

## The effect of music background on the emotional appraisal of film sequences

Ivanka Pavlović and Slobodan Marković

*Laboratory for Experimental Psychology, Faculty of Philosophy,  
University of Belgrade, Serbia*

In this study the effects of musical background on the emotional appraisal of film sequences was investigated. Four pairs of polar emotions defined in Plutchik's model were used as basic emotional qualities: joy-sadness, anticipation-surprise, fear-anger, and trust-disgust. In the preliminary study eight film sequences and eight music themes were selected as the best representatives of all eight Plutchik's emotions. In the main experiment the participant judged the emotional qualities of film-music combinations on eight seven-point scales. Half of the combinations were congruent (e.g. joyful film - joyful music), and half were incongruent (e.g. joyful film - sad music). Results have shown that visual information (film) had greater effects on the emotion appraisal than auditory information (music). The modulation effects of music background depend on emotional qualities. In some incongruent combinations (joy-sadness) the modulations in the expected directions were obtained (e.g. joyful music reduces the sadness of a sad film), in some cases (anger-fear) no modulation effects were obtained, and in some cases (trust-disgust, anticipation-surprise) the modulation effects were in an unexpected direction (e.g. trustful music increased the appraisal of disgust of a disgusting film). These results suggest that the appraisals of conjoint effects of emotions depend on the medium (film masks the music) and emotional quality (three types of modulation effects).

*Key words: film, music, emotions, appraisal, congruency*

Different objects and events have different potential to induce particular emotional experience and response. For instance, it is very likely that the fighting between two groups of football hooligans will induce a higher affective disturbance than the butterflies flying over colorful flowers. However, some authors hold that emotional experience is not directly induced by objective characteristics of external stimulus itself (e.g. fighting vs. butterflies scene), but it is rather subjectively constructed through the cognitive process of interpretation and

---

Corresponding author: smarkovi@f.bg.ac.rs

\* This work was supported by the Ministry of Science and Technological Development of Serbia, grant number 179033.

appraisal of external stimuli (Lazarus, 1991; Scherer, 2001; Schorr, 2001; Silvia, 2005). The dominant factor of appraisal is past experience with certain types of objects or events: for instance, different individual experiences with fighting will lead towards different appraisals, and consequently, different emotions. This view implies the existence of considerable individual differences of appraisals and corresponding emotional experiences: for example, some observers of a fighting scene will feel anger, some will feel fear, disgust or even fun.

In this paper we will focus on the external source of appraisal variation: the emotional appraisal of the scene will be changed if it is associated with different additional, contextual or background information. More specifically, the effects of music background on the emotional appraisal of visual (film) scenes will be concerned. For example, the emotional experience of a fighting film scene can be changed with the change of accompanying music. Appraisal model in this case would have the following general structure. A film sequence of a fighting scene (stimulus) refers to the violence as a dominant narrative (semantic content); the appraisal of this violent content is that it is something dangerous (interpretation), which leads towards the general affective disturbance and emotion of anger (affective experience). Now, the observer's appraisal of danger and a corresponding emotion of anger can be increased if the fighting visual scene is combined with the additional auditory stimulus such as, for example, a "dead metal" music. In that case, a new auditory mediated semantic content (violent music) is congruent with the visually mediated one (violent scene). However, the appraisal (interpretation) of the same scene can be changed if the music background changes. It can be experienced even as humorous and cheerful if it is covered by a burlesque music background. In other words, an incongruent combination of an aggressive fighting scene and a cheerful burlesque music background can lead towards more variable appraisals and emotions, including the feelings of bizarreness, fun, disgust, excitement, and so on.

In the following paragraphs most relevant findings of investigation of the relationship between emotional experience, film scenes and musical backgrounds will be shortly presented.

## EMOTIONAL EFFECTS OF FILM MUSIC

Film is technically an audio-visual dynamic record. Even in the early days of its development, so-called silent films were accompanied by the piano music played during the show. Nowadays, there are three major classes of auditory information used in the film: speech, environmental sounds, and music. Sometimes all of them communicate the same message. Usually, the verbal conversation and the environmental sounds carry the exposition of an explicit film story (narrative function) and express different affective states, as well (expressive function). However, film music is almost exclusively and

directly related to the modulation of emotional meaning of film scenes: music has the potential to highlight the emotions, to make the mood darker or lighter, to sublime feelings, to prolong or alter an impression, with its rhythm and color, and so on. (cf. Bower, 1981; Cohen, 2001, 2010; Eschrich, Münte, & Altenmüller, 2008; Porcile, 1969; Thomas, 1997). In his definition of film as an “emotion machine” Tan (1996) pointed out that music contributes to a genuine emotional experience of a film. Tan (1996) proposed six laws of emotion in the music–film relationship. Lipscomb and Tolchinsky (2004) emphasized the various roles of music communication in the film: music serves to reinforce, alter and augment the emotional content of the film narrative, including both a general mood (whether the film is fearful, romantic, funny and the like) and specific internal feelings of the characters.

Some studies of relationship between music and emotions indicated that music can facilitate the recognition of basic emotions (Bujor, 2009), and that listeners promptly attribute emotions to the music with both ease and high precision (e.g. the difference between sad and joyful music can be detected in the quarter of a second, see Bharucha, Curtis, & Paroo, 2006). Bujor (2009) suggests that music is an universal language, just as facial expressions or emotional prosody of the speech. Other studies have shown that appraisals and emotional reactions to musical compositions correspond to their structural and dynamic characteristics (cf. Bharucha, Curtis, & Paroo, 2006; Gundlach, 1935; Hacquard, 1959; Rigg, 1937; Stravinsky, 1980; for a comprehensive review of studies of the relationship between objective musical features and emotions see Gabrielson & Juslin, 2009). Some authors found very high between-subjects variability in the emotional response to music, which led them to conclude that the personal taste and individual appraisals are more important factors than the formal structure of music composition (Bharucha, Curtis, & Paroo, 2006; Silvia, 2005). On the other hand, some authors indicated that emotional reactions are independent of familiarity and musical education (Bujor, 2009; Rigg, 1937).

Supposing that music has a great “emotional potential” many authors investigated the effects of music on the emotional and cognitive processing of a film. Most of these studies have shown a significant effect of music background on different emotionally related variables. The simplest design used in some of these studies is a combination of one film scene with a different musical background. For instance, using this design, Marshall and Cohen (1988) specified the contrast effects of *allegro* vs. *adagio* music background on judgments of film sequences on semantic differential scales.

The study of Bullerjam and Güldenring (1994) indicated that film music had a significant effect on both higher cognitively processes, such as the identification of genre of the film, and the basic physiological responses to emotional aspect of films (see also Rickard, 2004). Boltz and his collaborators investigated the effect of mood-congruency between film and background music sequences on remembering a series of filmed episodes (Boltz, Shulkind, & Kantra, 1991). The

results indicated that, in conditions when music was presented simultaneously with the key scene, mood-congruent combinations led to better memory performances; when music foreshadowed the film scene, memory performances were significantly better in mood-incongruent combinations. In another study Tan, Spackman and Wakefield (2008) asked the participants to interpret the narrative of an action sequence from Steven Spielberg's *Minority Report* accompanied with either a mood congruent (calm) or mood incongruent (dramatic) music background. They found the differential effect of film-music congruency on the interpretation of characters' emotions: in congruent combinations the character's relationships were rated as calm, whereas in incongruent ones they were rated as tense and antagonistic.

Parke and his associates found that ratings of stress, activity and dominance for simultaneously presented music and film sequences are almost exactly in between the music-alone and the film-alone ratings (Parke, Chew, & Kyriakakis, 2007). These results suggest that film and music have additive quantitative effects on emotional responses. Sirius and Clarke (1993) found similar additive effects for the ratings of "abstract films" (computer animated films of mobile 3-D geometric figures) which were combined with different background music.

In their study Thompson, Russo and Sinclair (1994) investigated the effects of music background on the perception of closure in filmed events. Results have shown a significant effect of background music. However, when asked to explain their judgments of closure, subjects reported that in closure perception they relied more on visual, than on auditory information. Bottin and Arcuri (2002) found a significant effect of background music in the understanding of a film narrative. This result suggests that a coherent combination of auditory and visual stimuli is more likely to be interpreted in a unique way. Similarly, there is less agreement between subjects when they are appraising a scene accompanied by an incongruent soundtrack.

In order to account for the influence of music on the interpretation of a film narrative Cohen (2001, 2010) proposed the *Congruence-Associationist Model* (see also Cohen, MacMillan, & Drew, 2006). This model is based on an information processing framework with bottom-up and top-down processing. Bottom-up processes includes the perceptual grouping in visual, auditory and cross-modal (audiovisual) domains. When music and film have the congruent temporal accent patterns, then the music directs an attention on congruent visual information and contributes to figure-ground segregation. Top-down direction refers to the inferences based on long term memory. Long term memory encompasses past experience with a visual scene (e.g. fighting) and a corresponding emotion (e.g. fear and anger), whereas the music is represented as a background of a visual scene (i.e. music has sense only in the context of the narrative). Finally, both processing directions converge in the working memory domain. In this domain phenomenal experience of film-music scenes becomes a

narrative which can itself be stored in long term memory (e.g. remembering of an integral film-music event).

## PURPOSE OF THE STUDY

Summarizing the general findings of the above-mentioned studies we can identify two phenomena which are in line with Cohen's *Congruence-Associationist Model* (2005): (a) music modulates the emotional appraisal of a film scene, but (b) the visual information is more important than the music for the interpretation of a film narrative. Most of these studies used the polar emotional qualities as a tool for investigating the differential effects of contextual music (e.g. how pleasant and unpleasant music themes modulate the interpretation of a film narrative). The main shortcoming of these studies is that polar emotions were usually reduced to the basic hedonic tone or affective valence (e.g. pleasant or unpleasant feelings, positive or negative moods, and the like), which significantly restricts the generalizability of the findings. Some authors extended the range of emotional dimensions on pleasure and arousal (Bruner, 1990) or pleasure, arousal and dominance (Mehrabian & Russell, 1974). However, if the range of emotional qualities would be greater, then the conclusions would not be biased and limited to the hedonic tone domain. Also, the more complex interactions between particular emotions and film-music combinations could be specified. For example, as previous studies suggested, hedonically opposite musical backgrounds such as joyful and sad music would clearly modulate the appraisal of a film scene: sad music will reduce the appraisal of joy of a joyful film sequence, while joyful music will reduce the sadness of a sad film scene. However, there are no available data about other polar emotions, such as, for example, fear and anger. Those two emotions are hedonically similar (both have a negative valence), but they are polar on the behavioral level (fear-defense vs. anger-attack). We could expect the smaller modulation effect in the case of fear and anger: while sad music reduces the appraisal of joy of a joyful film sequence, the angry music most likely will not reduce the appraisal of fear of a fearful film sequence.

In the present study we tried to investigate the effects of musical background on the emotional appraisal of film sequences using the wider spectrum of different emotional qualities. For the purpose of the study we adopted Plutchik's classification of eight primary emotional qualities organized by polarity into four pairs: joy-sadness, trust-disgust, fear-anger and anticipation-surprise (Plutchik, 1994). We used only Plutchik's classification, but not the theoretical model of emotions. Through Plutchik's classification we tried to specify the effects of emotional congruency-incongruence of film-music combinations on the emotional appraisal of film sequences. Congruent combinations referred to the identical emotional qualities of film and music

(e.g. a joyful film accompanied by joyful music or a sad film accompanied by sad music), whereas incongruent combinations included the opposite emotions (e.g. a joyful film sequence accompanied by sad music or a sad film sequence accompanied by joyful music).

## PRELIMINARY STUDY

The purpose of preliminary study is the selection of film sequences and music themes which will serve as the stimuli in the main experiment. Selected film sequences and music themes should express eight Plutchik's emotions.

### Method

*Participants:* Thirty five undergraduate students of the Department of Psychology, University of Belgrade participated in the experiment.

*Stimuli:* Five persons, including the authors, selected 32 film sequences of approximately one minute (played without sounds), and 32 music themes of approximately one minute (see the list of 64 stimuli in Appendix 1).

The stimuli were selected according to the following criteria:

1. In order to attain a clear emotional specification, each stimulus (film sequence or music sequence) were saturated with a single dominant emotion. Emotions were defined by Plutchik's model of eight basic emotions. For the purpose of this study four film excerpts and four film themes for each emotion were specified (8 emotions x 4 film sequences = 32 film stimuli; 8 emotions x 4 music sequences = 32 music stimuli).
2. In order to attain stylistic variability, stimuli were diverse in genre.
3. In order to reduce the ability of words to induce emotions instead of the visual or auditory materials, film sequences with dialogues and monologues and songs with lyrics were excluded from the stimulus samples.
3. In order to reduce the possibility that prior knowledge would have an impact on the emotional experience, stimuli were less known.

*Procedure:* Sixty four stimuli were presented to two groups of participants. Each group judged one half of the stimulus samples (16 film sequences and 16 music themes). Film sequences were presented by LCD projector on the screen, creating 1 x 1 m image. Music themes were presented by stereo speakers. Participants were sitting approximately 3–4 m from the screen or the stereo speakers.

Participants' task was to judge each stimulus immediately after the presentation using the checklist. Checklist contained eight Plutchik's emotions – joy, sadness, anticipation, surprise, fear, anger, trust and disgust, and the additional ninth item – “does not cause emotions”. Participants were asked to specify single dominant emotion induced by the stimulus by marking an appropriate item on the checklist. The judgment time was not limited. The experiment lasted approximately 60 minutes.

### Results

Distributions of the frequencies for sixty four stimuli (32 film and 32 music stimuli) were obtained. Only the results for the highest ranked stimuli of each emotional category are shown here (see Table 1). In other words, selected stimuli

(film and music sequences) are specified as the best representatives of eight emotions. The percents of participants who associated stimuli with dominant emotions ranged from 100% (all 32 participants matched stimulus with a single emotion) to 50% (16 participants associated stimulus with a single emotion, while the rest of participants were scattered among other seven emotions).

Table 1: Selected stimuli (film excerpts and music themes) with corresponding dominant emotions and percents of participants who matched emotions with stimuli.

| <b>Emotions</b> | <b>Film excerpts</b>   | <b>Matching percents</b> |
|-----------------|--|--------------------------|
| Joy             | Breaking the Waves (15min32s – 16min23s)                         | 83.3%                    |
| Sadness         | Stellet Licht (1h 27min05s – 1h 29 min35s)                       | 83.3%                    |
| Fear            | The Ring (1h 41min24s – 1h42min32s)                              | 61.1%                    |
| Anger           | Romper Stomper (27min28s – 28min25s)                             | 72.2%                    |
| Anticipation    | Braveheart (1h22min51s – 1h23min51s)                             | 61.1%                    |
| Surprise        | Law Abiding Citizen (1h2min18s – 1h2min48s)                      | 83.3%                    |
| Trust           | The Deer Hunter (1h40min40s – 1h41min32s)                        | 50.0%                    |
| Disgust         | Henry:Portrait of the Serial Killer (4min17s – 4min54s)          | 100%                     |
| <b>Emotions</b> | <b>Music themes</b>  | <b>Matching percents</b> |
| Joy             | Dorothy Collins – Singing in the Rain (0min00s – 0min40s)        | 77.8%                    |
| Sadness         | Memoirs of a Geisha – Sayuri’s Theme (0min00s – 1min09s)         | 100%                     |
| Fear            | Dead Silence – Theme by Charlie Clouser (1min22s – 1min53s)      | 66.7%                    |
| Anger           | Dream Theater – Panic Attack (0min00 s– 0min47s)                 | 50.0%                    |
| Anticipation    | The Good, the Bad and the Ugly – Il Triello (0min23s – 1min 43s) | 50.0%                    |
| Surprise        | Laco Tayfa – Surmat (0min00s – 0min53s)                          | 94.4%                    |
| Trust           | Vangelis – Chariots of Fire (0min31s – 1min33s)                  | 48.9%                    |
| Disgust         | Gutted with Broken Glass – Ramrod (0min10s – 1min10s)            | 61.1%                    |

## EXPERIMENT

The purpose of this experiment was to investigate the effects of musical background on the emotional appraisal of film sequences. Participants judged the emotional quality of film sequences which were accompanied with either emotionally congruent or incongruent music background (e.g. congruent: joyful film accompanied with joyful music; incongruent: joyful music accompanied with sad music).

## Method

*Participants:* Two groups of twenty five undergraduate and PhD students of the Department of Psychology, University of Belgrade have participated in the experiment. None of these participants took part in Preliminary study.

*Stimuli:* Sixteen combinations of film sequences and music themes were used as stimuli (film and music sequences selected in Preliminary study). Two groups of film-music combinations were defined: eight congruent and eight incongruent (see Figure 1). Congruent combinations were obtained by matching film and music sequences with identical emotional quality (e.g. joyful film sequence accompanied with joyful musical background); incongruent combinations were obtained by matching film and music sequences with opposite emotions (e.g. joyful film sequence accompanied with sad musical background or vice versa, i.e. sad film with joyful music). The duration of stimuli was approximately one minute.

---

### Congruent stimuli

---

|       | 1aa | 1bb     | 2aa          | 2bb      | 3aa  | 3bb   | 4aa   | 4bb     |
|-------|-----|---------|--------------|----------|------|-------|-------|---------|
| Film  | Joy | Sadness | Anticipation | Surprise | Fear | Anger | Trust | Disgust |
| Music | Joy | Sadness | Anticipation | Surprise | Fear | Anger | Trust | Disgust |

---

### Incongruent stimuli

---

|       | 1ab     | 1ba     | 2ab          | 2ba          | 3ab   | 3ba   | 4ab     | 4ba     |
|-------|---------|---------|--------------|--------------|-------|-------|---------|---------|
| Film  | Joy     | Sadness | Anticipation | Surprise     | Fear  | Anger | Trust   | Disgust |
| Music | Sadness | Joy     | Surprise     | Anticipation | Anger | Fear  | Disgust | Trust   |

---

*Figure 1.* Emotionally congruent and incongruent film-music combinations. Within these categories emotions are arranged into four pairs (1–4). Each pair consists of two polar emotions (e.g. joy, denoted as *a*, and sadness, denoted as *b*). Congruent film-music combinations are denoted as *aa* or *bb*, while incongruent combinations were denoted as *ab* or *ba*.

*Procedure:* Two groups of students participated in the experiment. Each group was given four congruent and four incongruent stimuli (eight stimuli per group). In order to avoid the repetition of the same film sequence or same music theme within the group, the participants in the two groups watched different film-music combinations (e.g. joyful film with joyful music in Group 1, but joyful film with sad music in Group 2). All film-music combinations distributed across the two groups were shown in Figure 2. Congruency, as a between subjects factor, was defined so that the pairs of polar emotions 1 and 2 were congruent in Group 1 and incongruent in Group 2, whereas the pairs 3 and 4 were incongruent in Group 1 and congruent in Group 2. The result of this organization is the balance of congruent and incongruent combination between the groups.

Stimuli were film sequences accompanied with music themes. Film sequences were presented by LCD projector on the screen, creating 1 x 1 m image. Simultaneously with film sequences, music themes were presented by stereo speakers. Participants were sitting approximately 3–4 m from the screen and the speakers. Participants task was to judge the



intensity of the emotions perceived in the film sequences (joy, sadness, fear, anger, trust, disgust, anticipation, and surprise) using seven-step scales (1 – lowest intensity of emotion, 7 – highest level of intensity). The judgment time was not limited. The experiment lasted approximately 15 minutes.

| Group 1 | Congruent stimuli |         |              |          | Incongruent stimuli |       |         |         |
|---------|-------------------|---------|--------------|----------|---------------------|-------|---------|---------|
|         | 1aa               | 1bb     | 2aa          | 2bb      | 3ab                 | 3ba   | 4ab     | 4ba     |
| Film    | Joy               | Sadness | Anticipation | Surprise | Fear                | Anger | Trust   | Disgust |
| Music   | Joy               | Sadness | Anticipation | Surprise | Anger               | Fear  | Disgust | Trust   |

| Group 2 | Inongruent stimuli |         |              |              | Congruent stimuli |       |       |         |
|---------|--------------------|---------|--------------|--------------|-------------------|-------|-------|---------|
|         | 1ab                | 1ba     | 2ab          | 2ba          | 3ab               | 3ba   | 4ab   | 4ba     |
| Film    | Joy                | Sadness | Anticipation | Surprise     | Fear              | Anger | Trust | Disgust |
| Music   | Sadness            | Joy     | Surprise     | Anticipation | Fear              | Anger | Trust | Disgust |

*Figure 2.* The figure shows the stimulus combinations presentend to Groups 1 and 2. Emotions in both groups of stimuli were arranged (1) first by film-music congruency (congruent combinations *aa* or *bb*, and incongruent combinations *ab* or *ba*), than by (2) pairs of polar (opposite) emotional qualities (four paires of emotions; e.g. joy-sadness pair is denoted as *1*, etc), and finally by (3) single emotions within pair (*a* or *b*; e.g. joy is denoted as *a*, and sadness as *b*, etc).

*Design:* A two-factorial design was applied to each of four pairs of polar emotions (1) joy-sadness, (2) anticipation-surprise, (3) fear-anger, and (4) trust-disgust. The within-subjects factor was a pair of polar emotional quality of a film sequence (two levels, e.g. level 1: joyful film, level 2: sad film). The between-subjects factor was an emotional congruency of film-music combinations (two levels, e.g. level 1: congruent joyful film – joyful music or sad film – sad music combination; level 2: incongruent joyful film – sad music or sad film – joyful music combination).

## Results

A two-way analysis of variance was performed for each pair of bipolar emotions. In the following sections results of the analyses of variance for relevant emotional qualities for each design are shown. For instance, analyses of the judgment of joy and sadness are shown for joyful-joyful, sad-sad, joyful-sad and sad-joyful film-music combinations. The judgments of irrelevant emotions (e.g. fear, anger, etc. for joy-sadness stimulus combinations) were non-informative for the purpose of this paper and were not further analyzed.

### 1. Joy-Sadness combinations

*Judgment of joy:* Judgments of joy are shown in Figure 3a. The main effect of polar emotional qualities was significant,  $F(1,49) = 91,58$ ,  $p < .001$ , indicating that joyful film sequences were judged more joyful than sad ones. No main

effect of congruency was obtained. This indicated that the averaged congruent film-music combinations (joyful-joyful and sad-sad) are about the same level as the incongruent ones (joyful-sad and sad-joyful). The interaction of polar emotions / congruency was significant,  $F(1,49) = 12,93$ ,  $p < .001$ . This interaction tells us that the difference between joyful-joyful and sad-sad combinations is significantly greater than the difference between joyful-sad and sad-joyful combinations. Additional partial analyses revealed that sad music background did not reduce significantly the judgment of joy of joyful film sequence, but joyful music significantly magnified the judgment of joy of a sad film sequence,  $F(1,49) = 4,39$ ,  $p < .001$ . Direct contrast between incongruent stimuli indicated that the impression of joy was based more on visual information (film) than on auditory information (music): joyful film – sad music combination was judged as significantly more joyful than sad film – joyful music combination,  $F(1,49) = 3,69$ ,  $p < .001$ .

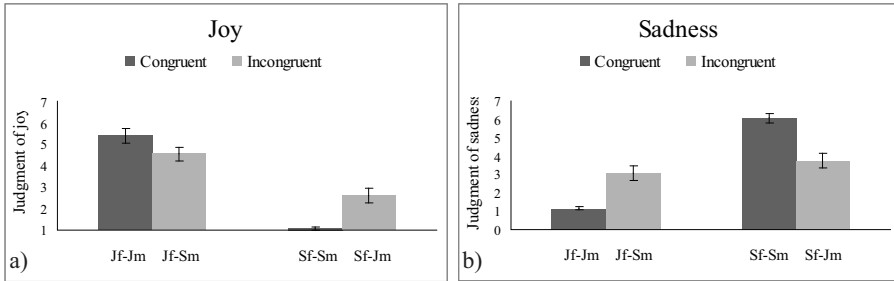


Figure 3. Judgments of joy (a) and sadness (b). Congruent film-music combinations are denoted as Jf-Jm (joyful film – joyful music) and Sf-Sm (sad film – sad music), and incongruent combinations are denoted as Jf-Sm (joyful film – sad music) and Sf-Jm (sad film – joyful music).

*Judgment of sadness:* Judgments of sadness are shown in Figure 3b. The main effect of polar emotional qualities was significant,  $F(1,49) = 75,48$ ,  $p < .001$ , indicating that sad film sequences were judged more sad than joyful ones. No main effect of congruency was obtained. The interaction of polar emotions / congruency was significant,  $F(1,49) = 43,27$ ,  $p < .001$ . Lack of the main effect of congruency and interaction could be explained like in the case of the judgment of joy (see the previous paragraph). Additional partial analyses revealed that joyful music background significantly reduced the judgment of sadness of a sad film sequence,  $F(1,49) = 4,50$ ,  $p < .001$ , while sad music background significantly magnified the judgment of sadness of a joyful film sequence,  $F(1,49) = 5,09$ ,  $p < .001$ . Direct contrast between incongruent stimuli indicated that both visual and auditory information (film and music) equally determined the impression of sadness: no significant difference between sad film – joyful music and joyful film – sad music combinations was obtained.

## 2. Anticipation-Surprise combinations

*Judgment of anticipation:* Judgments of anticipation are shown in Figure 4a. The main effect of polar emotional qualities was significant, as well,  $F(1,49) = 87,36$ ,  $p < .001$ , indicating that anticipating film sequences were judged more anticipating than the surprising ones. The main effect of congruency was obtained,  $F(1,49) = 5,92$ ,  $p < .02$ , indicating that congruent film-music combinations were judged as more anticipating than incongruent ones. Interaction was not significant, which was not expected. Namely, as partial analysis indicated, surprising music background did not significantly reduce the judgment of anticipation of an anticipating film sequence. Further partial analysis revealed that anticipating music significantly reduced the judgment of anticipation of a surprising film sequence,  $F(1,49) = 2,60$ ,  $p < .02$ . This finding suggested that a congruent surprising film-music combination was judged as more anticipating because the music helps us to anticipate a surprising event. On the other hand, a surprising film scene accompanied with anticipating musical background has a contrast effect: music does not prepare us for surprise and stimulus is judged as less anticipating. Direct contrast between incongruent stimuli indicates that the impression of anticipation was based more on visual information (film) than on auditory information (music): anticipating film – surprising music combination was judged as significantly more anticipating than surprising film – anticipating music combination,  $F(1,49) = 6,94$ ,  $p < .001$ .

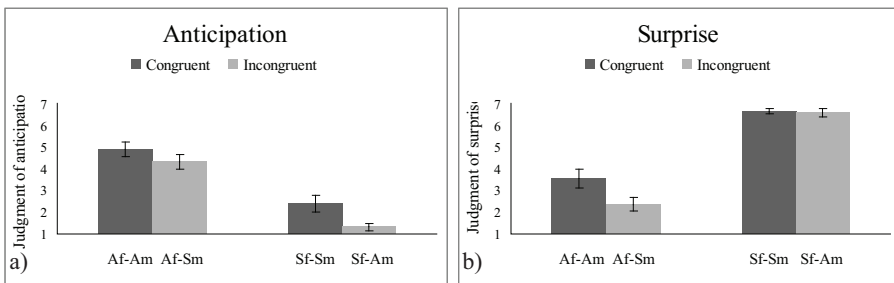


Figure 4. Judgments of anticipation (a) and surprise (b). Congruent film-music combinations are denoted as Af-Am (anticipating film – anticipating music) and Sf-Sm (surprising film – surprising music), and incongruent combinations are denoted as Af-Sm (anticipating film – surprising music) and Sf-Am (surprising film – anticipating music).

*Judgment of surprise:* Judgments of surprise are shown in Figure 4b. The main effect of polar emotional qualities was significant, as well,  $F(1,49) = 87,36$ ,  $p < .001$ , indicating that surprising film sequences were judged more surprising than the anticipating ones. The main effect of congruency was obtained,  $F(1,49) = 4,82$ ,  $p < .04$ , indicating that congruent film-music combinations were judged as more surprising than incongruent ones. Interaction was not

significant. Partial analysis indicated that an anticipating music background did not significantly reduce the judgment of surprise of a surprising film sequence. This suggested that visual information was stronger than auditory. Further partial analysis revealed that surprising music significantly reduced the judgment of surprise of an anticipating film sequence,  $F(1,49) = 2,60$ ,  $p < .02$ . This finding was paradoxical because it suggested that a congruent anticipating film-music combination was more surprising than an anticipating film scene accompanied with surprising musical background. Direct contrast between incongruent stimuli indicated that the impression of surprise was based more on visual information (film) than on auditory information (music): the surprising film – anticipating music combination was judged as significantly more surprising than the anticipating film – surprising music combination,  $F(1,49) = 12,86$ ,  $p < .001$ .

3. Fear-Anger combinations

*Judgment of fear:* Judgments of fear are shown in Figure 5a. The main effect of polar emotional qualities was significant,  $F(1,49) = 4,62$ ,  $p < .04$ , indicating that fearful film sequences were judged more fearful than angry ones. No main effect of congruency was obtained. The interaction of polar emotions / congruency was significant,  $F(1,49) = 4,62$ ,  $p < .04$ . The interaction indicated that the difference between fearful-fearful and angry-angry combinations was significantly greater than the difference between fearful-angry and angry-fearful combinations. Direct contrast between incongruent stimuli has shown that both visual and auditory information (film and music) equally determine the impression of fear: no significant difference between fearful film – angry music and angry film – fearful music combinations was obtained.

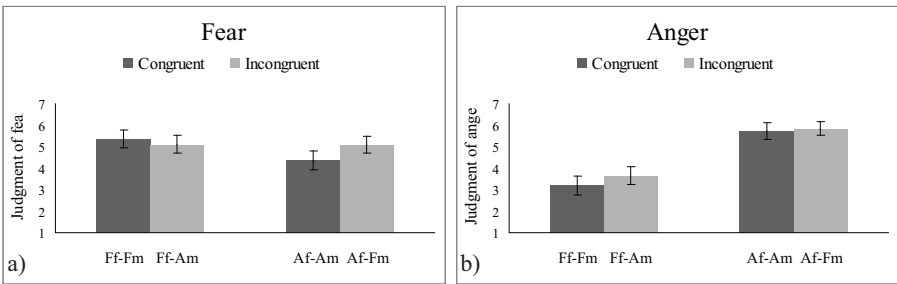


Figure 5. Judgments of fear (a) and anger (b). Congruent film-music combinations are denoted as Ff-Fm (fearful film – fearful music) and Af-Am (angry film – angry music), and incongruent combinations are denoted as Ff-Am (fearful film – angry music) and Af-Fm (angry film – fearful music).

*Judgment of anger:* Judgments of anger are shown in Figure 5b. The main effect of polar emotional qualities was significant,  $F(1,49) = 68,82$ ,  $p < .001$ ,

indicating that angry film sequences were judged more angry than fearful ones. No main effect of congruency was obtained. Interaction was not significant. Direct contrast between incongruent stimuli indicated that the impression of anger was based more on visual information (film) than on auditory information (music): the angry film – fearful music combination was judged as significantly more angry than the fearful film – angry music combination,  $F(1,49) = 6.02$ ,  $p < .001$ .

#### 4. Trust-Disgust combinations

*Judgment of trust:* Judgments of trust are shown in Figure 6a. The main effect of polar emotional qualities was significant,  $F(1,49) = 99,11$ ,  $p < .001$ , indicating that trustful film sequences were judged more trustful than the disgusting ones. The main effect of congruency was obtained,  $F(1,49) = 8,42$ ,  $p < .006$ , indicating that congruent film-music combinations were judged as more trustful than incongruent ones. The interaction of polar emotions / congruency was significant,  $F(1,47) = 4,81$ ,  $p < .04$ . Partial analyses revealed that a disgusting music background significantly reduced the judgment of trust of a trustful film sequence,  $F(1,49) = 2,97$ ,  $p < .005$ , while, a trustful music background showed no effect on the judgment of trust of a disgusting film sequence. Direct contrast between incongruent stimuli indicated that the impression of trust was based more on visual information (film) than on auditory information (music): the trustful film – disgusting music combination was judged as significantly more trustful than the disgusting film – trustful music combination,  $F(1,49) = 5,06$ ,  $p < .001$ .

*Judgment of disgust:* Judgments of disgust are shown in Figure 6b. The main effect of polar emotional qualities was significant,  $F(1,49) = 53,35$ ,  $p < .001$ , indicating that disgusting film sequences were judged more disgusting than trustful ones. The main effect of congruency was obtained,  $F(1,49) = 15,46$ ,  $p < .006$ , indicating that congruent film-music combinations were judged as more disgusting than incongruent ones. Interaction was not significant. Partial analyses revealed that disgusting music background significantly multiplies the judgment of disgust of a trustful film sequence,  $F(1,48) = 2,97$ ,  $p < .005$ . Trustful music background showed a marginally significant effect on a disgusting film sequence,  $F(1,48) = 1,95$ ,  $p < .06$ , but the direction of effect was not expected: trustful music magnified the judgment of disgust of a disgusting film sequence. In other words, both incongruent combinations (trustful-disgusting and disgusting-trustful) multiplied the impression of disgust comparing to the congruent (trustful-trustful and disgusting-disgusting) combinations. It seems that trust-disgust combinations were so bizarre that they generated more disgusting effects than congruent ones. The direct contrast between incongruent stimuli indicated that the impression of disgust was based more on visual information (film) than on auditory information (music): the disgusting film – trustful music combination

was judged as significantly more disgusting than the trustful film – disgusting music combination,  $F(1,49) = 4,64$ ,  $p < .001$ .

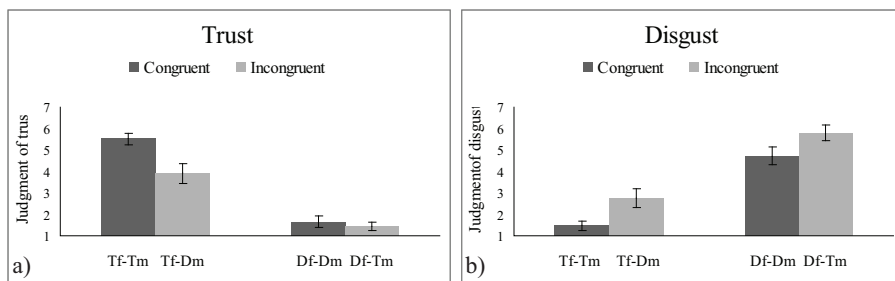


Figure 6. Judgments of trust (a) and disgust (b). Congruent film-music combinations are denoted as Tf-Tm (trustful film – trustful music) and Df-Dm (disgusting film – disgusting music), and incongruent combinations are denoted as Tf-Dm (trustful film – disgusting music) and Df-Tm (disgusting film – trustful music).

## DISCUSSION

In this study the effect of music background on the emotional appraisal of film scenes was investigated. In the following paragraphs two groups of findings will be discussed. The first group refers to the question of the dominance of visual versus auditory information in the appraisal of the emotion of the film sequences, and the second group refers to the specific modulation effects of music within the context of different emotional qualities.

*Visual versus auditory information:* The analysis of the effects of incongruent film-music combinations directly tells us which modality, visual or auditory, is stronger in modulating a dominant emotional appraisal of a film sequence. The results are very clear. In all cases, except the case of fear, the emotional quality of visual information (film) has a stronger effect than the emotional quality of auditory information (music). In terms of Schaeffer's (1946) *theory of mask* the emotional content of a visual medium masks the content of an auditory medium. The dominance of visual over auditory information was obtained in other studies of emotional appraisals of film sequences as well (cf. Marshall & Cohen, 1988; Thompson et al., 1994; for perceptual visual primacy see Bolivar, Cohen, & Fentress, 1994; Driver, 1997; Lipscomb & Kendall, 1994).

The dominance of visual information can be explained as a simple consequence of the experimental task: participants were asked to judge the emotional content of the film, so they invested more attention onto the film sequence, than on the musical context. However, as Cohen (2001, 2010) stated in his *Congruence-Associacionist Model* background music is not attentionally

peripheral even when the focus is directed onto the visual scene. On the contrary, one of the central roles of music and other acoustic information is just to amplify the attention and to direct it on specific features of the visual scene. In other words, although the visual information provides a basic perceptual (spatio-temporal) framework, acoustic information has an important role in the perceptual grouping of cross-modal (i.e. film-music) Gestalt. According to Cohen, the reason for the dominance of visual over auditory information is not on the bottom-up level (perceptual grouping), but it is rather on the top-down processing level (long term memory domain). Namely, both visual and auditory information are processed within long term memory, but visual representation induces stronger and more explicit semantic and emotional associations. For example, a film scene of a crying woman (used as a stimulus in our study) shows a specific event which is easily matched with past experience, specific meanings and emotional associations, and after this matching the scene is interpreted as unambiguously sad (appraisal of the explicit narrative is “woman cries because she is sad”). On the other hand, according to Cohen, music and other acoustic information have sense only within the broader visually represented contexts: so-called sad or melancholic music does not refer to any particular event stored in long term memory (exceptions are the explicit memories for concert performances and the like). One implication of this difference is that if the music (or other acoustic information) is not congruent with the visual scene, the visual information prevails as a basic framework for narrative interpretation. Having that in mind, it is not surprising why, for instance, the scene which shows dancing people is judged as more joyful than the scene with crying women even when the information coming from the music background is contradictory (dancing people with sad music and crying woman with joyful music).

*Modulation effects of music:* Generally, results of our study suggest that the intensity of judged emotional qualities of congruent film-music combinations depends on their polarity: for instance, the joyful film accompanied with joyful music is judged as substantially more joyful and less sad than the sad film accompanied with sad music. The high contrast between such polar congruent combinations is clear and understandable because it is a consequence of redundant information which is carried by both visual and auditory media (e.g. joyful-joyful, sad-sad etc). According to Cohen’s *Congruence-Associationist Model* (2001, 2010) congruency contributes to the focus of attention and makes the association in long term memory easier and stronger.

On the other hand, incongruent film-music combinations are informationally more complex, ambiguous, conflicting, and too demanding for the appraisal process. The binding of such contradictory visual and auditory information into a unique emotional appraisal requires the complex cognitive engagement and can lead towards more or less ambiguous solutions. Our data reveal three types of appraisal of incongruent film-music combinations.

a) *Modulation in expected direction: joy-sadness*: In cases of joy and sadness background music induces the “expected modulation” of the judged emotion. Expected direction is defined as a magnification of a corresponding and a reduction of an opposite emotion. For instance, sad music magnifies the sadness of a joyful film: a joyful film is judged as more sad when it is accompanied with a sad than with a joyful music background. Also, joyful music reduces the sadness of a sad film: sad film sequence is judged as less sad if it is accompanied with joyful music. The same was found for the judgment of joy of a sad film: joyful music magnifies the impression of joy of a sad film sequence. However, the reduction effect of sad music on the judgment of joy of a joyful film is not revealed. This finding indicates that auditory information has a limited influence on the appraisal of joy comparing to visual information. Generally speaking, our data suggest that the appraisals of joy and sadness show expected additive modulation effects (e.g. sad music magnifies the impression of sadness of a joyful film).

b) *Lack of modulation: fear-anger*: The second type of appraisal of incongruent film-music combinations shows no modulation effect, such as the cases of fear and anger. The data show the similarity in emotional effects of those two emotions: a fearful film sequence is not judged as less fearful and angrier if it is accompanied with angry music; also, an angry film sequence is not judged as less angry and more fearful if it is accompanied with fearful music. Even, in absolute extents fearful and angry film sequences are judged as almost equally fearful and angry. This similarity is understandable from the perspective of adaptive emotional behavior in situations which are appraised as dangerous and threatening. Namely, the violent scenes can induce two opposite appraisals and corresponding reactions, known as fight or flight behavior. According to this, it is not unusual that the same angry film sequence induces both high impression of anger and high impression of fear.

c) *Modulation in inverse direction: trust-disgust and anticipation-surprise*: Modulation in an inverse direction is defined as the reduction of corresponding and the magnification of opposite emotions. Let us consider, for instance the judgments of trust-disgust combinations. As it is expected, disgusting music magnifies the impression of disgust and reduces the impression of trust of a trustful film sequence. However, trustful music shows no such effects on judgments of a disgusting film sequence. Moreover, a disgusting film is judged as more disgusting when it is accompanied with a trustful than with a disgusting music background. It seems that trustful music induces some strange impression, which enlarges disgust. Similar unexpected inverse effects are found in emotions of anticipation and surprise. Namely, the surprising scene accompanied with surprising music is judged as more anticipating than the same surprising scene accompanied with an anticipating music background. It seems that anticipation is magnified in a redundant surprise-surprise combination comparing to a surprise-anticipation combination, because the surprising music directs the



attention to and prepares us for a coming surprising event. On the other hand, anticipating music reduces the attention and tension, so in this relaxing state the surprise of a sudden film event is more effective. An unexpected modulation effect was identified in the case of surprise, as well. However, this effect cannot be explained by using the same logic as in the case of anticipation. Namely, the data show that a congruent (redundant, expected) anticipation-anticipation combination is judged as more surprising than an incongruent (conflicting, unexpected) anticipation-surprise combination. Further studies should investigate this paradox more systematically. They should specify whether our data reflect regularity inherent to the emotions anticipation and surprise or are they just the consequence of some idiosyncratic meanings hidden in our film-music stimuli.

Previous studies of modulation effects in film-music combinations are not comparable with the present one, because we used a relatively complex categorisation of emotional qualities (i.e. Plutchik's model of eight emotions), while in other studies emotional appraisals were reduced on general pleasure and arousal (Boltz et al., 1991; Bottin & Arcuri, 2002) or on semantic differential dimensions, such as Evaluation, Potency and Activity (Marshall & Cohen, 1988). Our findings suggest that simple hedonic tone or arousal are not sufficient for the specification of modulation effects. For instance, three negative (unpleasant) emotions sadness, fear and disgust show three completely different forms of modulation effects.

In conclusion, one can say that the effects of music background on emotional appraisal of film sequences depend on the quality of emotions. The adaptive and functional specificities of interacting emotions, such as hedonic tone, arousal and behavior response, define the directions and the intensities of their conjoint effect. For instance, the relationship between polar emotions joy (pleasant, high arousing, proactive) and sadness (unpleasant, low arousing, passive) is quite different from fear (unpleasant, high arousing, defensive) and anger (unpleasant, high arousal, offensive). Having in mind that anger and fear are opposite in only one aspect (behavior: offensive-defensive), while joy and sadness are polar in all three aspects (hedonic tone, arousal and behavior), it is not unusual that angry music can easily induce the feeling of fear, while joyful music will never induce the sadness! In further studies we should establish a more comprehensive system for quantitative definition of emotions using dimensions such as hedonic tone, arousal, activity, and the like. In that case, the predictions of the conjoint effects of different emotions on the appraisal of multimodal scenes (e.g. music-film combinations) will be quantitative and more precise. It would be useful for both affective and cognitive sciences, that is, it could give us a better insight into both interactions of basic emotions and interactions of visual and auditory information processing. Finally, the study of emotional appraisals of film-music combinations could be inspirational for the psychology of art.

## REFERENCES

- Bharucha, J. J., Curtis, M., & Paroo, K. (2006). Varieties of musical experience. *Cognition*, *100*, 131–172.
- Bolivar, V. J., Cohen, A. J., & Fentress, J. C. (1994). Semantic and formal congruency in music and motion pictures: Effects on the interpretation of visual action. *Psychomusicology*, *13*, 28–59.
- Boltz, M., Shulkind, M., & Kantra, S. (1991). Effects of background music on the remembering of filmed events. *Memory and Cognition*, *19*(6), 593–606.
- Bottin, G., & Arcuri, L. (2002). *Music in film: Effects of underscoring on semantic appraisal and interpretation of film scenes*. Unpublished manuscript (<http://www.bottin.it/thesis>)
- Bower, G. H. (1981). Mood and memory. *American Psychologist*, *36*, 129–148.
- Bruner, G. C. (1990). Music, mood, and marketing. *Journal of Marketing*, *54*(4), 94–104.
- Bullerjam, C., & Guldenring, M. (1994). An empirical investigation of effects of film music using qualitative content analysis. *Psychomusicology*, *13*, 99–118.
- Cohen, A. J. (2001). *Music as a source of emotion in film*. New York: Oxford University Press.
- Cohen, A. J. (2010). Music as a source of emotion in film. In P. Juslin, & J. Sloboda (Eds.), *Music and emotion* (pp. 879–908), New York: Oxford University Press.
- Cohen, A. J., MacMillan, K. A., & Drew, R. (2006). The role of music, sound effects and speech on absorption in a film: The congruence-associationist model of media cognition. *Canadian acoustics*, *34*, 40–41.
- Driver, J. (1997). Enhancement of selective listening by illusory mislocation of speech sounds due to lip-reading. *Nature*, *381*, 66–68.
- Eschrich, S., Münte, T. F., & Altenmüller, E. O. (2008). Unforgettable film music: The role of emotion in episodic long-term memory for music. *BMC Neuroscience*, *9* (48).
- Gabrielson, A., & Juslin, P. N. (2009). Emotional expression in music. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (Eds.), *Handbook of affective science* (pp. 503–534), New York: Oxford University Press.
- Gundlach, R. H. (1935). Factors determining the characterization of musical phrases. *American Journal of Psychology*, *47*, 624–643.
- Hacquard, G. (1959). *La musique et la cinema*. Paris: Presses universitaires de France.
- Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.
- Lipscomb, S. D., & Kendall, R. A. (1994). Perceptual judgment of the relationship between musical and visual components in film. *Psychomusicology*, *13*, 60–98.
- Lipscomb, S. D., & Tolchinsky D. (2004). *The role of music communication in cinema*. In D. Miell, R. MacDonald, & D. Hargreaves (Eds.), *Musical communication* (pp. 383–404), New York: Oxford University Press.
- Marshall, S. K., & Cohen, A. J. (1988). Effects of musical soundtracks on attitudes toward animated geometric figures. *Music Perception*, *6*(1), 95–112.
- Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. Cambridge, MA: MIT Press.
- Parke, R. Chew, E., & Kyriakakis, C. (2007). Quantitative and visual analysis of the impact of music on perceived emotion of film. *Computers in Entertainment*, *5* (3).
- Plutchik, R. (1994). *The psychology and biology of emotion*. New York: Harper Collins.
- Porcile, F. (1969). *Presence de la musique a l'ecran*. Paris: Editions du Cerf.
- Rickard, N. S. (2004). Intense emotional responses to music: A test of the physiological arousal hypothesis. *Psychology of Music*, *32*(4), 371–388.
- Rigg, M. G. (1937). An experiment to determine how accurately college students can interpret intended meanings of musical compositions. *Journal of Experimental Psychology*, *21*, 223–232.

- Schaeffer, P. (1946). L'Element non-visuel au cinema. *La Revue de cinema*, 1–3.
- Scherer, K. R. (2001). The nature and study of appraisal: A review of the issues. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research* (pp. 369–391). New York: Oxford University Press.
- Schorr, A. (2001). Appraisal: The evolution of an idea. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research* (pp. 20–34). New York: Oxford University Press.
- Silvia, P. J. (2005). Emotional responses to art: From collation and arousal to cognition and emotion. *Review of General Psychology*, 9(4), 342–357.
- Sirius, G., & Clarke E. F. (1993). The perception of audiovisual relationships: a preliminary study. *Psychomusicology*, 13, 119–132.
- Tan, E. S. (1996). *Emotion and the structure of narrative film: Films as an emotion machine*. Mahwah, NJ: Erlbaum.
- Tan, S-L., Spackman, M. P., & Wakefield, E. M. (2008). *Source of film music (diegetic or non-diegetic) affects viewer's interpretation of film*. Paper presented at the Tenth International Conference on Music perception and Cognition, Sapporo, Japan, August 2008.
- Thomas, T. (1997). *Music for the movies*. Los Angeles, CA: Silman-James Press.
- Thompson, W. F., Russo, F. A., & Sinclair, D. (1994) Effects of underscoring on the perception of closure in filmed events. *Psychomusicology*, 13, 9–27.

## APPENDIX 1: LIST OF STIMULI USED IN EXPERIMENT 1

### Film sequences:

#### Trust:

1. Love Actually (Richard Curtis)
2. (500) Days of Summer (Marc Webb)
3. Carrie (Brian De Palma)
4. The Deer Hunter (Michael Cimino)

#### Joy:

1. The African Queen (John Huston)
2. Breaking the Waves (Lars von Trier)
3. It's All Gone Pete Tong (Michael Dowse)
4. Braveheart (Mel Gibson)

#### Anticipation:

1. Braveheart (Mel Gibson)
2. Fool's Gold (Andy Tennant)
3. The Bucket List (Rob Reiner)
4. Lulu on the Bridge (Paul Auster)

#### Anger:

1. Braveheart (Mel Gibson)
2. Law Abiding Citizen (F. Gary Gray)
3. Romper Stomper (Geoffrey Wright)
4. The Wind that Shakes the Barley (Ken Loach)

Disgust:

1. Die Blechtrommel (Volker Schlöndorff)
2. Dune (David Lynch)
3. Pink Flamingos (John Waters)
4. Henry: Portrait of a Serial Killer (John McNaughton)

Sadness:

1. Stellet Licht (Carlos Reygadas)
2. Breakfast at Tiffany's (Blake Edwards)
3. L'enfant (Jean-Pierre Dardenne & Luc Dardenne)
4. Wild Blood (Marco Julio Giordana)

Fear:

1. Ringu (Hideo Nakata)
2. The Ring (Gore Verbinski)
3. The Evil Dead (Sam Raimi)
4. Twin Peaks (David Lynch)

Surprise:

1. Stardust (Matthew Vaughn)
2. In Bruges (Martin McDonagh)
3. Law Abiding Citizen (F. Gary Gray)
4. The Addiction (Abel Ferrara)

**Music themes:**

Trust:

1. Vangelis – Hymne
2. Alan Silvestri – Forrest Gump (theme song)
3. Vangelis – Chariots of Fire
4. Johann Pachelbel – Canon in D Major

Joy:

1. Dorothy Collins – Singing in the Rain
2. Liquid Soul – Make Some Noise
3. Benny Hill (theme song)
4. Jaco Pastorius – The Chicken

Anticipation:

1. Memoirs of a Geisha – Snow Dance
2. The Good, the Bad and the Ugly (theme song)
3. Vangelis – Islands Of The Orient
4. Dave Matthews Band – Crash – Two Step

Anger:

1. Mozart – Requiem – Dies irae
2. Resident Evil (theme song)

3. The Used – Sound Effects And Overdramatics
4. Dream Theater – Panic Attack

Disgust:

1. Circle of Dead Children – Destiny of the Slug
2. Guttred With Broken Glass – Elysian Fields
3. Guttred With Broken Glass – Ramrod
4. Dark Autopsy – Corpse lands

Sadness:

1. Beethoven – Moonlight Sonata
2. Memoirs of a Geisha (theme song)
3. Black Hawk Down (theme song) – Danez Prigent & Lisa Gerrard
4. Carlos Valera – Una palabra

Fear:

1. One Missed Call (theme song)
2. Dead Silence (theme song)
3. Halloween (theme song)
4. Saw (theme song)

Surprise:

1. Laco Tayfa – Surmat
2. Bach – Solfeggietto
3. Pink Floyd – Atom Heart Mother
4. Ništa ali logopedi – Oi sa