Background Music in Educational Films:
The effect of background music induced arousal on the memory and the evaluation of information presented in educational films.

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Contents

Abstract

The aim of this study was to investigate which effect the structural feature background music has on memory and evaluation of educational films that were presented to children of grades 7 and 8 of primary schools. The most important findings of this study concerns the role of arousal. The results indicate that background music with varying arousal levels influences the extent to which information presented in educational films is memorized. It was found that the viewers' memory was increased after watching educational films that contained background music with medium arousal levels compared to educational films without background music (control condition), or films containing background music with low or high levels of arousal.

Introduction

Since the early days of mankind there has been music. In fact, music is known to be one of the oldest forms of expression (Menuhin and Davis, 1979). Through recent advances in technology and the availability of digital music, music has become more widespread and accessible than ever. Although music is used for leisure activities or to be enjoyed as a pleasurable art form, music also has numerous psychological functions, like playing a powerful social role, arousing (deep) emotions, and influencing cognitive functioning. The effect of music on the responses of human beings is evident and therefore a growing body of academic research is focusing on the physiological, psychological, behavioural, emotional and cognitive effects of music (Cassidy and Macdonald, 2007).

Research in various fields such as advertising, retail, neuroscience and education has shown that (background) music can affect human behaviour. Advertising effects are more probable with the right music (Zander, 2006). In retail context, background music can influence customer behaviour in the form of sales value and volume, repeat purchase and quantity purchased. Also many indirect returns to business are apparent such as positive perceptions of quality and venue/store brand image (Garlin and Owen, 2006). Background music can also mediate emotional responses to waiting cues and on-hold phone calls (Hui, Dubé and Chebat, 1997; North, Hargreaves and McKendrick, 1997; Oakes and North, 2008). Moreover music perception influences the autonomic nervous system, the hormonal and immune systems and activates (pre) motor representations (Koelsch and Siebel, 2005). In educational settings music is also used to improve the cognitive abilities of students. A famous example in this is the so called 'Mozart effect'. Rauscher et al. (1993) reported in their study that participants who listened to a recording of music composed by Mozart performed better on abstract and spatial abilities than when they listened to relaxation instructions or nothing. The enhancement of spatiotemporal reasoning through music is still a subject of debate (Jones and Zigler, 2002; Steele et al., 1999). Nevertheless, research indicates that by introducing background music, performance and behaviour of students may be enhanced (Hallam, Price and Katsarou, 2002).

Another field that benefits from using music is the area of filmmaking. Previous research showed that music can have an influence on the emotional impact, and thus the interpretation and remembering of film information (Bolivar, Cohen and Fentress, 1994; Boltz, 2001; Boltz, Schulkind and Kantra, 1991; Cohen, 1999). To this extent, film theorists have long acknowledged the fact that music plays an important role and contributes to the

story's meaning. According to Boltz (2004), this contribution of music contains a schematic structure that integrates a scene's action into one cohesive framework that directs the path of perception and attention.

In many educational films, on television as well as those specifically designed for classroom-use, background music is - like in feature film and TV industries - used to get approval and keep attention. It appears to be administered as a matter of routine, a 'finishing touch'. It is however, unclear if and to what extend music really helps to improve comprehension and helps to achieve learning-objectives. According to the limited capacity model of mediated message processing (Lang, 2000), video and audio structural information (e.g., luminance levels, cuts, slow motion, animation, zooms, pans, video graphics, frequency levels, sound effects, music, rate of presentation, narrative structure) have an influence on how television messages are processed. The limited capacity model describes television watching as a combination of controlled and automatic resource allocating mechanisms that combine to allocate processing resources to the encoding, storage, and retrieval of the bits of information that make up a television message. Certain message characteristics, such as structural features (e.g., background music) or emotion, as well as the goals of the viewer, may affect the resources allocated to storage, which in turn may affect how much and how well content information is stored (Lang, 2000).

Using the limited capacity approach to television viewing, the aim of this study is to analyze which effect the structural feature background music, with varying arousal levels, has on memory and evaluation of information presented in an educational film. The role of enclosed background music on the processing of information of educational films will be evaluated.

Background music in educational films

The effects of educational films, being informative, didactic or entertaining, in first instance take place in the mind. The goal of educational films is to get the presented (multisensory) information to be encoded, interpreted, and stored such that the information can be acted upon. When making a film the focus lies primarily on the visual medium to describe a story. The accompanying (background) music is nonetheless an integral component that can contribute to the story (Boltz, 2004). To comprehend how (background) music works within the context of educational films, the separate functions of music with respect to cognitive processes are considered. Cohen (1999) described eight functions that music has in a film or multimedia context. First, music masks unwanted noises, such as distractions

produced by the multimedia machinery or sounds made by people. Second, music helps to connect disparate events in other domains. The most prominent musical gestalt seems to attract media events from different domains. Continuous music signals continuation in the current theme, while a break in music signals a change in the film; for instance when the camera alternates between close-ups of two people who are looking at each other (Magliano, Dijkstra and Zwaan, 1996). Third, music may direct attention to specific aspects of a visual scene through structural or associationist congruence (Bolivar, Cohen and Fentress, 1994; Marshall and Cohen, 1988). Fourth, music alters the mood and feelings of the viewer of the movie (Pignatiello, Camp and Rasar, 1986). It can be used to encourage positive multimedia experiences. Fifth, different features of music can convey the emotional meaning of the movie. Sadness for example, is conveyed by slow pace, and happiness is conveyed by a fast or rising tempo. Further, music communicates meaning, especially in ambiguous situations (Cohen, 1993; Kalinak, 1992). Sixth, music can be used as a memorial cue by taking on the meaning of that which it accompanies. Music alone will then cause imagination of a particular individual or theme. Seventh, music has an aesthetic function. Whether or not music has the intended effect depends partially on personality characteristics, introverts for example may need less stimulation (Cassidy and MacDonald, 2007). Finally the eighth, and for this study the most important, function that music can have in a film, is arousal and focal attention. It is known that when there is music, a larger part of the brain is active than when there is no music. The increased level of arousal results in higher attention and higher impact of the multimedia experience, filtering out distractions.

A limited capacity model for educational films

High levels of exposure to a television program or an educational film are not a guarantee for a high memory for what is seen (Gunter, 1987). The limited capacity model of mediated message processing (Lang, 2000), here referred to as the limited capacity model, suggests that in order to process the message in an educational film, three sub-processes of information processing - encoding, storage, and retrieval - occur while watching. The viewers' processing resources are distributed across these three simultaneously occurring processes and is determined both by automatic processes (contents and structural features of the message) and by controlled processes (a persons' interests, needs and goals). How well an audiovisual message is processed depends on how thoroughly the information of that message is encoded, stored and ultimately retrievable. An optimal functioning message processing is only achieved if each of the above mentioned tasks are performed adequately. The model

suggests that the viewers' resources to process information are limited. There may be a mismatch between provided and required resources, resulting in an incomplete processing of the message. If there are not sufficient resources available, processing the educational film will be less effectively.

According to the model, introducing structural features (i.e., cuts, edits, graphics, and background music) makes it possible to elicit emotional arousal. This arousal may cause the automatic allocation of additional processing resources to the tasks of encoding and storage, resulting in an improved information recall and recognition (Vettehen, Nuijten and Peeters, 2008).

Background music to induce arousal

Arousal induced by background music could be considered a variable that explains the extent of memory and evaluation for an educational film. Arousal may be defined as the degree of excitation that viewers experience while watching an educational film (Vettehen, Nuijten and Peeters, 2008). Music has the capability to induce arousal. Rickard (2004) determined that different sorts of music can increase the level of arousal. Further findings suggest that background music can be used to increase or maintain the arousal level of students (Hallam, Price, and Katsarou, 2002). Another interesting finding, which has been mentioned briefly earlier on, is the so-called Mozart effect which implied that students would perform better on spatial-temporal tasks after listening to a Mozart sonata (Rauscher et al., 1993). This effect was afterwards elaborated with the mediating role of arousal, in which the used Mozart sonatas could be characterized as a kind of fast-tempo piece in a major key which is capable of inducing higher levels of arousal affecting performance (Schellenberg et al., 2007; Thompson et al., 2001).

When exposed to music, arousal levels will be promoted accordingly. If the arousal level of background music has an effect on the viewers' arousal, it is expected that the extent to which background music affects this arousal level will be dependent on the level of arousal of the background music that is used. Therefore the following hypothesis was tested:

H1: As the arousal level of background music increases, the arousal level of the viewers of the educational film will increase.

According to the limited capacity model, when a structural feature is arousing there is an automatic allocation of resources to the tasks encoding and storage for the presented

information as long as the processing system is not overloaded. This results in an improved recall of the information (Lang, 2000). The model predicts an inverted U-shaped relationship between an increase in structural features and memory, since initially structural features will help viewers to process the presented information by increasing the processing resources allocated to the presented information (Lang et al., 2000). The Yerkes-Dodson law provides a representation to clarify this further. This model of performance and arousal suggests that arousal will increase task performance to an optimum level. Once that level is crossed, task performance deteriorates (Yerkes and Dodson, 1908). Once the arousal stimulant - background music - crosses this threshold it could be considered to be an interference. Therefore it is expected that memory for the presented information in educational films will be better in educational films with background music with medium arousal than educational films with background music with low or high levels of arousal. In light of this, the following hypothesis is proposed:

H2: The arousal level of background music will be positively related to the memory for the presented information in educational films, following the U-shape described in the limited capacity model.

In the context of this study, high arousing background music may be perceived as more emotionally interesting than low arousing background music because of the dynamism conveyed by more arousing background music. It is assumed that higher arousal levels of background music will result in more positive evaluations of educational films. However this will only occur up to a certain level of arousal. Beyond that level, arousal will result in more negative evaluations of the educational films. Consequently, it is predicted that:

H3: The arousal level of background music is positively related to the evaluation of the presented information in educational films, following the U-shape described in the limited capacity model.

Method

Design and subjects

The design of this study is a 3 x 2 between-subjects experimental design with musical background induced arousal (low, medium and high), and two educational films (relatively neutral on arousal levels and valence levels) as independent variables. The control conditions in this study are the two educational films without the addition of background music. Subjects are assigned to either the condition of background music with low arousal, medium arousal, high arousal, or to the control condition. The dependent variables measured are memory for the given information in the educational films and the evaluation of the educational films. Memory is measured with forced choice questions. Per educational film 15 true/false questions and ten multiple choice questions were used. The evaluation of the educational film is measured with semantic differentials, whereas educational film elicited emotions are measured with the Self-Assessment Manikin (SAM), a non-verbal pictorial questionnaire (Bradley and Lang, 1994).

The subjects were 167 primary school pupils (89 male and 78 female) from grades seven (91 pupils) and eight (76 pupils) of four primary schools in the city Enschede (The Netherlands). More specifically, these were three catholic primary schools with the same educational structure and one Freinet primary school. From each primary school two classes (grade seven and grade eight) participated in the experiment. The subjects were aged seven to 13 years, with a mean age of 11,14 (SD = 1.00). The experiment was implemented as a part of the daily curriculum and functioned as a integrated biology and geography lesson. Because of the experimental setting, classes were randomly assigned to the experimental conditions and not the subjects.

Stimulus development

Music. The experimental design of this study consists of three musical background conditions (low, medium and high arousal). Since there was no knowledge of an existing pool of validated musical tracks regarding the effect of arousal and valence levels a pretest was done to determine which background music is in accordance with the intended arousal levels necessary for this study - for each of the conditions the levels of valence had to be uniform -. For this pretest a musical selection was required. Research has shown that tempo, tonality/mode, and texture in music influence the responses of listeners (Kellaris and Kent, 1994). These variables had to be taken in account with the selection of appropriate music

tracks. Garlin and Owen (2006) concluded that tempo is the main structural component of music that affect the arousal level of listeners. Tempo manipulations with fast tempo (160-180 bpm) induce greater arousal levels than low tempo (60 bpm) (Husain, Thompson, and Schellenberg, 2002; Kellaris and Kent, 1994). Tonality/mode manipulation affects the mood in which music in major modes is associated with happy emotional responses, and music in minor modes is associated with sad emotional responses (Webster and Weir, 2005). The texture of music refers to the non harmonized, simpler melodies versus thicker, harmonized music. Melodies and simple harmonies are associated with positive emotions, while more complex harmonies evoke negative emotions (Gabrielsson and Lindström, 2001 in Webster and Weir, 2005). In this study, each musical background condition (level of arousal and valence) consist of two music tracks in order to exclude the possibility that variables other than musical arousal and musical valence are accounted for the effects. The arousal and valence levels of these musical tracks must therefore be similar to each other. Furthermore the difference between vocal (with sung words) music and non-vocal (instrumental) music has to be taken into account. In the presence of instrumental music, added vocals may not increase the music's capacity to arouse very differently. Though vocal music is considerably more disruptive than purely instrumental music (Furnham, Trew and Sneade, 1999; Pring and Walker, 1994). Hence, the musical tracks in used in this study are instrumental.

For the pretest six different musical tracks were composed according the above mentioned theory, namely Synzone3, Jazzordemo6, Boogy, Mswing27, Herotrance and Newhiphop. From each of the six original musical tracks, blocks of three new versions were created. Per original musical track the beats per minute were adjusted to manipulate the tempo and to reach levels of low (60-95 bpm), medium (110-150 bpm) and high (150-190 bpm) arousal resulting in a block of three new versions of the original musical track. The assumption was made that when the tempo of the beats per minute in the musical tracks would be manipulated the musical tracks would have the same levels of valence but would differ in the levels of arousal. In order to check the induced arousal and valence by the musical tracks, the Self-Assessment Manikin (SAM) (Bradley & Lang, 1994) was used (see appendix III). Although the dominance dimension of the SAM was not used in this pretest it was measured as well to follow the protocol of the instrument. To determine which of the composed musical tracks were equal regarding the level of valence yet were associated with different levels of arousal (low, medium and high), 42 subjects (22 male, 20 female) rated the musical tracks on the three dimensions. The mean age of the participants was 24,05 years (SD = 4,27), ranging from 19 to 45 years. Results showed that that the three versions of the

musical track Herotrance and the three versions of the musical track Newhiphop could considered to reach the intended valence and arousal levels the best. Furthermore, the valence and the arousal ratings of the three versions of Herotrance were comparable to the three versions of Newhiphop. Herotrance and Newhiphop were rated medium on the valence scale (M = 5,52, SD = 0,68 and M = 5,69, SD = 0,34). On the arousal dimension the three versions of Herotrance were rated low (M = 2,79, SD = 1,81), medium (M = 4,36, SD 1,82) and high (M = 6,64, SD = 1,34). Newhiphop was also rated low (M = 3,43, SD = 1,51), medium (M = 4,57, SD = 1,45) and high (M = 5,64, SD = 1,15) on the arousal dimension. The accompanying valence and arousal levels of the musical tracks used in the pretest can be found in table 1.

Table 1

Pretest results of valence and arousal levels of the composed musical tracks

Musical track	Valence level	Valence SD	Arousal level	Arousal SD
Music track 1 - Synzone				
Number 1 - 70 BPM	5,36	1,78	3,71	2,13
Number 2 - 120 BPM	6,50	1,23	5,79	1,48
Number 3 - 160 BPM	5,43	1,74	6,50	1,40
Music track 2 - Jazzordemo6				
Number 1 - 95 BPM	6,21	1,31	2,64	1,34
Number 2 - 150 BPM	7,00	0,56	5,50	1,45
Number 3 - 190 BPM	6,43	2,53	5,71	1,44
Music track 3 - Boogy				
Number 1 - 90 BPM	4,29	1,33	4,29	1,33
Number 2 - 150 BPM	6,00	1,88	6,00	1,88
Number 3 - 190 BPM	7,36	1,28	7,36	1,28
Music track 4 - Mswing27				
Number 1 - 90 BPM	4,50	1,79	2,29	0,73
Number 2 - 140 BPM	5,50	1,65	3,36	1,22
Number 3 - 180 BPM	5,79	1,37	4,07	1,82
Music track 5 - Herotrance				
Number 1 - 60 BPM	4,79	1,67	2,79	1,81
Number 2 - 110 BPM	6,14	1,79	4,36	1,82
Number 3 - 150 BPM	5,64	2,02	6,64	1,34
Music track 6 - Newhiphop				
Number 1 - 60 BPM	5,57	1,51	3,43	1,51
Number 2 - 100 BPM	6,07	1,54	4,57	1,45
Number 3 - 150 BPM	5,43	1,74	5,64	1,15

Note. 1 = negative valence, 9 = positive valence; 1 = Low arousal, 9 = high arousal

Educational films. To increase the validity of this experiment, the used educational films must suffice some boundary conditions. In the first place the used educational films had to be very rich in information and this information must be well distributed across the film, i.e. throughout the whole film the film must contain an equal amount of information. Secondly, the films had to be relatively neutral on both arousal and valence levels in order to exclude background music - educational film congruency effects. Finally, real educational films were aimed at for enhancing the external validity of this study. To meet the mentioned requirements educational films from the public educational broadcaster of the Netherlands Teleac were examined. After screening 62 educational films, two educational films were selected on their information richness and neutrality by means of personal evaluation. The content of the first educational film was about the human body, more specific about blood circulation, and had a duration of approximately 19 minutes. The content of the second educational film was about Dutch landscapes; this film attended the matter river clay and had a duration of 10 minutes. For both of the educational films the original voice-over and background music were cut-out. The original voice-over was replaced with a newly recorded voice-over, to rule out the influence of different voice-overs, and to remove additional sound effects. The original background music was replaced with the different versions of the musical tracks selected in the pretest (equal volume of 6 db and in stereo).

Experimental conditions. The experiment consists of six experimental conditions and the control condition. Musical arousal levels are manipulated using three musical background conditions (low, medium and high). Each musical background condition consisted of two musical tracks containing approximately equal levels arousal (note that the valence levels of the musical tracks are uniform in every condition). The musical tracks are distributed to the two educational films. It is assumed that musical tracks with same arousal levels will have a similar effect on processing and evaluating the information in educational films. Each musical background condition consist of two conditions, meaning, condition A (Film 1 - Blood circulation/Musical track 1 - Herotrance – Film 2 - River clay/Musical track 2 - Newhiphop) and condition B (Film 1 - Blood circulation/Musical track 2 - Newhiphop – Film 2 - River clay/Musical track 1 - Herotrance). This experimental set-up is chosen to rule out the possibility that other variables than musical arousal are accounted for found effects. The subjects (i.e., classes) are either assigned to one of the three musical background conditions, and thus to one of the six experimental conditions, or to the control condition.

Table 2

Design experiment

Background music condition	Between subjects				
	Low	Medium	High	Control	Total subjects
Film 1 - Film 2 Blood circulation - River clay	1A (22 subjects) Herotrance - Newhiphop	2A (22 subjects) Herotrance - Newhiphop	3A (22 subjects) Herotrance - Newhiphop	4A (12 subjects) No background music	78
Film 1 - Film 2 Blood circulation - River clay	1B (20 subjects) Newhiphop - Herotrance	2B (18 subjects) Newhiphop - Herotrance	3B (23 subjects) Newhiphop - Herotrance	4B (28 subjects) No background music	89
Total subjects	42	40	45	40	167

Measures

This study measured the effects of musical background induced arousal on respectively memory for and evaluation of the presented information in the two educational films.

Arousal and valence measures. Arousal and valence levels were measured for emotions evoked by the musical tracks selected in the pretest. To measure whether the two educational films elicited the intended emotions, a manipulation check was carried out for subjects' arousal en valence levels evoked by the two educational films. To measure the evoked emotions the Self-Assessment Manikin (SAM), a non-verbal pictorial questionnaire that allows subjects to make three judgments regarding their emotions (Bradley & Lang, 1994), was used. The SAM measures the dimensions valence, arousal and dominance by using a graphic character arrayed along a continuous nine-point scale. The pleasure scale contains characters raging from frowning and unhappy to smiling and happy. The arousal scale ranges from a sleeping and calm character with eyes closed to an excited character with eyes wide open and a sparkling body. Finally, the dominance scale goes from a very small character to a really big character. The arousal and valence scales of SAM correlate highly with psycho-physiological measures of arousal and valence (Greenwald, Cook & Lang, 1989). In order to follow the instruments' protocol dominance was measured as well although the dominance ratings were not used in the analyses of this study. To make the SAM more obvious, the valence and the arousal scales were inverted, so high scores on valence represent positive valence levels, and high scores on arousal represent high arousal levels.

Evaluation measures. The evaluation of the information presented in the educational films was measured using ten 9-point semantic differentials. Six of these differentials were derived from Goldberg and Gorn (1987). Subjects rated the educational films as being ineffective to effective, sad to happy, unsatisfactory to satisfactory, unpleasant to pleasant, bad to good and disliked to liked. These items mainly measured how much subjects liked the

educational films. Four other items adapted from Kamins et al. (1991) were used to measure the degree to which the educational films were clear and understandable. Subjects rated the educational films as being incomprehensible to comprehensible, difficult to simple, boring to exciting and uninteresting to interesting.

Memory measures. Memory for the educational films was measured using forced choice questions. Per educational film, subjects were confronted with 15 true/false questions and ten multiple choice questions containing information that was presented in the educational film they had just seen. One point was given for each question that was answered correctly. Besides determining separate scores for each measure and the total score for the educational film, the total score of the two educational films were added and combined into an overall memory score. See appendix IV for the questionnaire.

Procedure

The experiment was conducted in four primary schools in the city of Enschede, the Netherlands. From every primary school, only the pupils from grades seven and eight participated in this experiment. The experimental conditions were randomly divided between the eight classes. Two classes were assigned to the low arousal condition, two classes to the medium arousal condition, two classes to the high arousal condition and two classes were assigned to the control condition. The experiment was carried out in the classroom of the pupils since the experiment was implemented as a integrated biology/geography lesson as part of the daily curriculum. The educational films were presented to the whole class at the same time on a digital media screen (digibord). This is a large digital media screen connected to a personal computer that is used by teachers and pupils for educational purposes and is placed in front of the classroom so that every pupil can see it from their work-bench. For answering the scales and questions of the experiment the pupils were given a pen and paper test. The whole experiment, including a general opening and ending, the explanation of the answering scales, the questions and the video had a duration of approximately one and a half hour. Depending on the schedule of the teachers the experiment was given in the morning or in the afternoon. The teachers were informed of the purpose of the experiment but were instructed not to share this information with the pupils.

The experiment started when the experimenter welcomed the pupils and gave a brief introduction about the University of Twente and the experiment. All pupils were told that the goal of the experiment was to enhance current educational films. An oral instruction how to fill out the SAM, the semantic scales and the forced choice questions was given. After this

oral instruction the pupils were asked to fill out some questions regarding demographic variables (age, gender, origin). The duration of the oral instruction and filling out of the questions had a duration of ten minutes. Depending on the experimental condition the class was assigned to, subjects watched either the educational film 1 - Blood circulation with low, medium, high or no arousing background music. Directly after watching the educational film 1 - Blood circulation the subjects completed the SAM and answered the ten questions that measured their evaluation of the educational film. After filling out the questions the pupils started together at the same time with the forced choice questions. First 15 true/false questions and second ten multiple choice questions. Every pupil was allowed to answer the forced choice questions in their own time. Every class took approximately 15 minutes for filling out the answers. After finishing the first test a short introduction on how to proceed for the second educational film and the accompanying questions was given by the experimenter. Depending on the experimental condition the class was assigned to, the subjects watched this time the educational film 2 – river clay with low, medium, high or no arousing background music. For filling out the questions the same procedure as with educational film one was used. The duration of filling out the questions took also approximately 15 minutes. When all the subjects were finished they were thanked for their participation and the pupils were allowed to ask questions about the experiment and the University of Twente.

Results

Six subjects (all of them in the high arousal condition) did not properly follow the instructions they were given with respect to some of the forced choice questions. Therefore, they were excluded from the analyses concerning the overall memory score. Furthermore, effects between the grades seven and eight, the gender and nationality on the combined scores of the forced choice questions per educational film and the overall memory score were analyzed. This was done by performing a independent samples t-test. Between grades seven and eight there was a significant difference on the combined score for the educational film about blood circulation ($t(164) = 3.24$, $p < .01$) and a significant difference on the overall memory score ($t(159) = 3.22$, $p < .01$). Regarding this difference grade eight had significant higher scores than grade seven. Analyses of the gender of the subjects did not produce any significant effects. However, there were significant differences in the outcome of the scores between subjects with a Dutch nationality and subjects with other ethnic backgrounds. For both of the combined scores for the two educational films, blood circulation ($t(164) = 5.03$, $p < .01$) and river clay ($t(160) = 6.14$, $p < .01$) as for the overall memory score ($t(159) = 6.52$, $p < .01$) subjects with the Dutch nationality scored significant higher than subjects with other ethnical backgrounds.

Manipulation check

To determine if the valence and arousal levels of the musical tracks, used as background music, affect the valence and arousal levels evoked by the educational films, subjects completed the SAM for both of the educational films. Scores on the valence and arousal dimension were compared across conditions. An analysis of variance (one-way ANOVA) showed that valence levels as well as the arousal levels of subjects elicit by both of the educational films did not significantly differ between the conditions. Indicating that there is not a significant difference between the low, medium, high and control condition and the levels of valence and arousal evoked by the educational films. Mean scores of the valence and arousal levels per educational film can be found in table 3. With respect to the evoked arousal levels in none of the conditions a significant difference was found between the educational film about blood circulation and the educational film River clay. Further analysis showed that there was a significant difference within the condition high arousal regarding the arousal level of the subjects for the educational film about river clay ($t(43) = 2.26$, $p < .01$). The score of the subjects on the arousal dimension for the educational film river clay was significant higher

in condition 3A (blood circulation - Herotrance – river clay - Newhiphop) (M = 3.36, SD = 2.36) than condition 3B (blood circulation - Newhiphop – river clay - Herotrance) (M = 2.13, SD = 1.10). In the other conditions such significant differences were not found.

Table 3

Means of valence and arousal levels evoked by educational films

	Educational film 1 Blood circulation				Educational film 2 River clay			
	Valence level		Arousal level		Valence level		Arousal level	
Experimental condition	M	SD	M	SD	M	SD	M	SD
Low	6,00	1,21	3,24	1,54	6,36	1,95	2,62	1,96
Medium	5,68	1,61	3,08	1,53	6,32	2,14	2,55	2,08
High	6,04	1,54	3,33	2,03	6,18	2,35	2,73	1,91
Control	5,45	1,92	3,08	2,22	6,82	2,10	3,38	2,67
p	= .27		= .90		= .55		= .30	

Memory for presented information

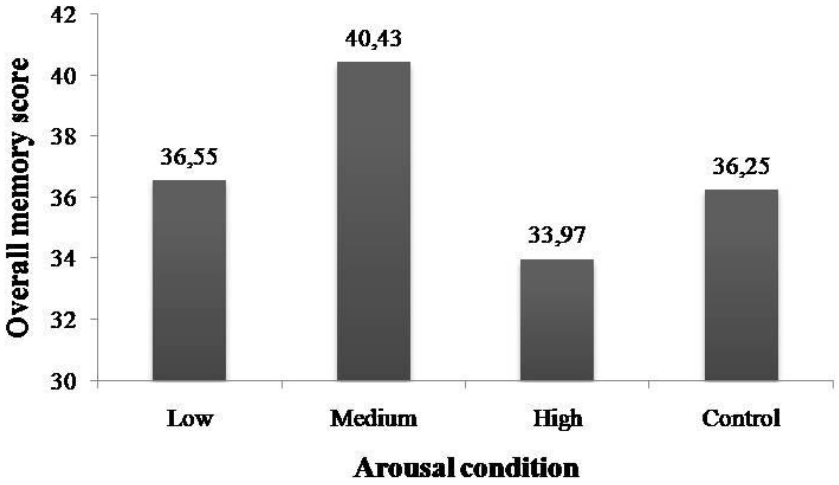
The effect of the arousal condition on the memory for the presented information in the educational films was measured with true/false questions and multiple choice questions. For the overall memory score (combined score of true/false - and multiple choice questions for the two educational films), an analysis of variance (one-way ANOVA) was conducted, with the arousal condition as factor and the overall memory score as dependent variable. A main effect was found for the arousal condition on total memory score ($F(1, 157) = 12.00$, $p < .01$). Results showed that the overall memory score of the subjects in the medium arousal condition was significant higher (M = 40.42, SD = 4.01) than that of subjects in the low (M = 36.55, SD = 4.55), high (M = 33.97, SD = 5.66) and control condition (M = 36.25, SD = 5.11). No significant differences were found between the total memory score of the subjects on the remaining conditions (figure 1 & Appendix I).

The combined memory measures for the two educational films were also analyzed separately for true/false questions and multiple choice questions. Analyses of variance showed that there was a main effect for the combined scores of the subjects on the true/false questions ($F(3, 157) = 7.80$, $p < .01$) as well as the multiple choice questions ($F(3, 162) = 11.75$, $p < .01$). In both cases, true/false questions (M = 24.70, SD = 2.38) and multiple choice questions (M = 1.72, SD = 2.01), the scores of the subjects in the medium arousal condition

were significant higher (M = 24.70; M = 15.72) compared to the conditions low arousal (M= 22.74; M = 13.83), high arousal (M = 21,82; M = 12.23) and control (M = 22.58; M = 13.68). There were no significant differences between the other conditions (Appendix I & II).

Figure 1

Overall memory score per arousal condition



Furthermore, an analysis of variance (one-way ANOVA) was conducted for the combined memory score (i.e., true/false questions and multiple choice questions) of the educational film about blood circulation. As factor the arousal condition was applied and as dependent variable the combined memory score of the subjects. For the two memory measures separately the same analysis of variance was executed. A significant main effect was found for the combined memory score ($F(3,162) = 11.66$, $p < .01$), the true/false questions ($F(3, 162) = 8.35$, $p < .01$) and the multiple choice questions ($F(3, 162) = 6.90$, $p < .01$). A Bonferroni post hoc test showed that for the combined memory score and the true/false questions the scores of the subjects in the medium condition were significant higher than the scores of subjects in the other three conditions. For the multiple choice questions, subjects in the medium condition scored significant higher (M = 8.30 SD = 1.31) than the subjects in the high (M = 6.84, SD = 1.82) and control condition (M= 7.00, SD = 1.66). Besides the found significant differences, the differences between the other conditions were insignificant (Appendix I & II).

For the educational film about river clay the same statistical procedure as for the educational film about blood circulation was followed. A main effect was found for the combined memory score ($F(3, 158) = 7.82$, $p < .01$) and the multiple choice questions ($F(3, 163) = 10.21$, $p < .01$). No main effect was found for the true/false questions ($F(3, 158) =$

3.49, p = .02). For the combined and multiple choice scores, subjects in the medium condition scored significant better (M = 19.20; M = 7.42) than in the high condition (M = 15.95; M = 5.42). Other findings were a difference (p = .02) between the scores of the subjects in the medium condition (M = 19.20, SD = 2.59) and in the control condition (M = 17.92, SD = 3.08) concerning the combined score, and a difference (p = .02) between the scores in the medium condition (M = 7.42, SD = 1.39) and in the low condition (M = 6.33, SD = 1.79) for the multiple choice questions. Further, the score of the subjects on true/false questions were significant higher (p = .01) in the medium condition (M = 11.78, SD = 1.70) than in the high condition (M = 10.45, SD = 2.12). No other significant results were found (Appendix I & II).

Finally, a t-test demonstrated that the scores of the subjects on the educational film about blood circulation were significantly (p < .01) higher compared to the scores of the subjects on the educational film about river clay.

Figure 2

Combined memory score for the film 'Blood circulation'

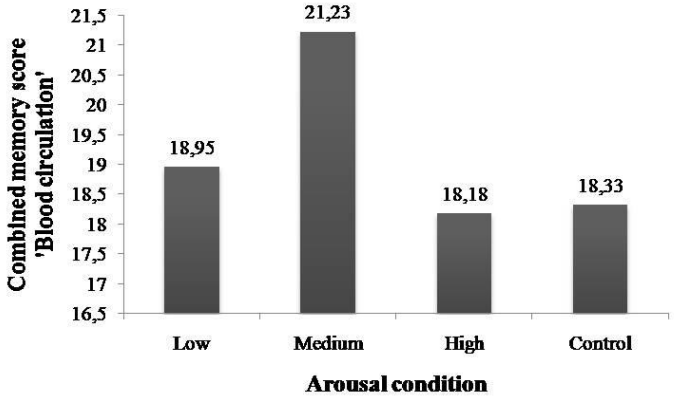
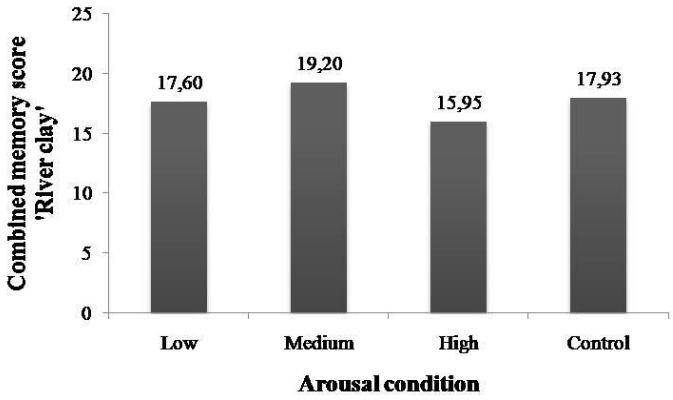


Figure 3

Combined memory score for the film 'River clay'



Evaluation of educational films

For the educational films a reliability analysis was conducted to test whether the ten items measuring the evaluation of the educational films (for blood circulation as well as for river clay) could be combined into an additive score for evaluation of the educational films. The Cronbach's alpha for the ten items used for both of the educational films, was high (alpha = .90). The alpha represents a reliable measure, so an additive index of the ten semantic differentials was constructed for evaluation of the educational films. One of the subjects failed to complete all the items and was therefore excluded from the analysis.

The effect of the level of arousal of musical tracks on the evaluation of the educational films was measured using an analysis of variance (one-way ANOVA), with the arousal

condition as factor and the evaluation of the educational films as the dependent variable. There were no significant differences found between the conditions low, medium, high and no arousal. Results showed that the level of arousal of the used musical tracks did not affect the evaluation of the educational films (Appendix I & II).

The same procedure was followed concerning the evaluation of the two educational films separately. The Cronbach's alpha for the educational film blood circulation was .81 and for the educational film river clay .91. With the evaluation of the educational film river clay one subject failed to complete all ten items and was therefore discarded from the analysis. For both of the films no significant differences between the conditions were found (Appendix I & II).

Conclusion

Interpretation of findings

It was hypothesized that the viewers' level of arousal will increase with increasing arousal level of the background music of educational films. The results shows that valence levels as well as the arousal levels of subjects elicited by both of the educational films did not significantly differ between the different conditions of background music. However, the pre-test showed that just listening to the musical tracks did induce different levels of arousal in the subjects of the pre-test. A reason for this could be the difference between the age of the subjects in both the pre-test and the experiment. Younger viewers are more at ease with higher levels of arousal than older viewers because they are used to the fast pace used in the media (Bellamy and Walker, 1996). Furthermore, they are at an age in which sensation seeking is higher than the subjects of the pre-test (Zuckerman, 1994). In addition, young children seem to be less nuanced in the way they classify their levels of arousal. Another explanation might be the fact that the film is subtracting the subject from the music, which makes them feel less aroused by the music.

The main aim of this study was to evaluate whether the arousal level of background music influences the memory of the information presented in educational films. It was expected that up to a certain extent, the arousal level of background music is positively related to the memory of the presented information. It was found that the overall memory score of the subjects in the medium arousal condition was significantly higher than that of subjects in the low, high and control condition. The total memory scores of the subjects in the control, low and high condition, were not significantly different from each other. This finding is in accordance with the limited capacity model described by Lang (2000). This model predicts an inverted U-shape relationship between increase in structural features and memory. In this study, an inverted U-shape relationship was found between the level of arousal of background music and memory of presented information in educational films. Other research shows a similar relationship between the level of arousal and memory (Lang, Dhillon, and Dong, 1995; Tavassoli, Shultz, and Fitzsimons, 1995; Shapiro, MacInnes, and Park, 2002).

In this study, two educational films (Blood circulation and River clay) were used to test the hypothesis. As described above it was found that overall the memory score was increased when background music with a medium level of arousal was used. In addition to this, it was tested whether the same holds true for the two separate films. The results of the two separate films showed the same trend. Again, the medium condition seems to positively

affect memory compared to the other conditions. However in the results of the film about River clay, only a significant difference was found between the medium and high condition. Furthermore, the scores of the subjects on the educational film about blood circulation were significantly higher compared to the scores of the subjects on the educational film about river clay. This might be explained by the fact that the educational film about River clay was the second film that was presented to the subjects, which possibly resulted in a decreased concentration for the second film.

Finally, it was hypothesized that the evaluation of the information presented in the educational films is positively affected by the arousal level of background music. Results showed that the level of arousal of the used musical tracks did not affect the evaluation of the educational films. In contrast, some studies show that there is a relationship between levels of arousal and evaluation of the information presented in media (Tavassoli, Shultz, and Fitzsimons, 1995; Vettehen, Nuijten, and Peeters, 2008).

Discussion

Previous studies generally used different music to represent music with high and low levels of arousal (Schellenberg et al., 2007; Thompson, Schellenberg, Husain, 2001). This study shows however that even with the same musical track it is only the manipulation of tempo (i.e., beats per minute) that can affect the level of arousal. It is suggested that tempo of music is an important component which directly relates to the level of arousal.

A final remark concerns the problem of producers of educational films who want to attract and at the same time inform viewers. Although a lot of producers believe that music with a higher tempo leads to greater attention, and therefore memory of the presented information, in reality this may not be so. This study indicates that producers can use background music to elicit arousal from viewers without necessarily sacrificing the viewers' ability to process the information presented in educational films. The findings of this study suggest that producers need to search for music with an optimum level of arousal at which the presented content would be memorized most effectively.

Recommendations

Significant differences were found within the group of subjects of the experiment. Subjects from grade eight scored significantly higher than subjects from grade seven. There was also a significant different found between subjects with a Dutch nationality and subjects with other backgrounds. This different might be caused by arrears in the Dutch language. To rule out these differences, it is recommended to perform experiments with subjects with the same academic level.

Furthermore it was observed that after ten minutes during the first educational film the concentration of the children decreased. The children became more restless. Therefore, it is recommended to use a film of not more than approximately ten minutes for these type of experiments. Furthermore it was noticed that watching two educational films (of longer duration) in a row decreased the subjects focus. The Quiz in the film Blood circulation and the sound-effects of animals in the film about River clay proved to be a good tool to attract the children's attention. Such features may enhance the attention level for other educational films as well.

Future studies could investigate the effect that background music has on the processing of educational films. Are there differences between introverts and extroverts? Studies showed that high sensation seekers in comparison with low sensation seekers require

a higher level of stimulation, and hence more arousal (Zuckerman, 1994). Extraverts have a higher optimal level of arousal and therefore it may be expected that they need higher arousing background music. It could also be argued that educational films with no background music or low arousing background music were perceived as more comprehensible and intelligible. Therefore it would also be interesting to examine if there is a difference between high involved viewers and low involved viewers regarding background music. Especially when viewers of an educational film are interested and all their resources are allocated to the gathering of information it could be assumed that background music is perceived as a distracter. Another issue that could be investigated is the effect of background music on the processing of information from educational films with different levels of difficulty. Finally, this research examined the relation of only one musical structural component (i.e., effect of tempo on arousal). Further research should attempt to explore the joint effects of structural components of background music that induce valence and arousal on the processing of educational films.

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Appendix I

In this appendix the tables of the results (descriptive and post hoc) concerning the memory and evaluation of the two educational films are presented.

1.1 Overall memory score for the educational films 'Blood circulation' and 'River clay'

Table 1

Descriptives overall memory score educational films 'Blood circulation' and 'River Clay'

Condition	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Low	42	36,55	4,549	,702	35,13	37,97	27	45
Medium	40	40,42	4,012	,634	39,14	41,71	30	47
High	39	33,97	5,659	,906	32,14	35,81	21	43
Control	40	36,25	5,113	,808	34,61	37,89	24	46
Total	161	36,81	5,341	,421	35,98	37,64	21	47

Table 2

Post hoc test, multiple comparisons overall memory score educational films (significance level .05)

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Medium	-3,877*	1,074	,002	-6,75	-1,01
	High	2,573	1,081	,111	-,32	5,46
	Control	,298	1,074	1,000	-2,57	3,17
Medium	Low	3,877*	1,074	,002	1,01	6,75
	High	6,451*	1,094	,000	3,53	9,37
	Control	4,175*	1,087	,001	1,27	7,08
High	Low	-2,573	1,081	,111	-5,46	,32
	Medium	-6,451*	1,094	,000	-9,37	-3,53
	Control	-2,276	1,094	,235	-5,20	,65
Control	Low	-,298	1,074	1,000	-3,17	2,57
	Medium	-4,175*	1,087	,001	-7,08	-1,27
	High	2,276	1,094	,235	-,65	5,20

*. The mean difference is significant at the 0.05 level.

Table 3

Post hoc test, multiple comparisons for the combined scores (true/false questions & multiple choice questions) on the educational films 'Blood circulation' and 'River clay'(significance level .05)

Dependent Variable	(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
True/False	Low	Medium	-1,962*	,612	,010	-3,60	-,33
		High	,918	,616	,831	-,73	2,56
		Control	,163	,612	1,000	-1,47	1,80
	Medium	Low	1,962*	,612	,010	,33	3,60
		High	2,879*	,624	,000	1,21	4,55
		Control	2,125*	,620	,005	,47	3,78
	High	Low	-,918	,616	,831	-2,56	,73
		Medium	-2,879*	,624	,000	-4,55	-1,21
		Control	-,754	,624	1,000	-2,42	,91
	Control	Low	-,163	,612	1,000	-1,80	1,47
		Medium	-2,125*	,620	,005	-3,78	-,47
		High	,754	,624	1,000	-,91	2,42
Multiple choice	Low	Medium	-1,892*	,597	,011	-3,49	-,30
		High	1,606*	,583	,039	,05	3,16
		Control	,158	,597	1,000	-1,44	1,75
	Medium	Low	1,892*	,597	,011	,30	3,49
		High	3,498*	,591	,000	1,92	5,08
		Control	2,050*	,605	,005	,44	3,66
	High	Low	-1,606*	,583	,039	-3,16	-,05
		Medium	-3,498*	,591	,000	-5,08	-1,92
		Control	-1,448	,591	,092	-3,03	,13
	Control	Low	-,158	,597	1,000	-1,75	1,44
		Medium	-2,050*	,605	,005	-3,66	-,44
		High	1,448	,591	,092	-,13	3,03

*. The mean difference is significant at the 0.05 level.

1.2 Memory scores for the educational film 'Blood circulation'

Table 4

Post hoc test, multiple comparisons combined memory score on the educational film 'Blood circulation' (significance level .05)

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Medium	-2,273*	,581	,001	-3,83	-,72
	High	,771	,568	1,000	-,75	2,29
	Control	,627	,581	1,000	-,93	2,18
Medium	Low	2,273*	,581	,001	,72	3,83
	High	3,043*	,575	,000	1,51	4,58
	Control	2,900*	,589	,000	1,33	4,47
High	Low	-,771	,568	1,000	-2,29	,75
	Medium	-3,043*	,575	,000	-4,58	-1,51
	Control	-,143	,575	1,000	-1,68	1,39
Control	Low	-,627	,581	1,000	-2,18	,93
	Medium	-2,900*	,589	,000	-4,47	-1,33
	High	,143	,575	1,000	-1,39	1,68

*. The mean difference is significant at the 0.05 level.

Table 5

Post hoc test, multiple comparisons for the memory score (true/false questions & multiple choice questions) on the educational film 'Blood circulation' (significance level .05)

Dependent Variable	(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
True/False	Low	Medium	-1,473*	,379	,001	-2,48	-,46
		High	,111	,370	1,000	-,88	1,10
		Control	,127	,379	1,000	-,88	1,14
	Medium	Low	1,473*	,379	,001	,46	2,48
		High	1,584*	,374	,000	,58	2,58
		Control	1,600*	,383	,000	,58	2,62
	High	Low	-,111	,370	1,000	-1,10	,88
		Medium	-1,584*	,374	,000	-2,58	-,58
		Control	,016	,374	1,000	-,98	1,02
	Control	Low	-,127	,379	1,000	-1,14	,88
		Medium	-1,600*	,383	,000	-2,62	-,58
		High	-,016	,374	1,000	-1,02	,98
Multiple Choice	Low	Medium	-,800	,354	,150	-1,74	,14
		High	,659	,345	,348	-,26	1,58
		Control	,500	,354	,955	-,44	1,44
	Medium	Low	,800	,354	,150	-,14	1,74
		High	1,459*	,350	,000	,53	2,39
		Control	1,300*	,358	,002	,34	2,26
	High	Low	-,659	,345	,348	-1,58	,26
		Medium	-1,459*	,350	,000	-2,39	-,53
		Control	-,159	,350	1,000	-1,09	,77
	Control	Low	-,500	,354	,955	-1,44	,44
		Medium	-1,300*	,358	,002	-2,26	-,34
		High	,159	,350	1,000	-,77	1,09

*. The mean difference is significant at the 0.05 level.

1.3 Memory scores for the educational film 'River clay'

Table 6

Post hoc test, multiple comparisons combined memory score for the educational film 'River clay' (significance level .05)

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Medium	-1,605	,669	,105	-3,39	,18
	High	1,645	,669	,090	-,14	3,43
	Control	-,330	,669	1,000	-2,12	1,46
Medium	Low	1,605	,669	,105	-,18	3,39
	High	3,250*	,677	,000	1,44	5,06
	Control	1,275	,677	,368	-,53	3,08
High	Low	-1,645	,669	,090	-3,43	,14
	Medium	-3,250*	,677	,000	-5,06	-1,44
	Control	-1,975*	,677	,024	-3,78	-,17
Control	Low	,330	,669	1,000	-1,46	2,12
	Medium	-1,275	,677	,368	-3,08	,53
	High	1,975*	,677	,024	,17	3,78

*. The mean difference is significant at the 0.05 level.

Table 7

Post hoc test, multiple comparisons for the memory score (true/false questions & multiple choice questions) on the educational film 'River clay' (significance level .05)

Dependent Variable	(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
True/False	Low	Medium	-,489	,410	1,000	-1,59	,61
		High	,836	,410	,260	-,26	1,93
		Control	,036	,410	1,000	-1,06	1,13
	Medium	Low	,489	,410	1,000	-,61	1,59
		High	1,325*	,415	,010	,22	2,43
		Control	,525	,415	1,000	-,58	1,63
	High	Low	-,836	,410	,260	-1,93	,26
		Medium	-1,325*	,415	,010	-2,43	-,22
		Control	-,800	,415	,335	-1,91	,31
	Control	Low	-,036	,410	1,000	-1,13	1,06
		Medium	-,525	,415	1,000	-1,63	,58
		High	,800	,415	,335	-,31	1,91
Multiple choice	Low	Medium	-1,092*	,375	,024	-2,09	-,09
		High	,911	,364	,080	-,06	1,88
		Control	-,342	,375	1,000	-1,34	,66
	Medium	Low	1,092*	,375	,024	,09	2,09
		High	2,003*	,369	,000	1,02	2,99
		Control	,750	,379	,298	-,26	1,76
	High	Low	-,911	,364	,080	-1,88	,06
		Medium	-2,003*	,369	,000	-2,99	-1,02
		Control	-1,253*	,369	,005	-2,24	-,27
	Control	Low	,342	,375	1,000	-,66	1,34
		Medium	-,750	,379	,298	-1,76	,26
		High	1,253*	,369	,005	,27	2,24

*. The mean difference is significant at the 0.05 level.

1.4 Evaluation of the educational films 'Blood circulation' and 'River clay'

Table 8

Descriptives combined evaluation educational films 'Blood circulation' and 'River Clay'

Condition	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Low	42	6,6643	,97175	,14994	6,3615	6,9671	4,35	8,50
Medium	40	6,7812	1,21664	,19237	6,3921	7,1704	2,60	9,00
High	45	6,6900	1,22254	,18225	6,3227	7,0573	4,00	9,00
Control	39	6,9808	1,01700	,16285	6,6511	7,3104	4,90	8,60
Total	166	6,7738	1,11193	,08630	6,6034	6,9442	2,60	9,00

Table 9

Post hoc test, multiple comparisons for the combined evaluation of the two educational films (significance level .05)

(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Medium	-,11696	,24640	1,000	-,7751	,5412
	High	-,02571	,23929	1,000	-,6649	,6134
	Control	-,31648	,24801	1,000	-,9789	,3460
Medium	Low	,11696	,24640	1,000	-,5412	,7751
	High	,09125	,24236	1,000	-,5561	,7386
	Control	-,19952	,25098	1,000	-,8699	,4709
High	Low	,02571	,23929	1,000	-,6134	,6649
	Medium	-,09125	,24236	1,000	-,7386	,5561
	Control	-,29077	,24400	1,000	-,9425	,3610
Control	Low	,31648	,24801	1,000	-,3460	,9789
	Medium	,19952	,25098	1,000	-,4709	,8699
	High	,29077	,24400	1,000	-,3610	,9425

Table 10

Post hoc test, multiple comparisons for the evaluation of the educational films 'Blood circulation' and 'River clay' (significance level .05)

Dependent Variable	(I) Condition	(J) Condition	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Evaluation 'Blood circulation'	Low	Medium	-,00357	,25520	1,000	-,6852	,6780
		High	-,14857	,24783	1,000	-,8105	,5133
		Control	-,02857	,25520	1,000	-,7102	,6530
	Medium	Low	,00357	,25520	1,000	-,6780	,6852
		High	-,14500	,25102	1,000	-,8154	,5254
		Control	-,02500	,25829	1,000	-,7149	,6649
	High	Low	,14857	,24783	1,000	-,5133	,8105
		Medium	,14500	,25102	1,000	-,5254	,8154
		Control	,12000	,25102	1,000	-,5504	,7904
	Control	Low	,02857	,25520	1,000	-,6530	,7102
		Medium	,02500	,25829	1,000	-,6649	,7149
		High	-,12000	,25102	1,000	-,7904	,5504
Evaluation 'River clay'	Low	Medium	-,23036	,31770	1,000	-1,0790	,6182
		High	,09714	,30853	1,000	-,7270	,9212
		Control	-,58132	,31978	,426	-1,4355	,2728
	Medium	Low	,23036	,31770	1,000	-,6182	1,0790
		High	,32750	,31249	1,000	-,5072	1,1622
		Control	-,35096	,32361	1,000	-1,2153	,5134
	High	Low	-,09714	,30853	1,000	-,9212	,7270
		Medium	-,32750	,31249	1,000	-1,1622	,5072
		Control	-,67846	,31461	,195	-1,5188	,1619
	Control	Low	,58132	,31978	,426	-,2728	1,4355
		Medium	,35096	,32361	1,000	-,5134	1,2153
		High	,67846	,31461	,195	-,1619	1,5188

Appendix II

In this appendix the figures of the results concerning the memory for the two educational films are presented.

2.1 Combined memory score for educational films 'Blood circulation and 'River clay'

Figure 1

Overall score true/false questions per arousal condition

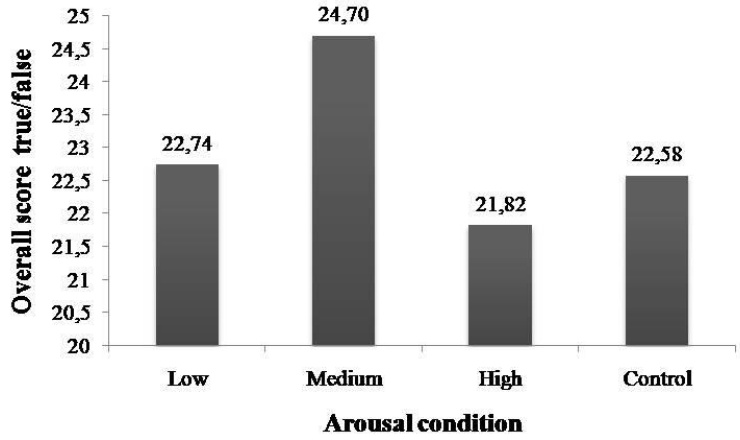
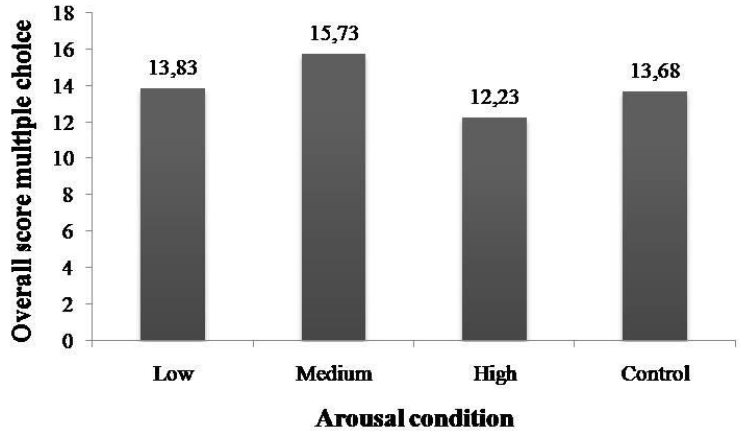


Figure 2

Overall score multiple choice questions per arousal condition



2.2 Memory score for the educational film 'Blood circulation'

Figure 3

Score true/false questions per arousal condition for the educational film 'Blood circulation'

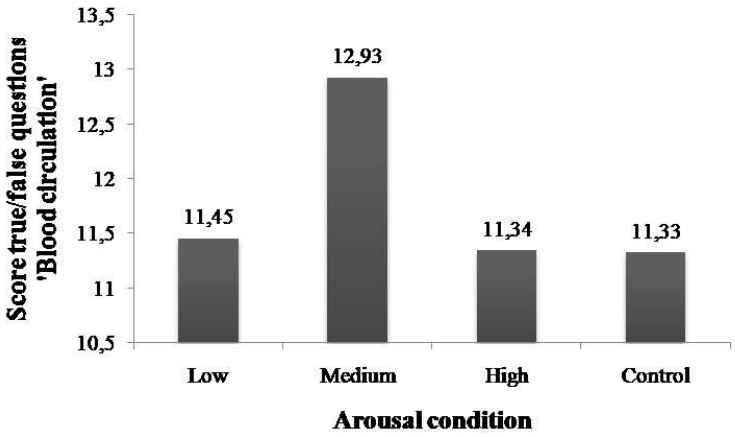
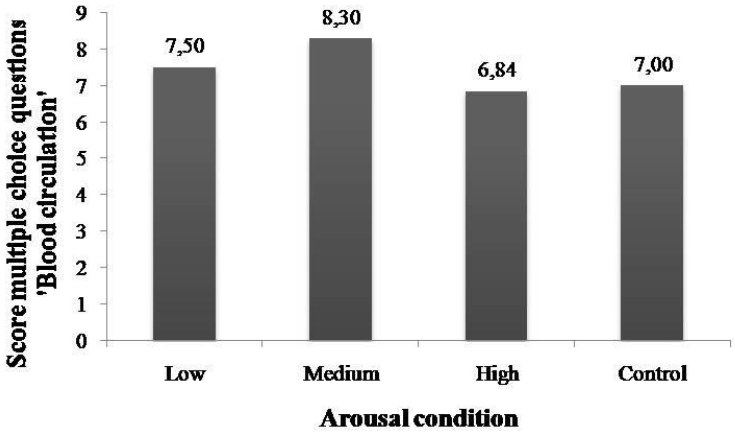


Figure 4

Score multiple choice questions per arousal condition for the educational film 'Blood circulation'



2.3 Memory score for the educational film 'River clay'

Figure 5

Score true/false questions per arousal condition for the educational film 'River clay'

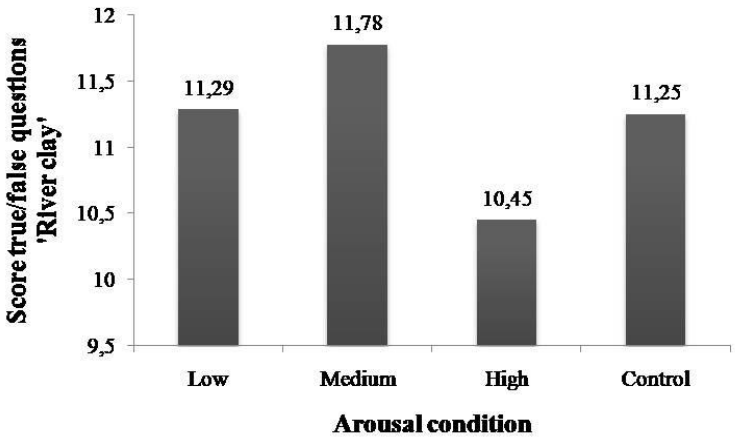
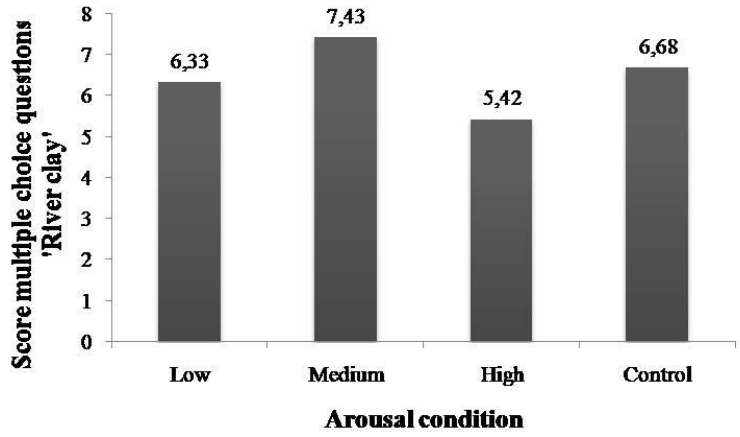


Figure 6

Score multiple choice questions per arousal condition for the educational 'River clay'



Appendix III

In this appendix the pretest using the Self-Assessment Manikin (SAM) (Bradley & Lang, 1994) in order to check the induced arousal and valence by the musical tracks is presented.

Welkom bij dit onderzoek.

- In dit onderzoek wordt geen koppeling gemaakt tussen uw naam en tijdens het onderzoek verkregen antwoorden en gedragingen.

- Bij dit onderzoek worden antwoorden op vragen en/of gedrag geregistreerd. Dit gebeurt d.m.v. antwoorden op vragenlijsten. Deze gegevens worden vervolgens **anoniem** behandeld, samengevoegd met andere proefpersonen, aan statistische analyses onderworpen en eventueel gebruikt voor wetenschappelijke publicaties.

- U wordt vriendelijk verzocht per vraag het voor u juiste antwoord aan te kruisen, dan wel de gevraagde informatie in te vullen. Het is voor ons van groot belang dat u **alle vragen** in de vragenlijst beantwoordt. Het invullen van de vragenlijst duurt ongeveer 10 minuten.

- Als u meer wilt weten over het onderzoek en/of geïnteresseerd bent in de resultaten van dit onderzoek dan kunt u aan het einde van deze vragenlijst uw e-mailadres achterlaten. Na afloop van dit onderzoek zal u dan per e-mail worden geïnformeerd over de inhoud en resultaten van dit onderzoek

Participantnummer ___

CD-1/2/3

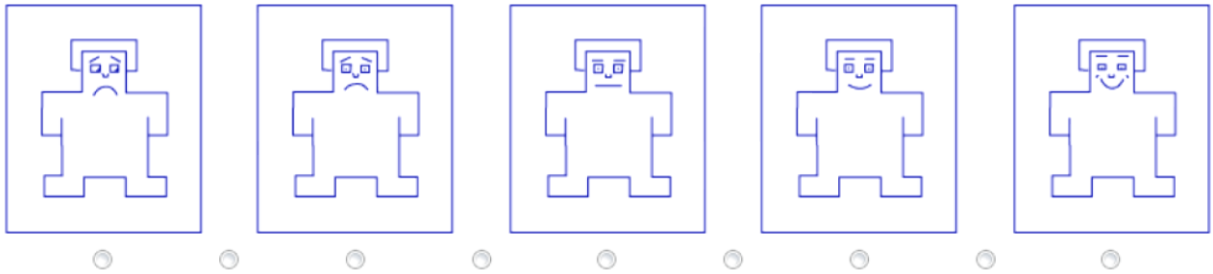
Muziek en Emotie

In deze sectie zijn we geïnteresseerd in uw mening over uw gevoelens betreffende de aan u gepresenteerde muziek.

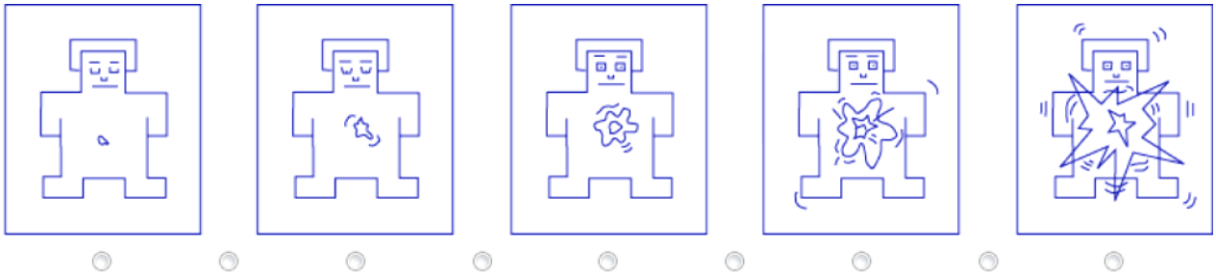
Muzieknummer 1

Kruis één van de negen hokjes onder de visuele schaal aan die het best weergeeft hoe u zich voelde ten tijde van het luisteren naar het muzieknummer. **Let op: Luister minimaal 1 minuut voordat u antwoord geeft.**

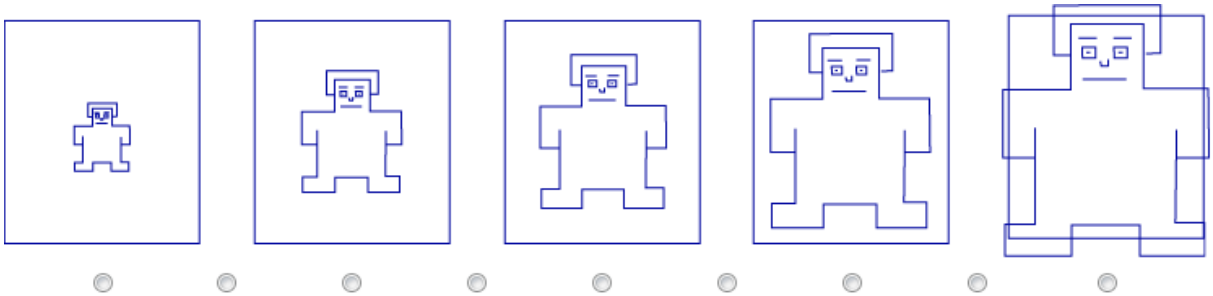
1. Onplezierig ←→ Plezierig



2. Kalm ← → Opgewonden



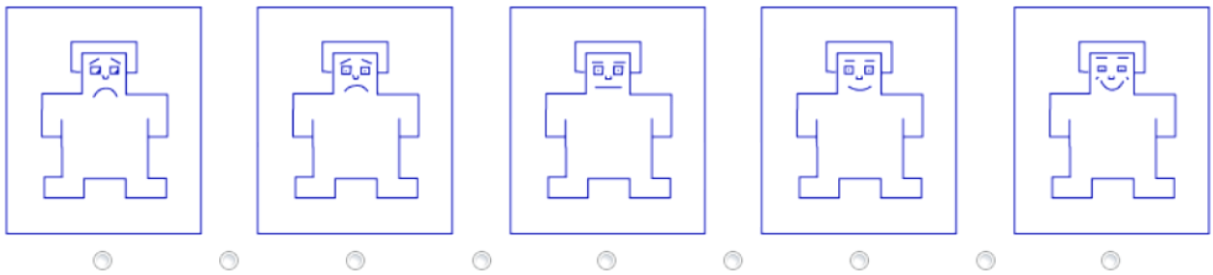
3. Beheerst worden (gedomineerd worden) ← → Beheersen (domineren)



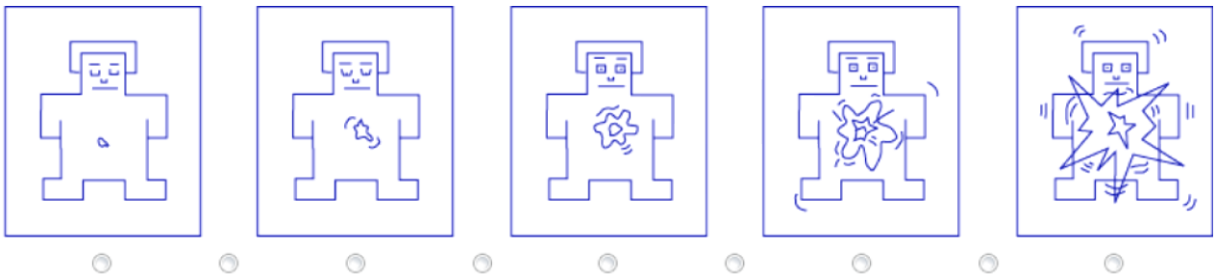
Muzieknummer 2

Kruis één van de negen hokjes onder de visuele schaal aan die het best weergeeft hoe u zich voelde ten tijde van het luisteren naar het muzieknummer. **Let op: Luister minimaal 1 minuut voordat u antwoord geeft.**

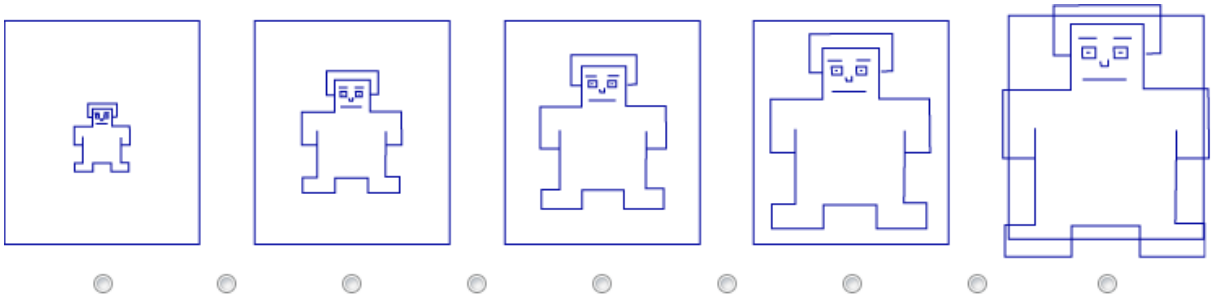
1. Onplezierig ←→ Plezierig



2. Kalm ← → Opgewonden



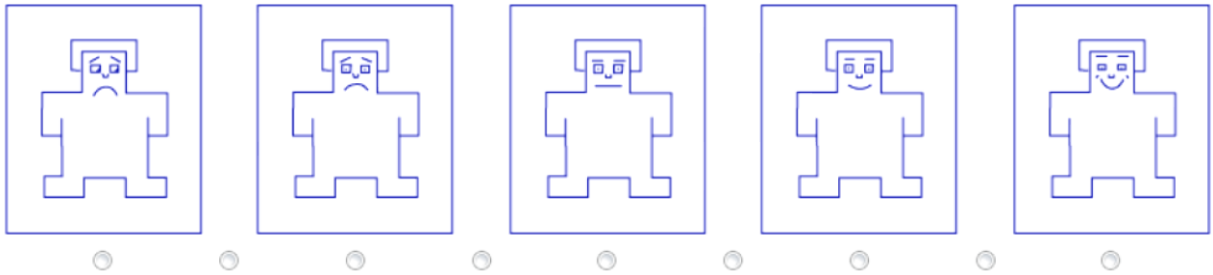
3. Beheerst worden (gedomineerd worden) ← → Beheersen (domineren)



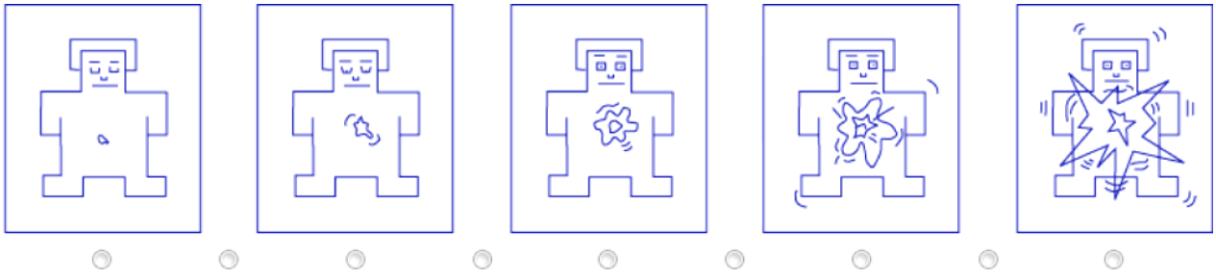
Muzieknummer 3

Kruis één van de negen hokjes onder de visuele schaal aan die het best weergeeft hoe u zich voelde ten tijde van het luisteren naar het muzieknummer. **Let op: Luister minimaal 1 minuut voordat u antwoord geeft.**

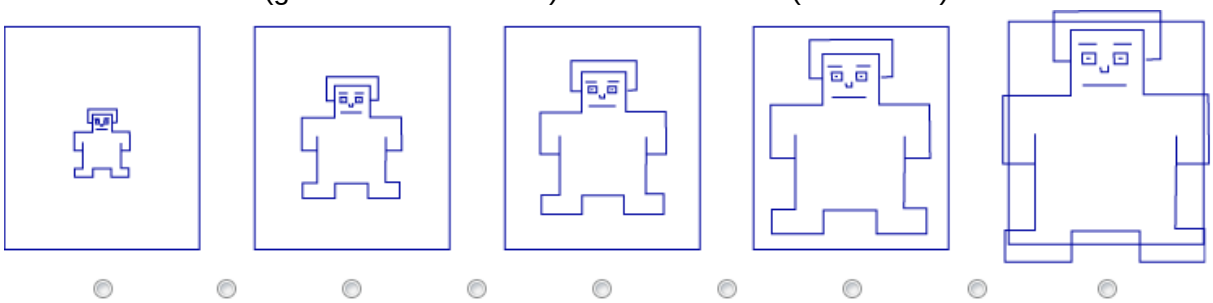
1. Onplezierig ←→ Plezierig



2. Kalm ← → Opgewonden



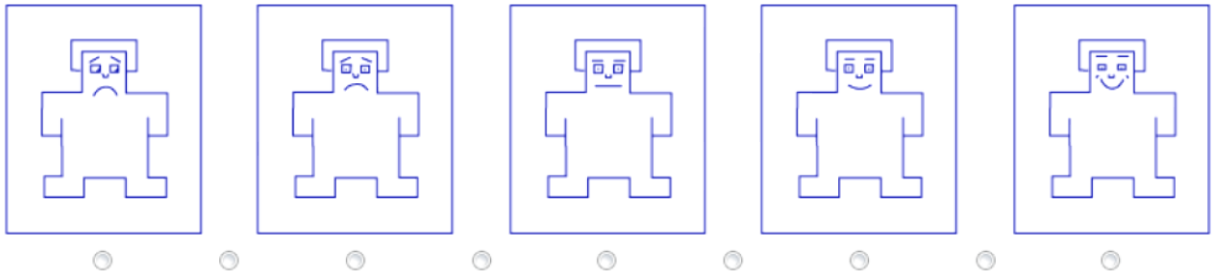
3. Beheerst worden (gedomineerd worden) ← → Beheersen (domineren)



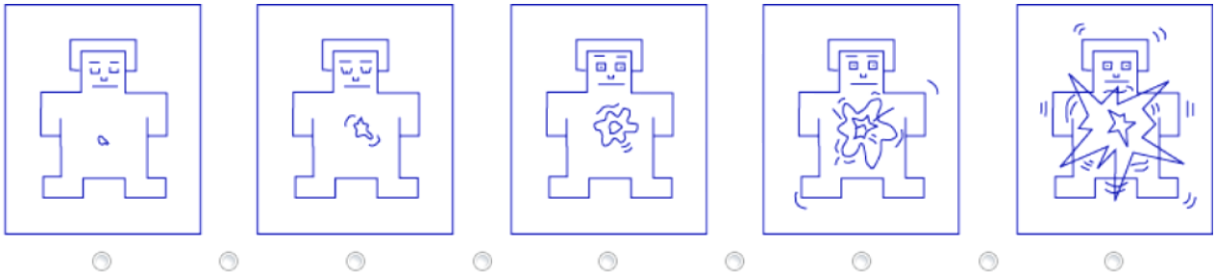
Muzieknummer 4

Kruis één van de negen hokjes onder de visuele schaal aan die het best weergeeft hoe u zich voelde ten tijde van het luisteren naar het muzieknummer. **Let op: Luister minimaal 1 minuut voordat u antwoord geeft.**

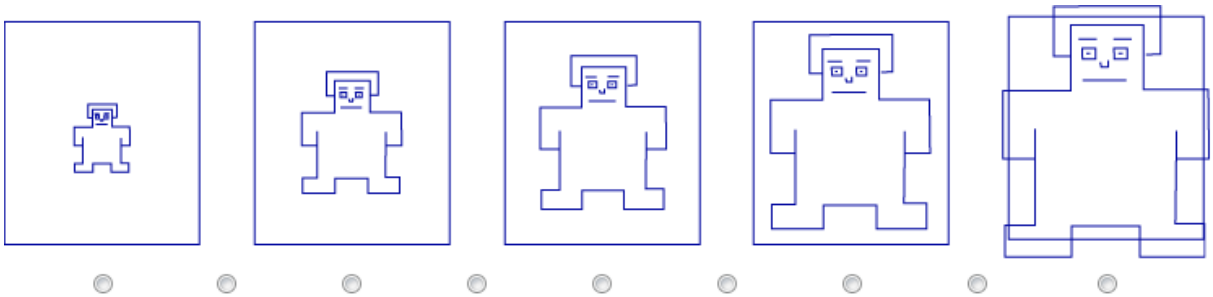
1. Onplezierig ←→ Plezierig



2. Kalm ← → Opgewonden



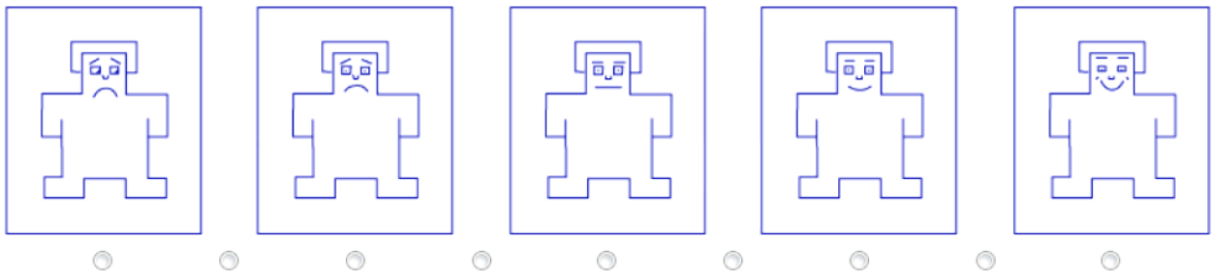
3. Beheerst worden (gedomineerd worden) ← → Beheersen (domineren)



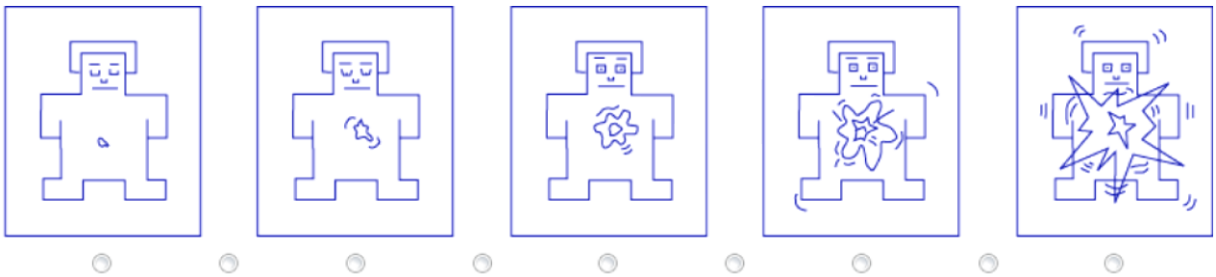
Muzieknummer 5

Kruis één van de negen hokjes onder de visuele schaal aan die het best weergeeft hoe u zich voelde ten tijde van het luisteren naar het muzieknummer. **Let op: Luister minimaal 1 minuut voordat u antwoord geeft.**

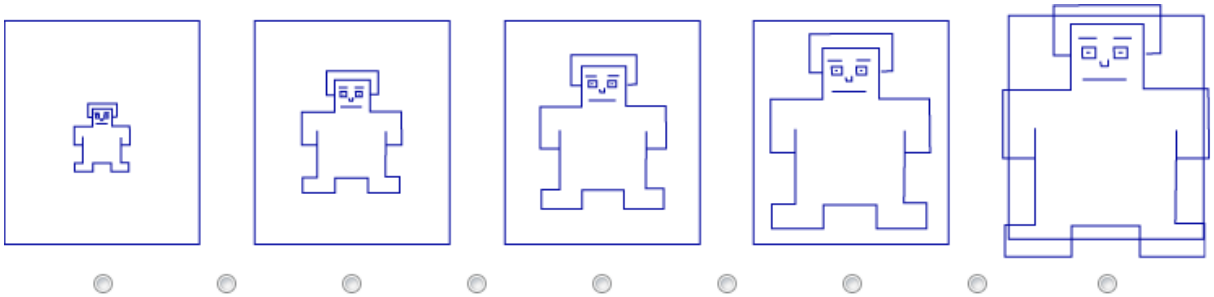
1. Onplezierig ←→ Plezierig



2. Kalm ← → Opgewonden



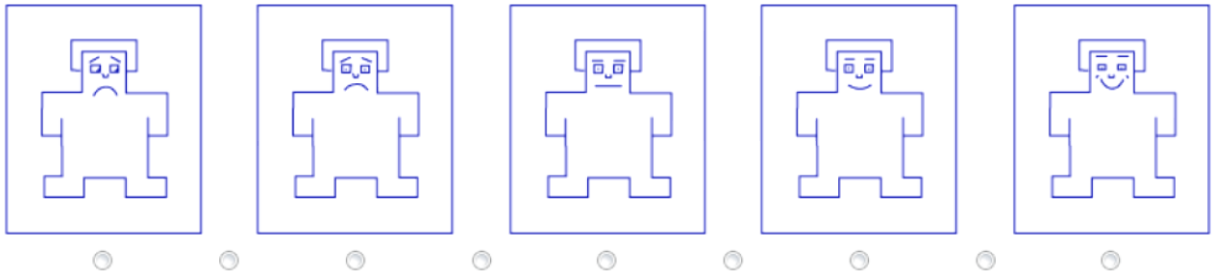
3. Beheerst worden (gedomineerd worden) ← → Beheersen (domineren)



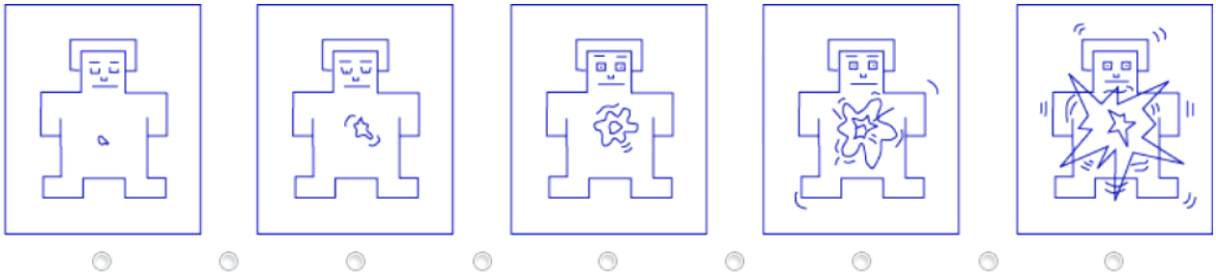
Muzieknummer 6

Kruis één van de negen hokjes onder de visuele schaal aan die het best weergeeft hoe u zich voelde ten tijde van het luisteren naar het muzieknummer. **Let op: Luister minimaal 1 minuut voordat u antwoord geeft.**

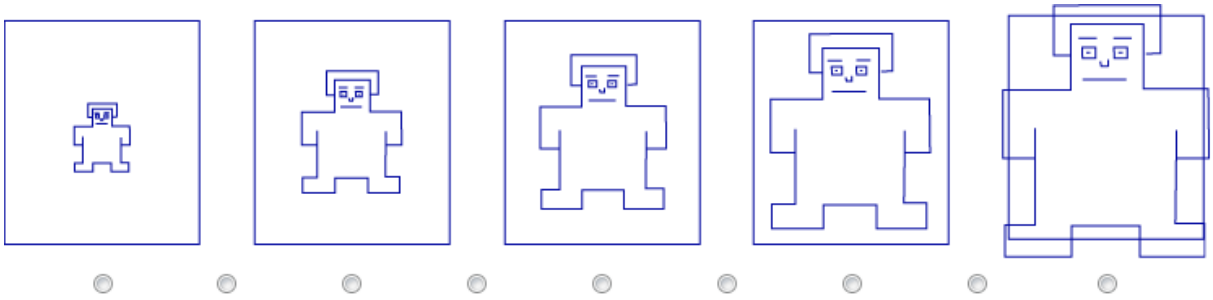
1. Onplezierig ←→ Plezierig



2. Kalm ← → Opgewonden



3. Beheerst worden (gedomineerd worden) ← → Beheersen (domineren)



Persoonlijk

Tot slot zijn we geïnteresseerd in een aantal persoonlijke gegevens. Deze gegevens worden gevraagd ten behoeve van het gehele onderzoek en zullen volledig anoniem behandeld worden.

1. Wat is uw leeftijd?
   ……

2. Wat is uw geslacht?

   - ❑ vrouw
   - ❑ man

3. Wat is uw hoogst voltooide opleiding?

   - ❑ lager algemeen (lagere/basisonderwijs)
   - ❑ lager beroepsonderwijs
   - ❑ middelbaar algemeen beroepsonderwijs (bijv. MAVO)
   - ❑ middelbaar beroepsonderwijs
   - ❑ voortgezet algemeen onderwijs (bijv. HAVO, VWO, Atheneum, Gymnasium)
   - ❑ hoger beroepsonderwijs
   - ❑ wetenschappelijk onderwijs, doctoraal
   - ❑ wetenschappelijk onderwijs, gepromoveerd

4. Wilt u per e-mail op de hoogte worden gebracht van de uitkomsten van dit onderzoek?

   - ❑ ja
   - ❑ nee

   Indien ja, e-mailadres:_____

Heeft u opmerkingen of suggesties over de vragenlijst of wilt u iets kwijt over de aan u gepresenteerde muziek wilt u dat dan hieronder vermelden?

Wij danken u hartelijk voor het invullen van deze enquête.

Appendix IV

In this appendix the questionnaire belonging to the experiment measuring the effects of musical background induced arousal on memory and evaluation of the presented information in the two educational films is presented.

Welkom bij dit onderzoek.

Leuk dat je meedoet! Waarom dit onderzoek vraag je je misschien af. Wij willen graag weten wat jij van de informatiefilmpjes vindt die jij in de klas te zien krijgt. Vind jij ze leuk of juist helemaal niet. Leer je wat van de filmpjes of juist niet. Om op deze en andere vragen antwoorden te krijgen laten we je zo dadelijk 2 filmpjes zien.

Na elk filmpje krijg je een aantal vragen. Eerst een paar vragen waarin je je mening mag geven over het filmpje en daarna een paar vragen over de inhoud van het filmpje. Let dus goed op.

Dankzij jouw hulp kunnen we in de toekomst informatiefilmpjes voor kinderen nog beter maken. Dank je wel.

Basisschool: _____

Voornaam: _____

Klas: _____

Datum: _____

VERSIE ____

Persoonlijk

Als eerst zijn we geïnteresseerd in een aantal persoonlijke gegevens van jou. Deze gegevens worden gevraagd om een algemeen beeld te vormen van de kinderen die met dit onderzoek meedoen en zullen volledig anoniem behandeld worden.

1. Wat is jouw leeftijd?
   ……

2. Wat is jouw geslacht?

❑ Meisje
❑ Jongen

3. In welk land ben jij geboren?
   En uit welk land komt jouw vader en jouw moeder?

	Jijzelf	Je moeder	Je vader
Nederland	☐	☐	☐
Turkije	☐	☐	☐
Marokko	☐	☐	☐
Syrië	☐	☐	☐
Suriname	☐	☐	☐
Nederlandse Antillen	☐	☐	☐
Aruba	☐	☐	☐
Anders,	☐	☐	☐
namelijk:			

Film 1

De Mens – Bloedsomloop

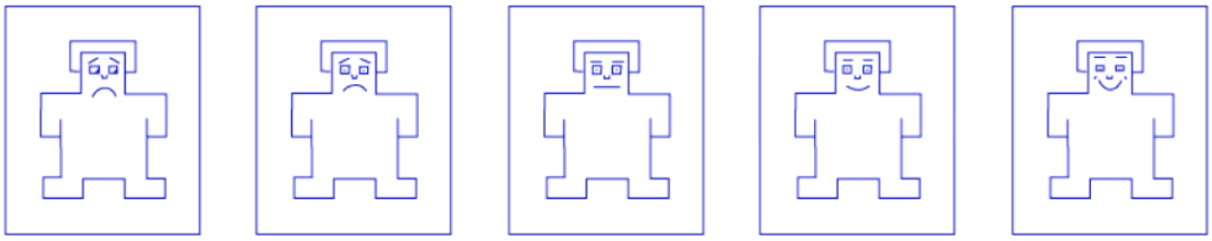
Evaluatie aflevering 'De bloedsomloop'

In dit deel zijn we geïnteresseerd in jouw mening over de aflevering over de bloedsomloop uit de serie 'De Mens'.

Wat moet je doen?

Hieronder zie je drie rijen met verschillende plaatjes. Probeer bij iedere rij plaatjes zo goed mogelijk aan te geven hoe jij je voelde tijdens het kijken naar de aflevering over de bloedsomloop. Kruis 1 van de negen rondjes onder de plaatjes aan die jij het beste vindt passen bij jouw gevoel. Het gaat om je eigen mening dus je antwoord is altijd goed.

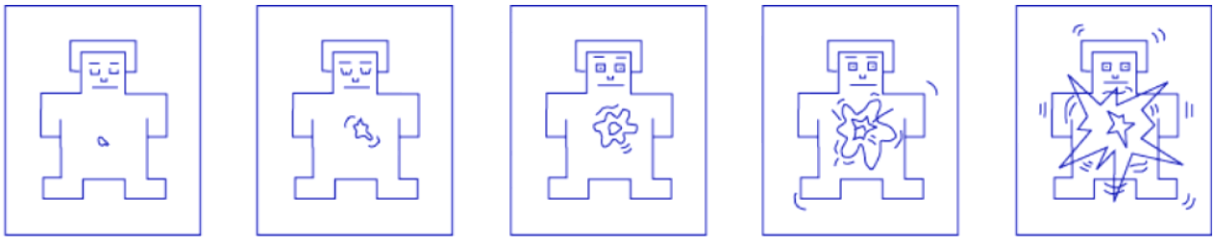
Vraag 1: *Hoe voelde je je tijdens het kijken naar de aflevering?*



Niet plezierig ***Plezierig***

1 2 3 4 5 6 7 8 9

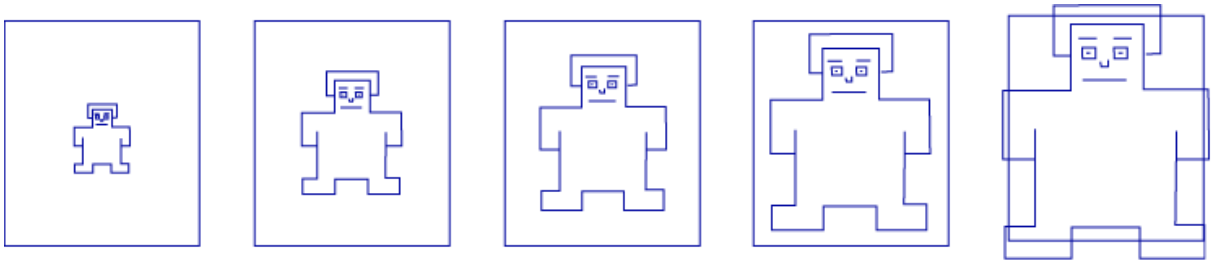
Vraag 2: *Hoe voelde je je tijdens het kijken naar de aflevering?*



Kalm ***Opgewonden***

1 2 3 4 5 6 7 8 9

Vraag 3: *Hoe voelde je je tijdens het kijken naar de aflevering?*



Klein ***Groot***

Ik snapte er niets van

1 2 3 4 5 6 7 8 9

Ik begreep alles.

VOLGENDE PAGINA VRAAG 4

Wat moet je doen?

Hieronder staan 10 keer twee woorden die elkaars tegenpool zijn. Tussen elk van die twee woorden zie je steeds 9 hokjes staan. Kruis bij elke twee woorden steeds dat hokje aan dat het best beschrijft wat je vindt. Als een hokje dichter bij een woord staat betekent het dat je het meer eens bent met dat woord. Als een hokje verder van een woord vandaan staat dan betekent het dat je het minder eens bent met dat woord.

Vraag 4: *Wat vond jij van het filmpje over 'de bloedsomloop'? Het filmpje over 'de bloedsomloop' was….*

Niet leerzaam	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Leerzaam**
Vrolijk	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Droevig**
Informatief	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Niet informatief**
Aangenaam	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Onaangenaam**
Slecht	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Goed**
Leuk	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Stom**
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Saai	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Boeiend**
Interessant	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Oninteressant**

VOLGENDE PAGINA OPGAVEN

Opgaven aflevering ‘De bloedsomloop’

In dit deel stellen we je wat vragen over een aantal zaken die behandeld zijn in de aflevering over de bloedsomloop uit de serie ‘De Mens’.

Heel veel succes!

Goed of Fout?

Hieronder staan een aantal beweringen. Geef telkens voor elke bewering aan of deze goed of fout is. Doe dit door een kruis in het juiste hokje achter de vraag te zetten.

Heb je een verkeerd hokje aangekruist maak dan het hele hokje zwart en zet een kruis in het goede hokje.

	GOED	FOUT
1. Doordat je hart pompt, wordt je hele lichaam van bloed voorzien.	☐	☐
2. Je hart bestaat uit 2 kamers, en 2 boezems.	☐	☐
3. De grote bloedvaten in je lichaam zijn rood of blauw van kleur.	☐	☐
4. In aders stroomt het bloed naar je hart toe.	☐	☐
5. De bloedsomloop is vergelijkbaar met een stratenplan van een stad.	☐	☐
6. De vertakkingen van slagaders worden ook wel straatjes genoemd.	☐	☐
7. Je lichaam heeft naast bouwstoffen ook afvalstoffen nodig.	☐	☐
8. Bloed wordt door je lichaam zelf aangemaakt.	☐	☐
9. Witte bloedcellen maken stoffen om bacteriën te doden.	☐	☐
10. Als je je inspant heeft je lichaam minder bloed nodig.	☐	☐
11. Een baby heeft een lagere rusthartslag dan een bejaarde.	☐	☐
12. Alleen met een operatie kan men een levend hart zichtbaar maken.	☐	☐
13. Door verkeerd voedsel en roken kunnen bloedvaten dichtgroeien.	☐	☐
14. Als je lichaam niet genoeg zuurstof naar je hersenen brengt, dan spreek je van een hartinfarct.	☐	☐
15. Verstandig eten en voldoende sporten zijn voor een goede bloedsomloop belangrijk.	☐	☐

VOLGENDE PAGINA MEERKEUZEVRAGEN

Meerkeuzevragen

Hieronder staan een aantal meerkeuzevragen. Geef bij iedere vraag aan wat volgens jou het meest juiste antwoord is. Doe dit door een kruis in het juiste hokje (A, B, C, D) achter de vraag te zetten.

Heb je een verkeerd hokje aangekruist maak dan het hele hokje zwart en zet een kruis in het goede hokje.

1. Waar ging het programma over?

A	B	C	D

a. Inentingen
b. Het lichaam
c. De bloedsomloop
d. Je leeftijd

2. Waar bestaat de bloedsomloop uit?

A	B	C	D

a. Je hart en je bloedvaten
b. Alle organen in je lichaam
c. Je spieren en je hart
d. Je haren en je spieren

3. Wat is/zijn (een) eigenschap(pen) van slagaders?

A	B	C	D

a. Ze vervoeren bloed van het hart naar de organen
b. Ze vervoeren bloed van de organen naar het hart
c. Ze hebben een dunne wand
d. Alle bovenstaande antwoorden zijn goed

4. Wat is de functie van de klepjes in aders?

A	B	C	D

a. Ze zorgen ervoor dat je de aders makkelijk kunt plat drukken
b. Ze zorgen ervoor dat het bloed sneller kan stromen
c. Ze houden bacteriën in het bloed tegen
d. Ze zorgen ervoor dat het bloed niet in de verkeerde richting stroomt

5. Hoe kan je je hartslag meten?

A	B	C	D

a. Met een ECG
b. Door met je hand te voelen, en zelf het aantal slagen te tellen
c. Met een hartslagmeter
d. Alle bovenstaande antwoorden zijn goed

6. Wat gebeurt er als je hart sneller gaat kloppen?

A	B	C	D

a. Je longen worden groter
b. Er wordt meer bloed rondgepompt
c. Je wordt verliefd
d. Geen van bovenstaande antwoorden is goed

VOLGENDE PAGINA MEERKEUZEVRAGEN

7. Wat gebeurt er met je rusthartslag naarmate je ouder wordt?

A	B	C	D

a. Die neemt toe
b. Die neemt af
c. Die blijft gelijk
d. Dat verschilt per persoon

8. Welke stoffen worden via het bloed opgenomen in het lichaam?

A	B	C	D

a. Zuurstof, bouwstof en brandstof
b. Bouwstoffen en afvalstoffen
c. Zuurstof en koolzuurgas
d. Groene en witte bolletjes

9. Hoeveel bloed heeft een mens?

A	B	C	D

a. Ongeveer een halve liter
b. Ongeveer 3 liter
c. Ongeveer 6 liter
d. Dat hangt af van zijn of haar lichaamsgewicht

10. Hoe kan je immuun worden voor gevaarlijke ziekten, zoals mazelen en rode hond?

A	B	C	D

a. Door een halve liter bloed af te staan
b. Door veel te sporten en gezond te eten
c. Door verzwakte bacteriën van die ziekte in het lichaam in te spuiten
d. Door altijd goed je handen te wassen voordat je iets eet

EINDE OPGAVEN

Film 2

Landschap & Grondsoort – Het rivierkleilandschap

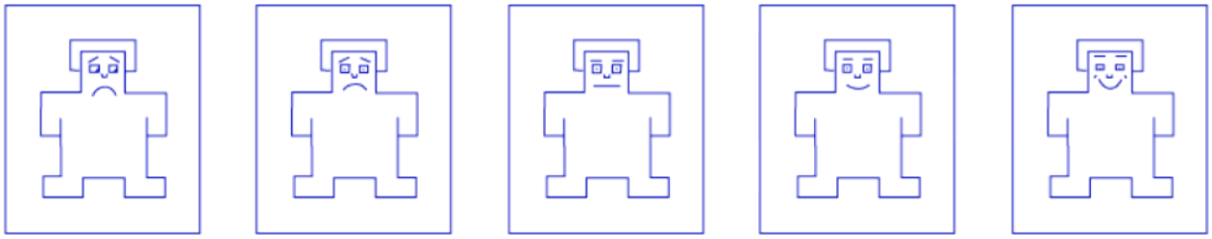
Evaluatie aflevering 'Het rivierkleilandschap'

In dit deel zijn we geïnteresseerd in jouw mening over de aflevering over het rivierkleilandschap uit de serie 'Landschap & Grondsoort'.

Wat moet je doen?

Hieronder zie je drie rijen met verschillende plaatjes. Probeer bij iedere rij plaatjes zo goed mogelijk aan te geven hoe jij je voelde tijdens het kijken naar de aflevering over 'het rivierkleilandschap' . Kruis 1 van de negen rondjes onder de plaatjes aan die jij het beste vindt passen bij jouw gevoel. Het gaat om je eigen mening dus je antwoord is altijd goed.

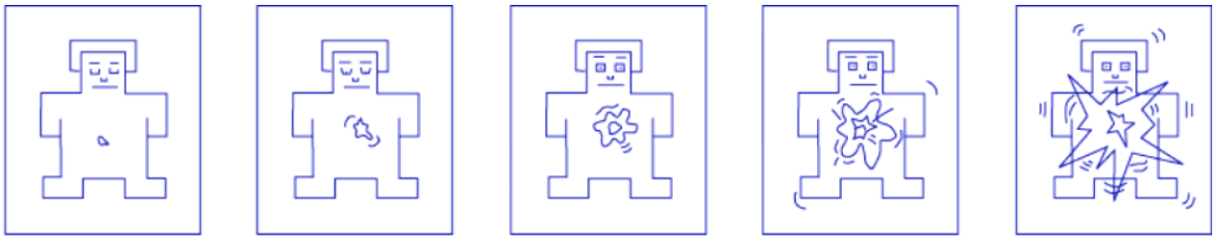
Vraag 1: *Hoe voelde je je tijdens het kijken naar de aflevering?*



Niet plezierig ***Plezierig***

1 2 3 4 5 6 7 8 9

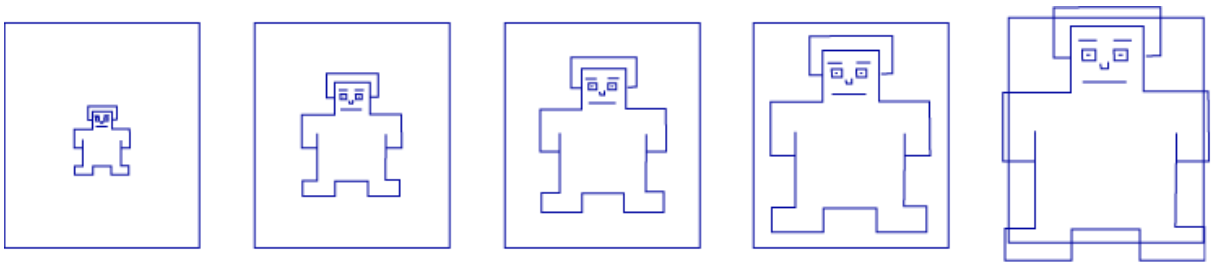
Vraag 2: *Hoe voelde je je tijdens het kijken naar de aflevering?*



Kalm ***Opgewonden***

1 2 3 4 5 6 7 8 9

Vraag 3: *Hoe voelde je je tijdens het kijken naar de aflevering?*



Klein ***Groot***

Ik snapte er niets van

1 2 3 4 5 6 7 8 9

Ik begreep alles.

VOLGENDE PAGINA VRAAG 4

Wat moet je doen?

Hieronder staan 10 keer twee woorden die elkaars tegenpool zijn. Tussen elk van die twee woorden zie je steeds 9 hokjes staan. Kruis bij elke twee woorden steeds dat hokje aan dat het best beschrijft wat je vindt. Als een hokje dichter bij een woord staat betekent het dat je het meer eens bent met dat woord. Als een hokje verder van een woord vandaan staat dan betekent het dat je het minder eens bent met dat woord.

Vraag 4: *Wat vond jij van het filmpje over 'het rivierkleilandschap'? Het filmpje over 'het rivierkleilandschap' was….*

Niet leerzaam	☐	☐	☐	☐	☐	☐	☐	☐	☐	**Leerzaam**
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VOLGENDE PAGINA OPGAVEN

Opgaven aflevering ‘Het rivierkleilandschap’

In dit deel stellen we je vragen over een aantal zaken die behandeld zijn in de aflevering over het rivierkleilandschap uit de serie ‘Landschap & Grondsoort’.

Heel veel succes!

Hieronder staan een aantal beweringen. Geef telkens voor elke bewering aan of deze goed of fout is. Doe dit door een kruis in het juiste hokje achter de vraag te zetten.

Heb je een verkeerd hokje aangekruist maak dan het hele hokje zwart en zet een kruis in het goede hokje.

	Goed	Fout
1. Het water in een rivier staat altijd even hoog.	☐	☐
2. Bij een bocht in de rivier, stroomt het water in de buitenbocht sneller dan in de binnenbocht.	☐	☐
3. Als water uit de rivier meer ruimte krijgt, gaat het water sneller stromen.	☐	☐
4. Bij laag water stroomt de rivier buiten zijn oevers.	☐	☐
5. Als het water uit een rivier buiten zijn oevers treedt, gaat het water langzamer stromen en zakken de zanddeeltjes als eerste naar de bodem.	☐	☐
6. Slib is hetzelfde als klei.	☐	☐
7. Een eigenschap van klei is dat het heel goed water vast houdt.	☐	☐
8. Een voordeel van hoogstamfruitbomen is dat de boeren hun land voor twee doelen tegelijk konden gebruiken: voor veeteelt en voor fruitteelt.	☐	☐
9. Om het mooie beeld niet verloren te laten gaan, groeit het meeste fruit tegenwoordig nog steeds in hoogstamboomgaarden.	☐	☐
10. De grond op oeverwallen bestaat uit zand en klei en is kruimelig en redelijk droog. Hierdoor is deze grond zeer geschikt voor akkerbouw en fruitteelt.	☐	☐
11. Oeverwallen zijn te herkennen aan de kaarsrechte wegen met statige populieren langs de zijkant.	☐	☐
12. Kommen liggen lager dan oeverwallen, waardoor de grond daar veel natter is.	☐	☐
13. Boeren in het rivierkleigebied gebruiken de - naast de rivier gelegen - Uiterwaarden voor veeteelt en later ook voor campings.	☐	☐
14. De zomerkades zorgen ervoor dat de Uiterwaarden in de zomer droog blijven.	☐	☐
15. Na de dijkdoorbraak in 1995 zijn de dijken opgehoogd. We weten nu zeker dat ons land nooit meer zal overstromen.	☐	☐

VOLGENDE PAGINA MEERKEUZEVRAGEN

Meerkeuzevragen

Hieronder staan een aantal meerkeuzevragen. Geef bij iedere vraag aan wat volgens jou het meest juiste antwoord is. Doe dit door een kruis in het juiste hokje (A, B, C, D) achter de vraag te zetten.

Heb je een verkeerd hokje aangekruist maak dan het hele hokje zwart en zet een kruis in het goede hokje.

1. Wat was het hoofdthema van dit programma?

a. Fruitbomen
b. Dijken
c. Overstromingen
d. Het rivierkleigebied

2. De stroomsnelheid van het water in een rivier is in de bocht niet overal gelijk. Wat is hier het gevolg van?

a. De bochten worden kleiner
b. De bochten worden groter
c. De rivier wordt dieper
d. Er verandert niets

3. Wat voeren rivieren behalve water nog meer af?

a. Grind, zand en slib
b. Slib en zout
c. Planten, diertjes en stenen
d. Niets, ze voeren alleen water af

4. Wat is het verschil tussen zand en slib?

a. Zanddeeltjes zijn zwaarder dan slibdeeltjes
b. Slibdeeltjes zijn zwaarder dan zanddeeltjes
c. Slibdeeltjes en zanddeeltjes zijn beide even zwaar, maar hebben een verschillende structuur
d. Er zijn geen verschillen tussen zand en slib

5. Hoe heet het grondgebied direct naast een rivier?

a. Kom
b. Oeverwal
c. Woonerf
d. Kwelder

VOLGENDE PAGINA MEERKEUZEVRAGEN

6. Waar is het grondgebied, dat ook wel "kom" wordt genoemd, uitermate geschikt voor?

A B C D

a. Voor grasland
b. Voor akkerbouw en fruitteelt
c. Om huizen en boerderijen op te bouwen
d. Alle bovenstaande antwoorden zijn goed

7. Hoe ziet een typische weg in een kom-gebied eruit?

A B C D

a. Kaarsrechte wegen met aan de zijkant statige populieren
b. Bochtige wegen met akkers en boomgaarden ernaast
c. Er zijn voornamelijk fietspaden
d. Je ziet er geen wegen

8. Wat deden de boeren om ervoor te zorgen dat hun huizen en land droog bleven bij een overstroming van de rivier?

A B C D

a. Ze bouwden duinen
b. Ze bouwden dijken
c. Ze bouwden hun huizen op hoge palen
d. Ze plantten hoogstamfruitbomen rondom hun huis

9. Als een dijk doorbreekt ontstaat er achter de dijk een plas.
Hoe wordt zo'n ronde plas naast een rivier ook wel genoemd?

A B C D

a. Een woerd
b. Een cirkel
c. Een wiel
d. Een molen

10. De Uiterwaarden worden in de zomer als camping gebruikt. Waarom worden deze campings aan het einde van de zomer meestal ontruimd?

A B C D

a. De meeste mensen kamperen alleen in de zomer
b. In de winter is de kans op overstroming in de Uiterwaarden groter
c. De grond is in de winter vaak bevroren
d. In de winter gebruiken de boeren de Uiterwaarden voor veeteelt

EINDE OPGAVEN