

Enriching Reading Experience with Dramatic Soundtracks

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Abstract

The goal of this research was to analyze to what extent applying dramatic soundtracks to a short story enrich the reading experience on an E-reader. This is an opportunity to give reading a new face allowed by the capabilities of the digital nature of eBooks and E-readers. The set up tested for imagery, transportation and attention through a questionnaire. Additionally arousal was measured with the help of GSR sensors. The results did not show a clear enrichment of the experience. The soundtracks were distracting at some points and complementing at others. The opportunity of dramatic soundtracks in eBooks is still a valid proposition which rests on the proper implementation.

Keywords: eBooks, e-readers, reading experience, soundtracks

1. Introduction

The ability to immerse the reader into a story and stir up emotions is usually the responsibility of the author. The past has seen development in writing styles, genres but it stayed as a skill of structuring words, stayed in the medium of the written language. The beauty about reading is that the written language is a framework which the reader has to fill in with their own images. No one is telling the reader how to imagine the story. But with new technologies come new opportunities that can give rise to new reading paradigms.

E-readers are becoming a true competitor to paper based books [1, 2]. This technology has improved immensely over the past years [3]. The introduction of e-ink and higher resolution screens makes it less tiring to read on screen based devices. Their size and weight is as big or smaller than paper based books. The main advantage of e-readers is that they can hold hundreds of books in one place, without taking up any shelf space. Another practical advantage is the huge database of books provided by services such as Amazon accessible worldwide with just an internet connection.

The development of e-readers has focused on adding practical functionality like skipping to a specific page or being able to highlight text. The digital nature of eBooks and the hardware capabilities of an e-reader allow giving reading a new meaning. This paper tries to explore the capabilities of e-readers to enrich the reading experience on an emotional level.

The research done in this paper is based on the observation that e-readers are the perfect platform to enable playing dramatic soundtracks which are synchronized to an appropriate passage. It is the digital nature of e-books, e-readers and the opportunities it brings with it, as well as the opportunity for a business.

The process of adding soundtracks to e-books can be divided into stages. The first one is the tagging of the book to indicate where and what type of soundtrack should be played. There are different possibilities of this step. Either the author can do that since she knows the story and what the passage should convey. So the author could collaborate with professional composers to design the soundtracks for the book. The other option would be to tag the book with moods the passages are conveying and leave the choice of soundtracks to an external party. This external party could be the application which browses through the music database online with the same tags as the desired passage. It could also be a previous reader of this book that happens to know what would sound good with a passage. This would add another dimension to reading where the reading experience could be shared. The soundtrack is chosen depending how the reader felt when reading a passage. The second stage is more of questions. What control over the soundtrack does the reader have? Does the book come with the soundtracks already, which means the book will have to be more expensive? Or does the reader see suggestions for soundtracks while reading and can decide at that moment if she is willing to pay for the song. Another possibility is that the book gives suggestion from the readers own library of music for specific passages. The last stage is the control of the playing soundtrack. How much control should there be. Where is the

balance between staying in the flow of the story and controlling the soundtrack? How should the interface look like to be hidden and easily accessible at the same time?

Before diving into the design of such a system the goal is to see if this is even worth a try. This research entails to discover to what extent playing a dramatic soundtrack enrich the reading experience on an e-reader.

2. Background

Audio books are one of the earlier examples of trying to change the act of reading. Instead of reading oneself, a recording of someone reading the book is listened to. These can be used if reading is not a preferred activity or if reading is not possible, for example on a bike. The use of sound simply replaces the act of reading. This context does not use sound for extra dramatic purposes.

Reading experience can be augmented with mixed reality for example the book developed by Grasset et al [4]. This interactive book allows the reader to access digital information projected onto and outside a physical book with the help of augmented reality glasses. Not only is there more visual information which enriches the experience but also sound in the form of realistic sounds which complement the events in the story. This example uses new developments in technology to give reading a whole new feel. This context is directed for the children's market where dynamic images and visual storytelling is appreciated. Distributed multimedia have also been used to enrich the experience in many other applications [5-9].

Another example describing an attempt to enhance the reading experience is Sonified RSVP (Rapid Serial Visual Presentation) where the text is displayed one word at a time in a quick succession on a mobile device [10]. Auditory icons, short realistic sound clips, were played when the fitting text appeared on the screen. The result was a more immersed reading experience rather than enriching the excitement. The author gives a hypothesis that the use of dramatic soundtracks could increase the excitement. The results do not directly relate to the research proposed in this paper because RSVP is significantly different way to visualize a text than the static text on e-readers.

It seems there have been successful attempts to enhance the reading experience with realistic sounds that directly representing the events in the text which would make a sound in real life. There is a lack of research towards the effect of dramatic soundtracks on the reading experience. This is surprising since TV, in particular movies, is a medium used to tell stories, which has been using soundtracks for dramatic effect since its beginning. Initially it was used to hide the sound of the projector but soon it became a desired modality which complemented the moving pictures [11].

There is no doubt that whether music is used in movies or by itself, it has the power to evoke emotions [12]. It is interesting to realize that music both represents emotions in a movie and elicits them in the audience at the same time [11]. It has also been proven that music in combination with pictures evoke stronger emotions than by themselves [12]. The question is if the same holds for music in combination with reading.

Until now, enriching the reading experience has been talked a lot but this is a broad term that needs a more concrete representation. A study used a validated questionnaire to test the imagery, transportation into the narrative and attention of a participant reading a text [13]. These three scales correspond to factors that play a role in enriching the reading experience.

The purpose of this research is twofold. One is to explore the value of dramatic soundtracks during reading as a source to enrich the experience. If there is a positive reaction to this type of soundtrack then the second goal is to provide guidelines and suggestions for anyone that wants to implement dramatic soundtracks into eBooks.

The hypothesis is that the reading experience accompanied by the soundtrack will show an increase on all three scales (imagery, transportation and attention) as well as induce higher arousal, seen on the galvanic skin response (GSR) signal.

"Music heightens the sense of reality of or absorption in film, perhaps by augmenting arousal, and increasing attention to the entire film context and inattention to everything else." [11]

3. Experiment

3.1 Method

Two short stories were downloaded from the internet. They were chosen on the basis of similar length, readability, containing passages that portray one specific mood that can be accompanied with a complementing soundtrack and difference in genre. The readability was measured with the Flesh index [14]. One story, called “End of days” [15], was about a meteor flying past the earth causing mass destruction by natural disasters striking all over the world. The story is told from a third person perspective following the main character as he deals with the mass destruction and being one of the few survivors. It is very much an action story with a short dramatic and sad part in the middle. The second story, called “Fatal love” [16], is about a young adult schizophrenic girl that does not know she is schizophrenic. she is lonely, with both her parents dead, and now her boyfriend dumping her she reflects on her life, finds some positive energy but then the police shows up at her doorstep asking her about her boyfriend which turns out to have been killed recently. Her murderous side comes out and kills one of the cops and gets killed by the other. The story starts sad then changes to a happier and energetic scene and then the scene turns to an aggressive action. The reason for testing two stories was to control to what extent genre and preference of the story affect the results.

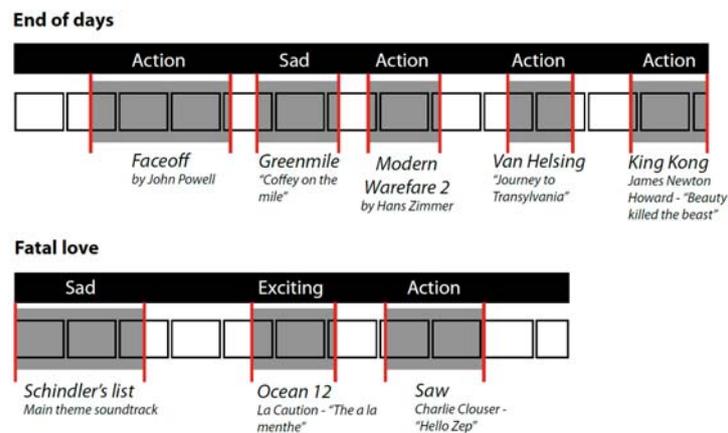


Figure 1. Stories and augmented soundtracks

The soundtracks were chosen by reading the story and examining what mood different passages portrayed. According to this, movies of similar genre were associated with and soundtracks chosen. Every potential soundtrack was tested by having it played in the background while reading the passage it should belong to. The soundtrack which complemented the passage the best and was long enough to consider slow readers was picked. Figure 1 shows where in the stories the soundtracks were placed, what type of passage it is and which movie the soundtrack is from, including its title if possible.

The effect of the soundtrack on three scales, imagery, transportation and attention were measured with a questionnaire given to the participant after each story. Arousal was also measured with GSR sensors since it is an important factor in the reading experience.

3.2 Participants

All 7 subjects were Dutch industrial design master students (holding a bachelor diploma) including one being a PhD student. The ages varied from 23 to 27 years, with six males and one female. One of the participants did not read novels regularly and the others varied from reading between 0.1 and 2 hours per week to one reading between 4.1 and 6 hours a week. The type of genres the participants preferred to read varied, from general statements like fiction or non-fiction to more specific like crime and biographies. The most popular reading location among the participants was their bed, with some reading in their living room, garden or on the train. Most subjects described their level of understanding the English language on an expert level with a couple having an intermediate. Nearly all participants had little experience with e-readers.

3.3 Instruments

An iPad was used as an e-reader containing an application, Listen reader, specially made for this test, holding two short stories. A GSR sensor was used, connected to an amplifier design to allow connecting sensors measuring physiological responses, which in turn was connected through a USB cable to a desktop computer. On this computer was the ASA (Advanced Source Analysis) software [17] used to record the GSR signal. The MatLab software was also used later on to draw graphs of the GSR data exported from ASA. The iPad was connected wirelessly to a laptop that had external speakers connected to it. The GSR graphs were enhanced with the help of Excel and Illustrator, to visualize where the soundtracks were playing.

3.4 Procedure

The testing took place at the faculty of Industrial design at the Eindhoven University of Technology in a biofeedback laboratory (Figure 2). During the test only the participant and the experimenter were present in the room. It was relatively quiet with the window closed to keep outside noise to a minimum. The participant was asked to sit down in a comfortable chair pointed towards the window, with the back to all the computers to avoid possible distractions for the participant. To the right side of the chair was a coffee table with the signal amplifier and the GSR sensor connected to it. The speakers were situated behind the sitting participant at ears height, one speaker on each side of the chair about a meter away from the participants head. The participant was asked to sit down and place the GSR sensor on the tip of the index and ring finger. The participant was told that they will get two different short stories to read, with one of them having sound accompanying it, and that they would be asked to fill in a short questionnaire [18] after each story. First the experimenter checked if the GSR sensors were working properly and then the participant was given the iPad with the title of the story displayed. The participant was instructed to tap the right side of the screen in order to switch to the next page while reading. The participant was asked to say when the first page was switched to in order for the experimenter to know when to start recording. While the participant was reading, the laptop connected to the iPad recorded the time it took for each page to be read and the moment in time the soundtrack started to play and finish. The application timed how long it takes the participant to read one page to have an idea of the average reading speed. This data was used by the application to approximate the passage the participant is reading in order to start playing the soundtrack at the desired moment. At the end of the test the participant was asked to fill in a questionnaire with personal information, including questions about their reading behavior.



Figure 2. Biobedback Lab at TU/e

4. Results

The questionnaire [18] consisted of a number of questions related to the same subscale: imagery, transportation and attention. The responses for questions relating to each subscale were averaged out per participant. The average score for each subscale among all participants in the same condition ($N =$

3 or 4 per condition) was averaged out, shown in Figure 3. This chart gives an overview of the general perception of each subscale per condition. Comparing the score per condition indicates what effect the different conditions had on the three subscales. The most noticeable difference is the increase in Imagery and attention for the “End of days” without soundtrack condition compared to the one with the soundtrack.

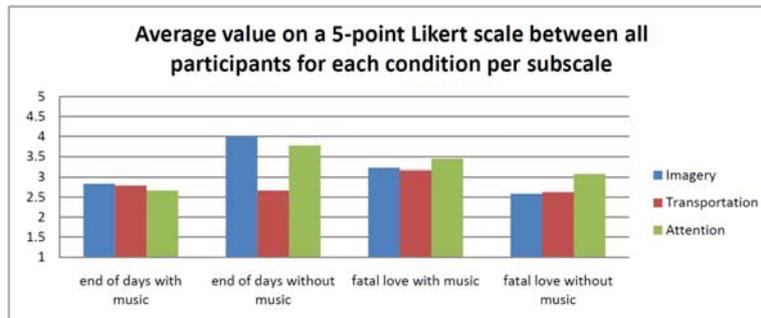


Figure 3. Average scores of the measurement scales

Figure 4 shows the average score of all participants per control question. This overview was useful to try to understand what could have influenced the results of the imagery, transportation and attention questionnaire.

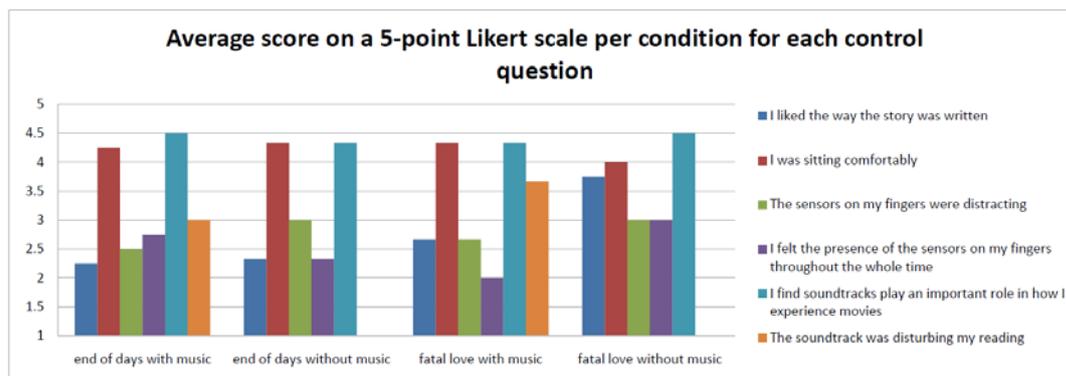


Figure 4. Average scores of the control questions

A two sample t-test was conducted to compare each subscale (imagery, transportation and attention) between with soundtrack and without soundtrack conditions of the same story. The t-test results for the “End of days” story were: Imagery ($p = 0.28$), Transportation ($p=0.38$), Attention ($p=0.22$). The results show that for all three subscales there was no significant difference between condition with and without soundtrack.

The results of the t-test for the “Fatal love” story are as follows: Imagery ($p = 0.01$), transportation ($p=0.33$), attention ($p=0.25$). Only imagery shows a significant difference between conditions with and without soundtrack but the other two are not significantly different.

In Figure 5 are examples of the way the results of the GSR measurements were visualized to help during the within subject and between subject analysis. For the within subject analysis the participants which had the same conditions were grouped together. This resulted in two groups, with one group reading “End of days” with the soundtrack and “Fatal love” without the soundtrack and the second group the opposite [18]. This allowed seeing if there is a difference in arousal between reading with and without sound for each subject for the two groups. For the in-between analysis the graphs were clustered first of all by story, and within that cluster, the graphs representing the condition with soundtrack were placed on one side and the without soundtrack condition on the opposite side [18].

The purpose of these graphs was to test if the effect of soundtracks on reading can be concluded from objective data like physiological arousal.

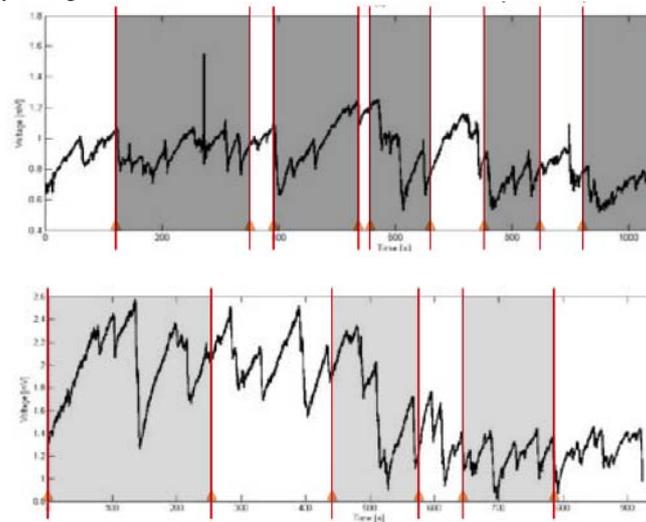


Figure 5. Examples of GSR signal

The within subject analysis shows no clear indication of the soundtrack having any effect on arousal per participant. For the in-between subject analysis there were no noticeable similarities in the pattern of the same conditions making it unclear if arousal was effected by the soundtrack or the lack of soundtrack. There was also no clear difference in the pattern between the conditions of with and without soundtrack which does not provide a clear effect of soundtracks on arousal.

In all four conditions, the GSR signal of each participant contained moments of higher arousal but which were at different moments in time. The signal varied a lot between participants which made it harder to analyze. Some were fluctuating little where as others fluctuated a lot.

5. Discussion

The goal of this research was to show to what extent playing a fitting soundtrack can enrich the reading experience, focusing on measuring imagery, transportation attention and arousal. The hypothesis was that the reading experience complemented by the soundtrack will have higher responses on the 5 point Likert scale on all three measures, compared to the same story without the soundtrack. In terms of arousal, there should be a clear pattern in the signal showing a higher arousal rate in passages accompanied with soundtracks then without.

The questionnaire results and arousal measurements do not confirm the hypothesis of soundtracks having an enriching role during reading. The results show that the way the soundtracks where used throughout this test set up, they distracted more times than positively enriched the reading experience. But there were moments where the soundtracks did positively enrich the reading experience as mentioned by the extra remarks given by the participants.

The t-test does show that the higher value for imagery in “Fatal love” with soundtrack is significant. This confirms the hypothesis for one subscale for one story. It was mentioned that “End of days” is easier to imagine because it has a typical movie type of story. The previous experience with such movies makes it easier to imagine. This suggests that the soundtrack has less value if the scene is already clear. This fits with another statement made by one of the participants that one soundtrack emphasized the passage too much.

One of the main factors that contributed to the negative experience was the mismatch between the mood of the soundtrack and passage. The transition into the soundtrack not being timed perfectly and slowly introduced caused distractions as well. On top of that, some of the soundtracks started too sudden and finished abruptly distracting the reader.

The imagery, transportation and attention scales were appropriate for the set up. They represented well the essence of a reading experience. What could have given more depth to the research was to ask the reader to judge on the 5 point Likert scale how well each soundtrack fit its passage. This data was mentioned by some when interviewed for extra remarks but these answers were vague and not comparable. Preferably every soundtrack should be rated on its match to the passage right after the soundtrack finished, in order to get the most recent impression out of the reader. This creates a problem because doing so would disrupt the reading experience, taking the reader out of the story, intruding on the overall reading experience that is being tested for.

It is not clear to what extent liking the content, the way the story is written, influences the three subscales. The overall rating of the three subscales for “Fatal love” with soundtrack is higher than the one without but the rating of liking the way the story is written is higher for the condition without sound then with. These are counterintuitive results. This is an interesting result worth exploring in future work.

The extra remarks given by the participants and the responses to the question “the soundtrack was disturbing the reading” indicates a subtle mismatch of the soundtrack with the passage can have a lasting negative effect on the reading experience.

The biggest issue with the objective measurements was the wide variation in the pattern which makes it impossible to draw conclusions. It is unclear if it is normal for the GSR among the participants to vary so much or if the sensors were not placed correctly (too tight or too loose). The activity performed by the participants before being tested could have influenced the GSR, for example having biked caused sweating and the body did not have enough time to get back to its natural state. Another setback of the sensors is that a movement performed by any limb was reflected in the data adding noise. Taking a deep breath was also registered by the sensors although having nothing to do with arousal. The participant was not asked to keep their hand still because that would impose their natural way of reading, adding a new variable which could influence the results.

The noticeable difference in Figure 3 of increase in Imagery and attention could indicate that the soundtrack was more distracting in “End of days” than “Fatal love”. But that does not fit the result in Figure 4 where the soundtrack is rated as more distracting in “Fatal love” than in “End of days”. The problem with this comparison is that no participants read both stories with sound.

The low number of participants plays a big role in the undefined results. Every extra participant could change the results dramatically. The reason for the counterintuitive results mentioned earlier could be because of an imbalance of opposing participants.

6. Conclusion and Future work

Although the results do not indicate the reading experience was enriched, it also does not indicate that it completely ruins the experience. Sound has been proven to enrich the experience [19, 20] but with ambient sounds rather than dramatic soundtracks. The Listen reader gave control over the sounds in an unobtrusive way, allowing the reader to stay immersed in their reading while being able to evoke the sounds at the desired moment. This unobtrusive control should be the focus point of the next study. Giving more control to the user will get rid of the enforcing nature of the current set up which contributed to the negative experience.

Many participants stated that the music not being continuous caused distractions, by the sudden change from silent to loud, and vice versa. It is interesting to note that it was mentioned that the lack of music emphasized the silence which was also distracting. There is something about sudden changes in the environment that causes distractions, gets the reader out of the story. This suggests that in future research, the soundtrack should be designed to play throughout the whole story as done with the Listen reader.

The loudness of the music is very important. The user should have full control over this property. On the other hand, with a soundtrack playing throughout the whole story, the volume should vary automatically, playing softer during passages that are less dramatic.

This set up mainly focused on using soundtracks to emphasize the mood of the passage. The ability to build up tension with music was less addressed and should be implemented in the future research. The reason why this is harder to implement is because of the difference in reading speed. A movie is designed to be watched at a specific speed by everyone. The soundtrack is specially adapted to fit that

speed. If one were to speed up the image but leave the soundtrack as it is, the music would soon desynchronize, losing its expressiveness and power to complement the movie.

Not only should the choice of soundtracks be facilitated by an expert, film composer, but the soundtrack has to be designed to adapt towards the reading speed of the reader. One suggestion would be to divide the soundtrack into short samples that can be looped. This way every reader would have the buildup of the soundtrack synchronized with the story avoiding mismatch of soundtrack and passage.

The opportunity of adding dramatic soundtracks to e-books is interesting and is worthwhile to explore further by implementing an interface which gives control to the reader in an unobtrusive way and maybe even choice of soundtracks.

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