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The effect of background music in documentaries on viewers' mood states, risk perception and retention of content

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Student:
Marissa Peters

Supervisors:
Dr. H. van der Meij
J. Steinrücke MSC

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My final master thesis “The effect of background music in documentaries on viewers’ mood states, risk perception and retention of content” lies in front of you. During the challenging period of September 2018 up to July 2021, I have worked to complete my master’s degree in Educational Science and Technology. This thesis was the final product of my master’s education at the University of Twente.

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Please enjoy reading.

Marissa Peters
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Summary

Technology in general, and video in particular, is playing an increasingly important role in the field of educational science and educational programs (Li, Li & Franklin, 2016). This study investigates a factor that might contribute to people's emotional response to, and retention of, video content: background music. The study uses a documentary to investigate the impact of different kinds of background music (or none).

The research question is: "What is the effect of different types of background music in documentaries on viewers' mood, risk perception and retention?" This study searched for an answer to this research question by conducting an experiment containing three conditions. The two experimental conditions had to watch a video clip about climate change set to either ominous or uplifting background music, while the control condition heard no music at all. Questionnaires were administrated to determine respondents' mood states, and risk perception of climate change. Retention was assessed with a knowledge test. Quantitative data was analyzed through the use of IMB SPSS Statistics version 24, which subsequently was used to determine any between-group differences. A key finding was that background music had a significant effect on mood states. Participants who had viewed the video with ominous music gave higher ratings for their negative mood states than did participants in the two other conditions. The direct effect of background music on viewers' risk perception was only small and insignificant. However, when investigating a so-called moderator effect, a significant effect of background music on risk perception was found through a higher negative mood state. The results showed no direct effect of background music on retention.

Keywords: instructional video, background music, mood state, risk perception, retention, learning

Samenvatting

Technologie in het algemeen, en video in het bijzonder, speelt een steeds belangrijkere rol op het gebied van onderwijskunde en educatieve programma's (Li, Li & Franklin, 2016). Deze studie onderzoekt een factor die mogelijk kan bijdragen aan de emotionele reactie van mensen op, en de retentie van, video inhoud: achtergrondmuziek. Het onderzoek gebruikt een documentaire om de impact van verschillende soorten achtergrondmuziek (of geen) te onderzoeken.

De onderzoeksvraag luidt: “Wat is het effect van verschillende soorten achtergrondmuziek in documentaires op de stemming, risicoperceptie en retentie van kijkers?” In dit onderzoek is gezocht naar een antwoord op deze onderzoeksvraag door een experiment uit te voeren met drie condities. De twee experimentele condities moesten een videoclip bekijken over klimaatverandering met ofwel onheilspellende ofwel opbeurende achtergrondmuziek, terwijl de controleconditie helemaal geen muziek hoorde. Er werden vragenlijsten afgenomen om de stemmingstoestanden van de respondenten en de risicoperceptie van klimaatverandering te bepalen. Retentie werd beoordeeld met een kennistoets. Kwantitatieve gegevens werden geanalyseerd met behulp van IMB SPSS Statistics versie 24, die vervolgens werd gebruikt om eventuele verschillen tussen groepen te bepalen. Een belangrijke bevinding was dat achtergrondmuziek een significant effect had op gemoedstoestanden. Deelnemers die de video met onheilspellende achtergrondmuziek hadden bekeken, gaven hogere beoordelingen voor hun negatieve gemoedstoestand dan deelnemers uit de twee andere condities. Het directe effect van achtergrondmuziek op de risicoperceptie van kijkers was slechts klein en insignificant. Bij het onderzoeken van een zogenaamd moderator-effect werd echter een significant effect van achtergrondmuziek op risicoperceptie gevonden door een hogere negatieve gemoedstoestand. De resultaten toonden geen direct effect van achtergrondmuziek op retentie.

Steekwoorden: instructievideo, achtergrondmuziek, gemoedstoestand, risico perceptie, retentie, leren

Introduction

Music nowadays has become an indispensable part of a movie. Despite the lack of empirical research into the effects of music in films, it is used widely around the world today. Even at an early stage, when the movie industry as we know it was in its infancy, and silent movies were being developed, the power of music came to light. When live music was added to a silent movie, the emotions of the audience were found to be triggered and amplified. Ever since, music has been used as a means of evoking certain emotions in movie viewers. Therefore, it comes as no surprise that the famous producer Quincy Jones (Score Documentary, 2016) describes music as 'emotion lotion'. He states that seeing a character walking down a dark alley is not what scares people. The scare arises when the event is accompanied with ominous music; only when music is added to the scene viewers really start to feel anxious for the movie character. The right combination of tones in a musical piece can unite a group of strangers in a movie theater, says Jones. After establishing its place within the entertainment industry, the question arose whether music could also fulfill a similar role in the infotainment industry, such as documentaries (Score Documentary, 2016).

With an increase in the use of background music (or music in short) in many different sectors (such as advertising, stores), more and more research is being conducted into the possible effects of music. Numerous studies cite the positive influence of music on the brain and on behavior (Yamasaki et al., 2016; Madjar et al., 2020; Bellier et al., 2019) While it is not exactly known how the brain responds to music, it is clear that a lot is going on in the brain when someone is listening to music. Music stimulates areas of the brain that are involved in, among other things, emotions, motor skills, memory and language. For instance, music can activate. Think of athletes who listen to music with a loud and steady beat to boost themselves before a game. In addition, it can trigger memories, provide relaxation, lower blood pressure and reduce stress. An example of the latter type of effect comes from the use of music in healthcare. Music provides a demonstrable reduction of a patient's anxiety just before undergoing a surgical procedure (Bradt et al., 2013). Moreover, music can not only have a positive effect for patients, but also for doctors and other practitioners. Studies have showed that music increases the focus of doctors during surgery (Yamasaki et al., 2016), and a reduction in anxiety was found among nursing students when background music was played while performing certain nursing tasks (Ince & Çevik, 2017).

Although the positive effect of music in general has been proven, less is known about the role of factors such as type of music, the volume and the music preference of the listener.

A majority of empirical studies on the influence of music has looked at the effects of subdued instrumental music. Classical music and slow-paced musical pieces are most commonly associated with the positive results (Bonny, 1986; Anyanwu et al., 2016).

Music is also often used by pupils during studying. This fact has not escaped the attention of researchers. For example, students have been found to use music to increase their focus on academic tasks (Kotsopoulou & Hallam, 2010) and to ensure that they are calm and relaxed. More broadly, music appears to be increasingly used in instruction. However, little is known about its effects on the learning processes. To get a better understanding of how people digest music, one should look at how music is processed in working memory. In Baddeley's (2007) model of working memory, the phonological loop is the memory component through which music is processed. Because this component is also responsible for processing all other auditory and verbal information, conflicts between these kinds of information may arise. In other words, music can inhibit the processing of other information that uses the same channel. Baddeley also distinguished the visuo-spatial sketchpad for the processing of visual information. This information processing channel is separated from the phonological loop, but it is assumed that visual and auditory information can sometimes reinforce each other. In view of the processing capacity of people, the present study revolved around a multimedia product (video) that did not employ spoken text. There was only background music to avoid a competition for memory space with spoken text. It was decided to occasionally, and to a limited extent, present on-screen text (visually) because this information was deemed necessary to tell the story of the video.

In the experimental study that is reported, a documentary about climate change is presented to the audience. The documentary contains different kinds of background music in various conditions. In one condition, the documentary includes positive or optimistic background music. In another condition, the background music is darker in tone intended to yield more pessimistic views. In a third (control) condition the documentary is played without any background music. The effects of the manipulation of background music on the following variables are measured: mood states, risk perception and retention.

Theoretical framework

Multimedia instruction.

In the experimental study that is reported, a documentary about climate change is presented to the audience. Documentaries are a form of multimedia instruction in which visual images are presented together with spoken words and possibly background music.

According to van Merriënboer (1999) little is known about the combination of audio, screen texts, and illustrations in video. Moreover, the limited number of existing studies show conflicting results. There are many media forms that appear to have a single format. For instance, books are visual, and podcasts are auditory. However, the human mind processes these systems in combination. A visual activity like reading a book for example, will also activate the auditory systems as we 'hear' the sentences in our head (Noetel, Griffith, Delaney et al., 2021). Similarly, when listening to the radio or a podcast, the visual system might present a 'picture' in our mind of what we hear. Baddeley's (2007) model of working memory endorses this linkage between systems while also distinguishing a primary one for auditory and verbal information (i.e., the phonological loop) and a memory component that is responsible for processing visual information (i.e., the visuo-spatial sketchpad). In the same vein, Mayer's (2008) cognitive theory of multimedia learning claims that learning can be more effective when complementary information is presented to both the visual channel as well as the auditory channel.

A beneficial complementary effect may or may not occur when a multisensory learning environment is involved (Hibbert, 2014). Many documentaries provide viewers with an additional challenge by the presence of background music. Music creates a complex situation since music and spoken words (verbal information) are both processed through the same channel, the phonological loop, which may induce conflicts (Baddeley, 2007). In other words, background music can inhibit the processing of other information that uses the same channel.

Background music.

When can background music have a beneficial effect? One situation in which this may occur is when there is little or no other auditory information. That is, when there is no spoken voice that competes for memory space (Baddeley, 2007). Another beneficial situation may occur when there is congruity between the music and the visual information. According to the Congruence-Association Model by Cohen (2013) the effects of music are overall integrative (Rogers & Gibson, 2012), in which type of music is emphasized. Generally speaking, the

human mind expects music to exhibit a certain synchrony and congruity to the visual information depicted in the movie or documentary. According to the Congruence-Association Model by Cohen (2013) the brain receives input from two sensory sources of structure. First there is acoustic, or musical structures, such as beat and rhythm. Second there is optical, a visual structure, such as objects moving on the screen, cars driving by, balloons in the air etc. Our mind cannot pay equal attention to everything that is coming through. Therefore, it is plausible that de brain directs most of its attention to the shared structural (congruent) patterns.

The meaning of music is another important aspect of the model. Music provokes certain associations. Congruence and association together can explain why a certain image or action can be interpreted a specific way accompanied by one music score, and in a completely different way when accompanied by another (Cohen, 2013).

In addition, as music communicates a mood state, it is capable of carrying semantic and content-related information that can activate a specific schema (Shevy, 2007). Schemas are prototypical cognitive structures that represent concepts or events (Score Documentary, 2016). The schema concept is known in educational design theories, but that is not an exclusive domain. Schemas are just as important in other areas as well. Film is no exception. Schemas can be found in some of the most popular musical pieces in films (e.g., Lord of the rings, ET, Close Encounters). Joseph Trapanese from the Score documentary (2016) explained that films have schemas too. To introduce such a schema, a motif is frequently used. This motif then becomes something familiar for the audience. A motif is a group of notes that represent the highlight of a film score comparable to the motifs in a symphony. Beethoven was one of the first composers to take a theme or a motif and spin it out in a huge way (Debney, 2016). Motifs are usually simple tunes, almost like pop songs that repeatedly are introduced in slightly different ways. Thus, a motif becomes a common thread in the movie that helps the audience in understanding the relationships between events and facilitates them in following the overall story. When the movie comes to an end, and the music is playing the motif in full glory, it is already familiar to the audience and therefore activates memories which in their turn may elicit certain emotions. Therefore, when music evokes a schema, it can contribute to building of a mood-coherent audiovisual narrative.

Music and mood.

One of the fundamental aspects of music, is that it can trigger emotions (Eladhari, Nieuwdorp & Fridenfalk, 2006). An emotion is an inner experience or movement of the mind that is

evoked by a certain situation (such as listening to music), or that can occur spontaneously (Frijda, 1986). Emotions are subjective experiences that are associated with physical reactions, facial expressions and behavior. Emotions can be perceived as positive or negative according to Cook, Roy and Welker (2018). This makes it possible to use music as a tool that can strengthen or weaken a mood or tendency to act beyond that of eliciting certain emotions.

To classify emotions, Watson, Clark and Tellegen (1988) developed the Positive And Negative Affect Schedule (PANAS) questionnaire. The PANAS is a widely used 20-item self-report measure for assessing positive and negative emotions or affect experiences (Serafini et al., 2016; Crawford & Henry, 2004). Positive Affect reflects the degree to which a person feels pleasantly alert (e.g., pleasure, joy). Negative Affect reflects the other side of an experience namely the degree to which someone experiences distress (e.g., anger, fear).

Because music can have such a powerful emotional effect, people have used it to influence their mood states (Cook et al., 2017). For instance, students often use music during study in order to increase their task concentration (Kotsopoulou & Hallam, 2010). This usage of music accords with the finding that instrumental background music may positively affect attention in the workplace (Shih et al., 2012). In line with this, Giles (1991) further adds that many people function better in a learning environment when it presents background music that makes them happier and more relaxed. She found that the most effective music is that which a person likes. Tamir (2009) adds that although people might want to increase positive emotionality to achieve a specific goal, a negative emotionality sometimes may better fit a specific goal. Specifically, Tamir claims that it may be useful to employ music to evoke negative emotions such as sadness, anger and fear in order for them to achieve a certain goal. A case in point is the finding in a study by Tamir, Mitchell and Gross (2008) that people were more willing to engage in a confrontational videogame after listening to anger-inducing music. According to the instrumental account, participants are open to experiencing unpleasant emotions when pursuing a certain goal that only unpleasant emotions can promote. This finding fuels the view that music can serve as a tool for emotional persuasion that in turn influences perception and learning.

Risk perception.

A domain in which emotional persuasion can play a major role is risk perception.
Risk perception is about the subjective appraisal of people towards a given risk in both its characteristics and severity. In the present study, the risk perception pertains to the hazards of global climate change. Early theorists about risk perception like Zajonc (1980) stated that

rational decision-making processes are guided by the affective reactions people exhibit towards certain stimuli. These emotional responses often arise prior to cognition and play a crucial role towards rational thought processes (Leiserowitz, 2006). Epstein (1994) believes that the affective feelings that people hold have a direct role in motivating behaviour (and subsequent learning). Feeling good about a given situation leads to lower risk perception, whereas feeling bad about a given situation leads to higher risk perception (Finucane, Alhakami, Slovic & Johnson, 2000).

Following this reasoning, the tested prediction in the present study is that, more so than uplifting or no music, ominous music increases the presence of negative mood states. This in turn raises perception of the risk of climate change, increases the motivation to learn and eventually yield a higher level of retention. The underlying assumption is that an effect on learning is present when the mood state fits the requested goal. In this specific research, ominous music is expected to lead to a negative (sad) mood, which leads to higher risk perception, which leads to higher motivation, in their turn leading to better learning outcomes.

Research questions and models

The aim of this current study is to investigate the effects of a certain type of music (e.g., uplifting or ominous) on the viewers' mood states, risk perception and retention of learning content. Participants are randomly assigned to one of three conditions. The participants are viewing a video accompanied by ominous music (condition 1), a video with uplifting music (condition 2), or a video with no music at all (condition 3). The video deals with the topic of climate change as this domain represents an area that is likely to be affected by risk perceptions. This thesis addresses the following main research question:

What is the effect of different types of background music in documentaries on viewers' mood states, risk perception and retention of learning content?

The following hypotheses guided this research.

1. Following the Congruence-Association Model by Cohen (2013), it is hypothesized in this study that uplifting music will have a positive effect on the variable mood states, whereas ominous music will have a negative effect on the variable mood states.
2. It is hypothesized that a negative mood will increase people's risk perception. More specifically, it is hypothesized that viewers will perceive the current climate change as more threatening and scarier when ominous music is being played instead of uplifting music or no music.
3. It is hypothesized that retention of the learning content will be higher when listening to ominous music while watching the relevant fragment of the documentary compared to listening to uplifting music or no music due to the concept of risk perception.

Method

Design.

This study is an experimental quantitative research design. This experimental study used a between-subject design with type of music as the independent variable and mood states, risk perception and retention as the dependent variables. The independent variable consisted of three levels: the presence of ominous music, uplifting music, or no music.

Respondents.

Participants (N=127) were recruited via an online invitation through convenience sampling. The online invitation mentioned some information about the researcher and the purpose of this study. Inclusion criteria were having a minimal age of 18 years old and having a phone or laptop/computer with a working internet connection. Due to not finishing the survey, 43 participants were omitted from this study, leaving 84 participants. The variable age was divided into cohorts of years (see Table 1 in Appendix A). Within the remaining group of 84 participants, the most common age, the mode, was between 25 and 34 (N=26) and the median between 35 and 44 (N=11). The study contained 26 males and 57 females (see the distribution among conditions in Table 2 in Appendix A). One participant did not fill out the demographical information. Since all other questionnaires critical to this study were filled out, it was not considered necessary to remove this participant. The most common level of education was higher professional education (hbo) (N=37). The lowest level of education was senior general secondary education (havo) and the highest level of education was Doctorate/PhD. The distribution of level of education among conditions is displayed in Table 3 in Appendix A.

People who agreed to the conditions stated in the informed consent were randomly assigned to one of three conditions by the program Qualtrics, which resulted in 28 participants per condition. After a condition was assigned, viewers were showed the corresponding documentary and were given the online questionnaires to fill out. Participants (N=84) were all from the Netherlands. This study was approved by the ethical commission of the faculty BMS of the University of Twente.

Materials.

Evaluation to substantiate choice of music.

The video that was used in all three conditions of this study was accompanied by either ominous, uplifting or no music. To assess the ominous or uplifting nature of the music, an evaluation by two independent musical experts was performed during the early stages of this study. First, they were asked for key components in music that could affect the listeners' mood states. According to the experts, a piece of music usually consists of five parts: melody, harmony, rhythm, form, lyrics. All these facets can influence the mood states of the recipients. In addition, the particular instruments that are used in the music can affect the influence of music on the listeners' emotions. Next, the experts were asked to analyze three pre-selected samples of ominous and uplifting music on the factors of melody, harmony, rhythm, form and instruments. Because no lyrics were used, this feature was omitted. The experts classified each piece of music on these features without knowledge of the goal of the study. Finally, the pre-selected were ranked as examples of ominous and uplifting music. The pre-selected pieces of music were chosen by the researcher and supervisor who also ranked these for being ominous and uplifting.

Ominous music.

Sad or ominous music is mostly written in a minor scale. The melody tends to be soft and gradually develops in small intervals with a rather slow BPM of 60 – 90. As for form, musical pieces that use an interaction between paragraphs with hope and paragraphs with despair give a stronger sad feeling than musical pieces that are sad from beginning to end. The instruments that are considered saddest are the woodwinds family. The versatile violin follows as it can trigger many different emotions. Piano and soft string instruments are also an option for melody.

Out of the three ominous pieces (The gravel road, Despair, Rue's farewell), "Rue's farewell" composed by James Newton Howard (James Newton Howard - Topic, 2018) was chosen by both experts as well as the two researchers. The music can be described as a sad piece with a three-paragraph construction evolving from low and dark, to a sad melody, growing into an ending of violins and strong and bright notes that allow you to release your sadness.

Uplifting music.

Happy or uplifting music is mostly written in a major scale. The melody tends to be strong and develops fast with large intervals. The rhyme of the melody usually is fast and lively,

with many different note lengths and patterns with a fast tempo. According to the experts, uplifting songs have less conventional guidelines compared to the sad/ominous pieces. The instruments that are considered happiest are the brass family, followed again by the versatile violin. Piano and strong string instruments are great for both melody and company. Additionally, percussions are a strong plus in many uplifting musical pieces as they lift the spirits and add some energy to a song.

From the three uplifting pieces (Circles, A new dawn, Moving forward), "Moving forward" composed by Mikael Manvelyan (Mikael Manvelyan - Topic, 2020) was chosen by both experts as well as the two researchers. The music can be described as a piece with a base of a clean and simple melody and drum rhythm. As the piece develops, instruments are added which gives the music a bit more energy.

Questionnaire prior knowledge.

Since measuring the exact prior knowledge of participants on climate change is not feasible, this study asked participants to estimate their prior knowledge on climate change before taking part in the experiment. This was done by a short questionnaire (which can be found in Appendix B) using a 5-point Likert scale ranging from 1 (nothing at all) to 5 (very much) (e.g., How much do you know about the effects of climate change on our daily lives?). A conducted reliability analysis on the prior knowledge questionnaire showed a Cronbach's Alpha (α) of 0.861. It was decided later on in the study to not use the data of this particular questionnaire.

Fragment of film with or without ominous or uplifting music.

Documentaries about climate change or aspects of climate change (e.g., An Inconvenient Truth, Chasing Coral, Fire in Paradise, Before the Flood) were evaluated to see if there were already any videos that could be used in the study. An existing video commercial of the WWF was eventually chosen for the basis because it was a perfect combination of all different aspects of climate change. On top of that, it had a professional look-and-feel to it that we might have been not able to achieve with a self-developed video. From that source, a video fragment of about two minutes was selected and written information about climate change was added. The resulting video alternates between images and written information about climate change. This format was used to offer an attention-grabbing video where viewers' emotions are triggered by images and a certain type of music, followed by learning material and a certain type of music. The video of 2 minutes and 19 seconds was suitable for presentation on a laptop, computer or smartphone.

The video starts off with an image of a big pile of plastic garbage. The music, if present, starts immediately. The video is an enumeration of short images of our earth showing melting ice, drought, animals, (air)pollution, natural disasters etcetera, as illustrated in Figure 1.

Figure 1: Stills video enumeration of images

In between fragments, some facts (mostly in line with the image showed before) are mentioned about the effects of climate change on our planet. As can be seen below in Figure 2, these facts were presented as text written in a white font presented on a black background. The text did not cover an image to avoid distracting participants from reading the text (or processing the visual). Written text instead of a spoken narrative was used to prevent a processing conflict in the phonological loop (not a simultaneous presentation of music and spoken narrative).

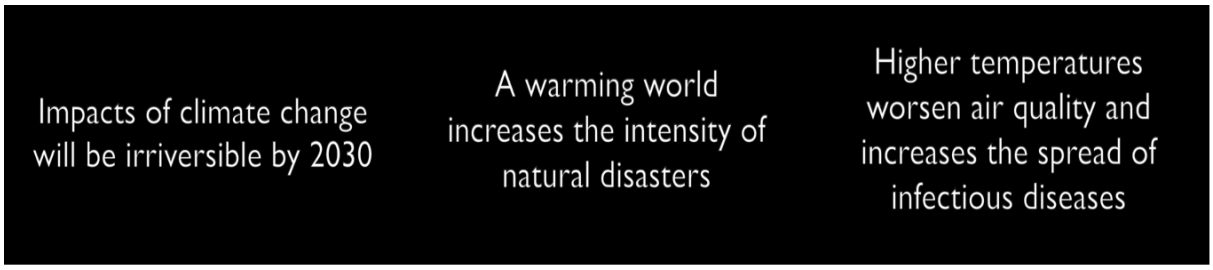

Figure 2: Stills video climate change facts (Facts retrieved from ecotricity.co.uk)

Questionnaire mood.

Participants' mood states towards climate change were measured with the Positive And Negative Affect Schedule (PANAS). PANAS is a widely used 20-item self-report measure of positive and negative affect (Serafini et al., 2016). PANAS was developed in 1988 by Watson, Clark and Tellegen and provides independent measures of Positive Affect (PA) and Negative Affect (NA) (Crawford & Henry, 2004). The PA component represents the extent to which a person feels pleasantly alert, while the NA component represents subjective distress encompassing states such as anger and fear. PANAS consists of 10-item mood scales for PA

as well as 10-item mood scales for NA. Its items were derived from the Zevon and Tellegen's mood checklist (Zevon & Tellegen, 1982). Emotions regarding the PA scale are: attentive, active, alert, excited, enthusiastic, determined, inspired, proud, interested, strong. Emotions regarding the NA scale are: hostile, irritable, ashamed, guilty, distressed, upset, scared, afraid, jittery, nervous. Respondents were asked to rate the extent to which they experienced each particular emotion while watching the video, using a 5-point Likert scale ranging from 1 (not at all) to 5 (very much) (Appendix C).

The reliability of the PANAS has been found to be very high in previous studies (Ostir, Smith, Smith & Ottenbacher, 2005). The reliability of the PANAS in the present study was good with a Cronbach's Alpha (α) of 0.865 for PANAS PA and a Cronbach's Alpha (α) of 0.888 for PANAS NA. This meets the desired minimal Alpha for psychological constructs ($\geq$0.65; Vaske, Beaman & Sponarski, 2017).

Questionnaire risk perception.

Participants' level of risk perception was assessed with a short questionnaire that contained 5 questions about the risks of climate change (see Appendix D). According to Sjöberg, Moen and Rundmo (2004) risk perception is a subjective assessment of the probability that a specified type of accident is likely to occur and an evaluation of how concerned people are with the consequences. Participants were asked to assess the risk for specific climate situations, using a 5-point Likert scale ranging from 1 (very unlikely) to 5 (very likely) (e.g., How likely do you think it is that we experience a major ecological catastrophe if things continue on their present course?). A reliability analysis on the risk perception questionnaire showed a Cronbach Alpha (α) of 0.863.

Retention test.

Participants' retention was measured with a test that measured recall of the facts presented in the written text in the video. The test contained 4 multiple choice questions and 1 open question. The multiple-choice questions (e.g., How many species are at risk of extinction by climate change?) (e.g., How many percent of coral reefs have died in the last 30 years?) had 3 answers alternatives. Participants could earn one point per correct answered multiple-choice question. The open question (e.g., Name 4 reasons why climate change is detrimental for human life too.) could yield 4 points, one for every correct reason that participants mentioned. All the correct answers to the questions could be extracted from the video. The complete test and score sheet can be found in Appendix E and F.

A reliability analysis on the retention test showed a Cronbach's Alpha (α) of 0.535.

Procedure.

The study was carried out online. After clicking the link in the invitation, participants were randomly assigned to one of the three conditions by the program Qualtrics. After a short instruction on how to progress through the experiment, the program led the participants to start of the experiment. First, all participants were asked to estimate their prior knowledge on climate change by filling out the prior knowledge questionnaire. Next, participants were invited to view the 2.19-minute video about climate change. Participants were randomly assigned to a condition by Qualtrics. Depending on the condition, the video contained ominous music, uplifting music, or no music at all.

Thereafter, the mood questionnaire was introduced and administrated. This was followed by an introduction and administration of the risk perception questionnaire, and the retention test. Finally, some demographic information was gathered (e.g., gender, age, educational background). Participants were then thanked for their participation and were asked to provide their e-mail address in case they wanted to participate in the ballot for winning a National green gift card of 20 euros.

Data analysis.

The data were analyzed by the use of IMB SPSS Statistics version 24. All data regarding the mood questionnaire, risk perception questionnaire and retention test were transferred from Qualtrics to SPSS and recoded when necessary.

Frequency analyses were used to analyze the demographic information and the distribution within the three conditions. The distribution of age, gender and level of education over the different conditions was determined by means of a Chi^2 test and can be found in Appendix A. No significant confounding variables were found. Additionally, the reliability of the questionnaires and test was assessed by determining the homogeneity, or internal consistency, presented by Cronbach's Alpha (α).

Subsequently, between-group differences were analyzed using two-tailed t-tests and ANOVA tests using a significance level of 0.05. The Bonferroni test was also applied. Bonferroni's adjustment was calculated by taking the alpha value (0.05) and dividing it by the number of tests, 3. Departing from a 5 percent error rate, three significance tests would yield an error rate of 0.017.

Results

Mood PANAS Positive Affect (PA)

In order to determine a potentially significant difference in positive mood states between the three different conditions, a one-way ANOVA was conducted. The ANOVA showed that there was a significant difference between groups, ($F(2,81) = 4.175$, $p = 0.019$). Participants in the ominous condition gave higher ratings on the PANAS PA-scale ($M = 2.92$) than did participants in the uplifting condition ($M = 2.68$) and participants in the no music condition ($M = 2.37$). Table 1 shows the findings.

A Bonferroni post hoc test showed that the ominous condition scored significantly higher on the PANAS PA than the no music condition ($p = 0.015$). No significant difference was found between the ominous condition and the uplifting condition ($p = 0.607$) or between the uplifting condition and the no music condition ($p = 0.341$).

Table 1
PANAS Positive Affect for conditions

Condition	**N**	***Mean***	***SD***
Ominous	28	2.92	0.66
Uplifting	28	2.68	0.77
No music	28	2.37	0.71
Total	84	2.66	0.74

The Mean (M) was based on a scale with a minimum score of 1 and a maximum score of 5. The higher the score, the bigger the effect.

Mood PANAS Negative Affect (NA)

In order to determine a potentially significant difference in negative mood states between the three different conditions, a one-way ANOVA was conducted. The ANOVA showed that there was a significant effect of condition, ($F(2,79) = 4.628$, $p = 0.013$). Participants in the ominous condition gave higher ratings on the PANAS NA-scale ($M = 2.97$) than did participants in the uplifting condition ($M = 2.36$) and participants in the no music condition ($M = 2.39$). Table 2 shows the findings.

A Bonferroni post hoc test showed that the ominous condition scored significantly higher on the PANAS NA than the uplifting condition ($p = 0.026$) A significant effect was also found between the ominous condition and the no music condition ($p = 0.035$) No difference was found between the uplifting condition and the no music condition ($p = 1.000$).

Table 2
PANAS Negative Affect for conditions

Condition	**N**	***Mean***	***SD***
Ominous	27	2.97	0.78
Uplifting	28	2.36	0.73
No music	27	2.39	0.98
Total	84	2.57	0.88

The Mean (M) was based on a scale with a minimum score of 1 and a maximum score of 5. The higher the score, the bigger the effect.

Risk perception

In order to determine whether there was a significant difference in risk perception between conditions, a one-way ANOVA was conducted. The ANOVA showed that there was a small, insignificant difference between conditions ($F(2,81) = 0.603$, $p = 0.550$). Participants in the ominous condition gave a slightly higher rating for risk perception ($M = 4.08$) than participants in the uplifting condition ($M = 4.01$) Participants in the no music condition gave the highest risk perception ratings of all three conditions ($M = 4.22$). Table 3 shows the findings.

A Bonferroni post hoc test showed no important differences between the three conditions with $p = 0.860$ between the uplifting condition and the no music condition, and $p = 1.000$ between the ominous condition and the uplifting condition, and between the ominous condition and the no music condition.

Table 3
Risk perception for conditions

Variable	**N**	***Mean***	***SD***
Ominous	28	4.08	0.88
Uplifting	28	4.01	0.57
No music	28	4.22	0.68
Total	84	4.10	0.72

The Mean (M) was based on a scale with a minimum score of 1 and a maximum score of 5. The higher the score, the bigger the effect.

Retention

A one-way ANOVA showed that there was no significant effect of condition on retention, ($F(2,81) = 0.195$, $p = 0.823$). Participants in the ominous condition scored slightly higher on retention ($M = 0.64$) than participants in the uplifting condition ($M = 0.60$) and participants in the no music condition ($M = 0.63$) These differences however, were negligible. Table 4 shows the findings.

A Bonferroni post hoc test showed no difference at all with $p = 1.000$ between all conditions.

Table 4
Retention for conditions

Variable	N	*Mean*	*SD*
Ominous	28	0.64	0.29
Uplifting	28	0.60	0.22
No music	28	0.63	0.21
Total	84	0.62	0.24

Mood as moderator for risk perception

In order to test whether there might have been a moderator effect on risk perception, a linear regression was conducted with 'risk perception' as the dependent variable, and 'condition', 'PANAS PA', and 'moderator effect' as independent variables. This analysis showed that these variables had no significant effect on risk perception ($F(3.80) = 1.02$, $p = 0.389$).

The linear regression with 'risk perception' as dependent variable and 'condition', 'PANAS NA' and 'moderator effect' as independent variables was significant, however ($F(3.80) = 5.99$, $p = .001$). 18.3 % of the variance in 'risk perception' could be explained through 'PANAS NA' and 'moderator effect'. The regression coefficient of 'PANAS NA' was 0.274 and significant ($t(80) = 3.30$; $p = .001$). The regression coefficient of 'moderator effect' was -0.226 and significant ($t(80) = -3.18$; $p = .002$).

Mood as moderator for retention

In order to test whether there might have been a moderator effect on retention, a linear regression was conducted with 'retention' as the dependent variable, and 'condition', PANAS PA', and 'moderator effect' as independent variables. This analysis showed that these variables had no significant effect on retention ($F(3.80) = 0.278$, $p = 0.841$). Substituting 'PANAS PA' for 'PANAS NA', also yielded no significant effect ($F(3.80) = 0.884$, $p = 0.453$), which eliminates the possibility of a moderator effect on retention.

Discussion

Discussion of findings.

The main research question of this study was if different types of background music (uplifting or ominous) influence the viewers' mood states, risk perception and retention. An answer was sought by conducting an experiment involving three conditions. In two experimental conditions participants viewed a video clip on climate change that held ominous or uplifting music. In the control condition participants viewed the video clip without any background music.

A significant effect of background music on mood states was found. Participants who had viewed the video with ominous music gave higher ratings for their positive mood states than did participants in the control condition. These participants also gave significantly higher ratings for their negative mood states than did participants in the two other conditions. These results are in line with our expectations and with previous studies, whose findings fueled the idea that music can serve as a tool for emotional persuasion (Cook, Roy & Welker, 2018; Cook et al., 2017; Tamir, 2009), can be perceived as positive or negative, and can strengthen or weaken a mood state (Cook, Roy & Welker, 2018). The finding of a higher rating of negative mood states also accords with the study of Tamir (2009) which found that participants are open to experiencing unpleasant emotions when pursuing a goal that only unpleasant emotions can promote. In other words, employing music to evoke negative emotions such as sadness, anger and fear may be useful in order for people to achieve a certain goal.

We had also expected that ominous music would increase the risk perception as a result of having experienced a higher negative mood state. That experience would induce participants to perceive the current climate change as more threatening and scary. When investigating this so-called moderator effect, results indeed showed a significant effect of type of music on risk perception. Besides the fact that the results are in line with a moderator effect, they are also in line with previous studies whose findings addressed that feeling bad about a given situation (climate change in this case) leads to higher risk perception (Finucane, Alhakami, Slovic & Johnson, 2000). The direct effect of background music on viewers' risk perception, however, was only small.

The results showed no direct effect of background music on retention. It was hypothesized that retention would be higher when listening to ominous music compared to listening to uplifting music or no music. This hypothesis was guided by previous studies (Leiserowitz, 2006; Epstein, 1994) that showed an increase in the motivation to learn when

risk perception was high. Early theorists about risk perception like Zajonc (1980) stated that rational decision-making processes are guided by the affective reactions that people exhibit towards certain stimuli. These emotional responses often arise prior to cognition and play a crucial role in rational thought processes (Leiserowitz, 2006). Accordingly, Epstein (1994) concludes that the affective feelings of people often have a direct effect on motivating behavior, and subsequent learning. We found no moderator effect. Such an effect was predicted by the arousal-mood hypothesis which assumes a mediation effect of arousal and mood on learning (Lehmann & Seufert, 2017).

The absence of a significant effect on learning could be due to several factors. One such factor is the amount of time that participants were given. Tabbers et al. (2001) conducted an experiment in which they co-varied time and treatment conditions. The time factor was either restrained or free. The treatment in one group consisted of visuals plus audio commentary, whereas the other group received visuals with on-screen text instead of audio commentary. The findings indicated that the audio commentary group had higher learning outcomes than the on-screen text group when time was constrained. When both groups were allowed to spend as much time as they liked to process the information, the superiority of the audio commentary disappeared. In other words, leaving the time expenditure free might have equalized the treatment effects.

Another explanation for the absence of an effect of music on learning could be the retention test format. According to Lehmann and Seufert (2018) listening leads to better understanding, while reading invites a stronger focus on details. This claim suggests that audio commentary might be more beneficial for answering comprehension questions, while on-screen text might be more beneficial for answering recall questions (Rubin et al., 2000). The retention test in our study contained both comprehension and recall questions. Therefore, on-screen text may not have been the best fit for all questions that viewers had to answer.

Strengths.

The current study showed a significant effect of type of music on mood states and risk perception. These findings are valuable, especially since so little research is done on this topic. An important strength of this study is the choice of music, especially for the ominous condition. Before making the choice for a specific musical piece, an official evaluation by two independent musical experts was performed. The expert offered insights on musical features that could affect the listener such as melody, harmony, rhythm, form and instruments. In addition, the experts suggested a number of parameters on these features that characterize sad or happy music. These insights are helpful for further studies involving the choice of music

with the aim of affecting specific mood states. Participants in the ominous condition indicated that the combination of the music and visuals was mesmerizing. This accords with the Congruence-Association Model by Cohen (2013) according to which it is beneficial when there is congruity between the music and the visual information. The type of music is an important factor in this model, which may indicate that our choice of music for the visuals participated in the significant effects on mood and risk perception that were found.

Additionally, participants were placed in their own familiar environment. They could go about as they would normally do in their home. Also, they were unlikely to feel uncomfortable or pushed by an attending researcher. The ecological validity makes the results more valid.

Furthermore, strength can be found in the reliability of the instruments used. The PANAS for instance appeared to be having a very high reliability according to previous studies (Ostir, Smith, Smith & Ottenbacher, 2005). The reliability analysis conducted in the present study endorsed this.

Limitations

Since the PANAS is designated as a self-report instrument, there is a possibility that participants overstate or understate their experience of emotions, leaving only an impression of relative values as opposed to absolute and accurate assessments of participants' mood states. In other words, measuring mood states or emotional arousal through self-reports is a subjective method where caution is required (Edwards & Martin, 2014). Sano and Picard (2013) stated that the quality of measured emotions depends on the extent to which participants can perceive their emotions and additionally, report it reliably. Threats to such appraisals arise when participants provide socially desirable answers or randomly choose a score when in doubt.

Furthermore, looking at the lack of significant effect on retention, the retention test can be questioned. Apart from the fact that this test was not very reliable one could argue that the items did not agree very well with what we wanted to measure. Open questions and multiple-choice questions were used interchangeably, while both types of questions according to Rubin et al. (2000) require a different approach. Rubin et al. (2000) states that audio commentary is more beneficial for answering comprehension questions, while on-screen text is more beneficial for answering recall questions. Therefore, the choice for on-screen text in this study would create a conflict with the open questions and may counteract any significant effects.

Although the use of participants' own familiar environment can be seen as a strength, it can also be seen as a limitation. Since there was not a controlled environment, it was also not possible to ensure that all participants closely followed the script and acted in a way that was expected of them. Participants could have had to deal with distractions, or breaks etc. More importantly, it was also impossible to check if participants completed watching the video.

Finally, there is a specific factor that complicates research with music, namely copyright. Copyright gives the owner of the music the exclusive right to make copies and use the music as they please. This of course complicates the use of music in researchers' own studies. This is a challenging limitation for conducting research because of the lack of freedom of use of music.

Conclusion

Music can be useful to achieve emotional persuasion and raise learning (Rogers & Gibson, 2012; Eladhari, Nieuwdorp & Fridenfalk, 2006; Kotsopoulou & Hallam, 2010; Giles, 1991). However, the current study showed us that in order to doing so, music is expected to exhibit a certain synchrony and congruity to the visual information depicted in the movie or documentary.

The goal of this study was to explore the effect of different types of background music in documentaries on viewers' mood states, risk perception and retention of learning content. It can be concluded that music has a significant effect on mood states and on risk perception with mood state as moderator. This means that music can be a tool for emotional persuasion as long as the music and the incited mood serve the specific goal. Music, through mood states, can affect listeners' risk perception which can be used for specific purposes.

There is research that shows that music can be beneficial to learning when the right conditions are met (Mayer, 2008; Rogers & Gibson, 2012; Giles, 1991; Tamir, 2009). This means that little or no other auditory information must be presented (Baddeley, 2007), that there is congruity between the music and the visual information (Cohen, 2013), and that the music had to fit the specific goal (Tamir, 2009). Another example is the effect of music found in sports and operation rooms, where according to Giles (1991) the specific music has to make a person happier and more relaxed. The inconsistent findings raise the question: "How do you ensure that music contributes to learning?". It seems as if this question is harder to answer than we initially thought… and we are far from there yet.

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Appendices

Appendix A

Distribution

Table 1

Distribution of age among conditions

Age	Ominous n=27	Uplifting n=28	No music n=28	Total n=83
18-24	3	4	5	12
25-34	7	8	11	26
35-44	2	5	4	11
45-54	10	3	3	16
55-64	4	8	4	16
65-74	1	0	0	1
75-84	0	0	1	1

Table 2

Distribution of gender among conditions

Gender	Ominous n=27	Uplifting n=28	No music n=28	Total n=83
Male	8	10	8	26
Female	19	18	20	57

Table 3

Distribution of education level among conditions

Level of education	Ominous n=27	Uplifting n=28	No music n=28	Total n=83
Senior general secondary education (havo)	3	4	3	10
Secondary vocational education (mbo)	0	4	2	6
Higher professional education (hbo)	15	10	12	37
University education (wo)	2	6	3	11
Masters degree	5	4	8	17
Doctorate/PHD	2	0	0	2

Appendix B

Questionnaire prior knowledge

Going into this research, it is essential for the researcher to gain some insight into the participants' prior knowledge on climate change.

Therefore, we kindly ask you to estimate your prior knowledge on climate change on the questions below making a choice from 1 (nothing at all) to 5 (very much).

1. How much do you know about the effect people have on climate change?

1(nothing at all)	2(just a little)	3(average)	4(quite a bit)	5(very much)
O	O	O	O	O

2. How much do you know about the effects of climate change on our daily lives?

1(nothing at all)	2(just a little)	3(average)	4(quite a bit)	5(very much)
O	O	O	O	O

3. How much do you know about the long-term effects of climate change?

1(nothing at all)	2(just a little)	3(average)	4(quite a bit)	5(very much)
O	O	O	O	O

Appendix C

Questionnaire mood

Please rate the extent to which you experienced each particular emotion below while watching the video previously, making a choice from 1 (not at all) to 5 (very much). Dutch translations are in brackets.

	1(not at all)	2(a little)	3(moderately)	4(quite a bit)	5(very much)
Attentive (aandachtig)	O	O	O	O	O
Active (energiek)	O	O	O	O	O
Alert (alert)	O	O	O	O	O
Excited (opgewekt)	O	O	O	O	O
Enthusiastic (enthousiast)	O	O	O	O	O
Determined (vastberaden)	O	O	O	O	O
Inspired (geïnspireerd)	O	O	O	O	O
Proud (trots)	O	O	O	O	O
Interested (geïnteresseerd)	O	O	O	O	O
Strong (sterk)	O	O	O	O	O
Hostile (vijandig)	O	O	O	O	O
Irritable (prikkelbaar)	O	O	O	O	O
Ashamed (beschaamd)	O	O	O	O	O
Guilty (schuldig)	O	O	O	O	O
Distressed (bedroefd)	O	O	O	O	O
Upset (van streek)	O	O	O	O	O
Scared (angstig)	O	O	O	O	O
Afraid (bang)	O	O	O	O	O
Jittery (rusteloos)	O	O	O	O	O
Nervous (nerveus)	O	O	O	O	O

Appendix D

Questionnaire risk perception

Please answer the questions below making a choice from 1 (very unlikely/not at all) to 5 (very likely/very much).

1. In the next 10 years, how likely do you think it is that changes in the climate will have a negative impact on our world?

1(very unlikely)	2(unlikely)	3(not likely/not unlikely)	4(likely)	5(very likely)
O	O	O	O	O

2. In the next 10 years, how likely do you think it is that changes in the climate will have a negative impact on you personally?

1(very unlikely)	2(unlikely)	3(not likely/not unlikely)	4(likely)	5(very likely)
O	O	O	O	O

3. How likely do you think it is that we experience a major ecological catastrophe if things continue on their present course?

1(very unlikely)	2(unlikely)	3(not likely/not unlikely)	4(likely)	5(very likely)
O	O	O	O	O

4. How damaging do you think climate change is?

1(not damaging at all)	2(a little damaging)	3(moderately damaging)	4(quite damaging)	5(very damaging)
O	O	O	O	O

5. To what extent do you worry about climate change?

1(not at all)	2(a little)	3(moderately)	4(quite a bit)	5(very much)
O	O	O	O	O

Appendix E

Retention test

Please answer the questions below about the video you watched previously as accurately as possible.

1. When will the impacts of climate change be irreversible?

   O 2030
   O 2040
   O They already are irreversible

2. How many species are at risk of extinction by climate change?

   O over a hundred
   O over a thousand
   O over a million

3. Name 4 reasons why climate change is detrimental for human life too.

   1 …….
   2 …….
   3 …….
   4 …….

4. How many tons of plastic currently fills the ocean?

   O over 1 million
   O over 10 million
   O over 100 million

5. How many percent of coral reefs have died in the last 30 years?

   O 25 percent
   O 50 percent
   O 75 percent

Appendix F

Review sheet retention test

1. When will the impacts of climate change be irreversible?

   O 2030
   O 2040
   O They already are irreversible

The right answer to the question above is answer one (2030). When answered correctly, one point can be earned. In SPSS a 1 will be noted for a correct answer and a 0 will be noted for a wrong answer.

2. How many species are at risk of extinction by climate change?

   O over a hundred
   O over a thousand
   O over a million

The right answer to the question above is answer three (over a million). When answered correctly, one point can be earned. In SPSS a 1 will be noted for a correct answer and a 0 will be noted for a wrong answer.

3. Name 4 reasons why climate change is detrimental for human life too.

   1 .....
   2 .....
   3 .....
   4 .....

There were several facts given in the survey video that respondents saw. The facts mentioned in the survey video are the following.

- Rising temperatures have increased heat related deaths.
- Higher temperatures worsen air quality.
- Higher temperatures negatively affect crop production.
- Higher temperatures increase the spread of infectious diseases.
- Higher temperatures threaten fresh water deposits.
- A warming world increases the intensity of natural disasters.
- The burn area and intensity of fires has increased.
- Hurricanes are reaching new extremes.
- As global temperatures increase, millions of people are fleeing their homes to avoid the impacts of droughts and extreme storms, creating a refugee crisis.
- Plastic and pollution
- Over a million species are at risk of extinction.

One point can be earned per given answer. The answer given has to be mentioned in the video and therefore be present in the list of facts given above. When a respondent gives a correct answer that is not mentioned in the video, zero points will be given. This was decided because

the questionnaire measures the retention of the information given in the video. When a respondent comes up with a different answer that was not mentioned in the video, then that would simply be proof of pre-existing knowledge, which is not the goal of this questionnaire. A respondent will earn one point when his/her answers contain the words above in red. Different words with the same meaning will also be allowed. In the following statement (As global temperatures increase, millions of people are fleeing their homes to avoid the impacts of droughts and extreme storms, creating a refugee crisis), a point was also awarded when droughts, storms or a refugee crisis as a result of increasing temperatures was mentioned on its own.
In SPSS a 1 will be noted for a correct answer and a 0 will be noted for a wrong or incomplete answer.

4. How many tons of plastic currently fills the ocean?

    O over 1 million
    O over 10 million
    O over 100 million

The right answer to the question above is answer three (over 100 million). When answered correctly, one point can be earned. In SPSS a 1 will be noted for a correct answer and a 0 will be noted for a wrong answer.

5. How many percent of coral reefs have died in the last 30 years?

    O 25 percent
    O 50 percent
    O 75 percent

The right answer to the question above is answer two (50 percent). When answered correctly, one point can be earned. In SPSS a 1 will be noted for a correct answer and a 0 will be noted for a wrong answer.

Summarized, a respondent can earn eight points when answering all questions correct.
When an answer is not given to a question, that question will not be awarded any points and will therefore be represented by a 0 in SPSS.

Appendix G

Instructions to participants

Your consent for participation is requested by the researcher in this study about the effect of background music in documentaries on viewers' mood, risk perception and retention of content.

Participation in the current study is completely voluntary. Participants thereby reserve the right to terminate their participation in this study at any point of time without explanation.

The researcher will maintain the confidentiality of the research records and data. Data will only be presented to third parties anonymously.

By submitting this form, you confirm that you are over 18, have read the above and agree to the terms as described.

A national green gift card (Nationale groene kadobon) of €20 will be raffled amongst participants.

If you have any further questions, please feel free to contact me at marissa-peters@hotmail.com.

Thank you in advance for your participation.
Marissa Peters

Before you start.

1. Place yourself in a calm and silent surrounding.
2. Please make sure that the sound on your computer is working.
3. Make sure you cannot be disturbed during the completion of this survey.
4. Please respond to all questions as honestly and accurately as you can.
5. There are no right or wrong answers on this survey.

You will now continue to the first questionnaire.

Questionnaire prior knowledge (Appendix B)

Please watch the video below carefully. There will either be music, or no music. Please check this carefully by turning up your volume.

Questionnaire mood (Appendix C)

Questionnaire risk perception (Appendix D)

Retention test (Appendix E)

Please fill in the following information about yourself. Your answers to the following questions will be used for research purposes only and will be kept strictly confidential.

You have now finished this survey. Thank you for participating!
Please leave your e-mail below when wanting a chance of winning the National green gift card of €20.