enjoyment of the reading, such as the level of attention a participant held during the reading.

Table 1. Response Evaluation Table

Participant	A	B	C	D	E	F	G	H	I	J
Engagement (15 pts)	N/A	14	13.5	15	11.5	11	14	11	13	11.5
Attention (10 pts)	N/A	9	8.5	10	7.5	7	9	8	8	7.5
Comprehension (5 pts)	5	5	5	5	4	3	5	4	5	4
Interest (5 pts)	N/A	5	5	5	4	4	5	3	5	4
Auto-scroll (Like, Dislike, Neutral)	D	N	D	D	L	D	L	~L	~D	D
Sound (Like, Dislike, Neutral)	L	L	L	L	~D	~L	L	~L	~L	~L

Note: Participant A was the first pilot test, and, because of initial test protocol issues, did not complete the scales for engagement and attention. Total points from the scale are listed in parentheses beneath each category in the left-most column. To conserve space and increase readability, *Like* is abbreviated to *L*, *Dislike* is abbreviated to *D*, and *Neutral* is abbreviated to *N*. For participants who indicated they mostly liked or mostly disliked a feature, ~ is used in front of the abbreviation in the table.

The attention section of the study was an evaluation that combined the attention-grabbing and focus-level scale with the self-reporting portion of the post-test survey. The participants’ physical demeanor and self-reports indicated attention and focus fluctuated depending on general attitudes toward reading, interest in graphic narratives, narrative understanding, personal components of their daily routine, and preferability of auto-scroll and sound features.

Interest. The interest section of the study was an evaluation of the self-reporting scale in the post-test survey, which indicated interest was no lower than 60%. Interest levels varied among participants, depending on reading and genre preferences, as well as sound and auto-scroll preferability. Other components proved to be interconnected and had an

impact on the interest variable, such as engagement and comprehension.

Comprehension. The comprehension section of the study was an evaluation determined according to the participants' narrative recollection. The summary of the reading was understood by everyone, which qualified them for a level of at least a three on the five-point scale. On this scale, 1 is the lowest level of understanding and 5 is the highest level of understanding. The participants' level of comprehension also contributed to the interest and attention levels of the reading. If the attention and interest levels were lower, then the comprehension results were affected. As expected, auto-scroll had little impact on the comprehension and interest levels but had influence on attention, while sound influenced comprehension. Those who disliked the sound features or who indicated they liked the sound features but found the sound distracting, had lower comprehension results.

Discussion

After evaluating my results, both the usability tests and participant responses, I found the participants' lack of exposure to animated graphic narratives made the reading interesting and engaging. The auto-scroll component of the reading presented one of the most interesting findings of the experiment. Only three of the ten participants liked the auto-scroll features; the remaining participants believed the auto-scroll made the reading more complicated for them in certain portions of the texts and largely disliked the feature. This component was most interesting because the primary focus of the study was to evaluate the effects of sound during the reading experience, but the auto-scroll usability issue demonstrated an unanticipated, yet noticeable effect on the reading experience, which is discussed in more detail later.

The sound features, overall, proved to be a significant factor in the levels of narrative engagement. Nine of the ten participants liked the sound and felt as though it enhanced the narrative quality, further captivating and engaging them in the narrative more than the self-paced, silent reading portion of the experiment. Several participants mentioned the subtle sounds that made them feel physically present in the narrative. As indicated in Rodero (2010), mental imagery can be enhanced and evaluated through dual-coding processing, which is reflected in the study through visual immersion and an emotional impact. The study,

however, expressed several unanticipated components that affected the reading.

Auto-scroll. During the experiments, each participant was asked about how sound shots and effects and auto-scroll features affected their reading experience. However, the significant impact of the auto-scroll alone in the reading experience was unexpected and required further research. The results from the study expressed that out of ten participants, including the two pilot tests, six participants mostly or completely disliked the use of auto-scroll in the reading. Everyone stated how the auto-scroll moved at inconsistent speeds and made the reading difficult at times. Three participants liked the application of auto-scroll in the reading and one participant also liked the auto-scroll paired with the sound features, but they were neutral on the usage comparatively. These results led to further research on the preferability of auto-scroll in reading (Räihä & Sharmin, 2014), which indicated waivered concentration during times of auto-scrolling speed changes for some readers, but not to the extent of notable decline in comprehension. In fact, the preferability or negative viewpoint toward the auto-scroll did not have a significant impact. However, it did expose a pertinent usability issue of the study. Throughout the experiment, several other components affected the participants that were not previously considered, such as eye fatigue and visual aids/graphics.

Eye fatigue. Reading fatigue was discovered as a potential confounding variable for the initial pilot test. Further research was conducted to determine the effect of eye and reading fatigue established the laptop display used in the experiment contributed to fatigue. In addition to visual fatigue, reading fatigue was determined to be an inevitability for participants.

Graphic/visual aids. The reading material for the study is the visual graphic narrative *The Boat*. Thus, animated graphics and visuals are constant throughout the reading and the study. I did not consider that the graphics would be almost as impactful as the sound effects and shots, because I did not design the study to investigate visuals. In further research, I found “visual aids can be very useful in supporting a topic, and the amalgamation of both visual and audio stimuli is particularly effective since the two most important senses are involved” (Shabiralyani et al., 2015, 227).

Shabiralyani et al. (2015) found people generally remember 50% of what they both hear and see, though people only remember 10% of what they only read, 20% of what they only hear, and 30% of what they see. Therefore, an assumption can be surmised that these statistics may change when participants empathize/sympathize with the characters and are engaged in animation and sounds that activate dual coding processes. Although a majority (7/10) of the participants in my study emphasized the use of sound effects and shots (music) is what immersed them in the reading more, responses in the post-test survey indicate the graphics, especially paired with the sound, engaged the participants as well. Therefore, the study revealed participants found the graphics engaging and enhanced mental imagery.

A noticeable fluctuating variable I found during the analysis was lack of knowledge of animated graphic narratives prior to the reading. Upon further investigation, I found transparency/comprehension of visual narratives is not universal but cultural (Cohn, 2019), requiring prior experience and fluency.

During the experiments, participant D relied on the influence of personal backgrounds. Participant D illustrated the most thorough engagement and comprehension in the reading, especially regarding sound features. The participant had a personal background and connection to the reading, because participant D is part Vietnamese, and their grandparents, aunt, and father escaped Vietnam during the fall of Saigon. During the study, participant D passionately mentioned their personal connection to the main character, how they remember their grandmother singing the nursery rhyme sung during the sound portion of the reading, and how the sound features in combination to the narrative made them feel connected to their ancestors. Participant D's experience during the usability test confirms Cuadrado et al.'s (2020) findings about the unintentional emotional effects caused by stimuli that are relatable to the receiver. This relatability and its emotional effects dramatically altered Participant D's experience reading *The Boat*. Compared to the other participants who did not have an ancestral connection to the event, participant D's background allowed them to comprehend, engage, and enjoy the reading the most as shown in Table 1 in the Engagement category.

Further research indicates graphic narratives are valuable in aiding

reading comprehension and engagement by encouraging sensory arousal, especially for individuals who would otherwise struggle with narrative understanding of traditional texts (Cook, 2017). *The Boat* functions as both a graphic narrative and audio experience, making it a unique kind of reading experience, presumably leading to greater sensory arousal.

Greater sensory arousal is experienced when listening to audio stories rather than watching them (Richardson et al., 2020). My study corroborates these findings to an extent. Although the dialogue was not read aloud as in Richardson et al.'s (2020) study, many participants commented on the visual graphics in the narrative, but most felt sensual immersion with the sound shots and effects coupled with the visual reading. However, due to the nature of the study, I can only speculate about any correlation.

Conclusion

Limitations

The limitations of the study were the small sample size, homogeneous sample, and ungeneralizable findings; however, my study was established as a formative usability test, designed to gain insights into a topic; therefore, I did not require a large sample size. The goal is a small usability test focusing on discovery insights is to then inform larger studies that can produce significant results. The small sample means my results are not generalizable for the population. The homogeneous sample also presented a significant drawback in creating a representative study, reducing variability in age and social class; therefore, the sample and results did not represent the American population.

Considerations and Future Directions

The use of sound in *The Boat*, particularly the folk song playing in the last chapter, demonstrates the emotional nature of the graphic narrative and its effects on the reader's experience with the text. This narrative is made more effective considering the historical nature of the story, one that is easily relatable due to several cultures suffering similar circumstances, and it is shockingly unfathomable to those privileged enough not to know such hardships. Although a graphic narrative uses both text and illustrations, this visual graphic narrative incorporates sounds and panel movements that are intended to enhance the story in the way in which

a moving picture would. Providing spatial and contextual awareness for readers requires less mental imaging than regular graphic narratives. Therefore, the reading experience is enhanced through extrasensory engagement created with the sound effects of the story.

My initial hypothesis was that the corresponding sounds enhance storytelling by centralizing such sounds to the reading, thereby enforcing the narrative's relevance and allowing readers to consciously listen and establish more impactful meaning in the reading. The initial hypothesis failed to consider several factors that contribute to sound inducing an engaging experience. Some participants said the sound proved to be a distraction on occasion. Despite that evaluation, this usability experiment produces adequate explorative research findings that can be built upon in the future.

In future research, some directions I would advocate for researchers to pursue include creating a block (a study where participants are divided in homogeneous subsets), double-blind study. By doing so, researchers can study various homogeneous groups, compare them to each other, and simultaneously evaluate the different components of the study, while limiting bias in the experiment. I would also suggest more diversity in participants so possible background characteristics can be represented in the study. I also recommend additional usability tests on various animated narratives to investigate different kinds of storytelling modes and methods. Additionally, iterative testing on different versions of the same story would also yield great insights if such testing could be accomplished with stories in development.

Takeaways

I found usability and personal background are the two most pertinent factors for such a study. Future studies must determine if their results are accurately based on what is being evaluated or due to design error. My pilot test and study findings indicate many such factors of study design that can influence results. Multiple iterations of pilot tests are needed to ensure a sound design, as well as studying the published findings of case studies, such as this one. I also found personal background influences the depth of the results, regardless of the quality of the study's design. Although my study focused on the effects of sound on the reading experience, the usability of the narrative and the personal backgrounds

of the participants crafted the results of the study. Audience analysis and deliberate selection criteria for participants in future studies will be necessary steps for researchers. I hope the usability structure of my study offers a blueprint for future researchers who can adopt the method to focus on new questions of sound and its effects on the reading experience. ■

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Student Biography

Kiara Williams is a December 2022 graduate from Sam Houston State University with a degree in Criminal Justice and a minor in Psychology. In a quest to enhance her college experience, she became involved in Alpha Phi Sigma, Alpha Lambda Delta, and the National Association of Blacks in Criminal Justice. When Kiara was invited to join Alpha Lambda Delta, she was admitted into the Honors College that requires a number of specialized seminars. One seminar was about activism through graphic novels, where she was assigned a research project that later inspired the concept for her honors thesis. The catalyst of this inspiration was one of the seminar professors, Dr. Strubberg in the English Department. Under Dr. Strubberg's advisement, Kiara researched the effects of using sounds while reading. Kiara is currently working full-time with plans to engage in more extensive research projects that may add value in the world.