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# The Emotional Movie Database (EMDB): A Self-Report and Psychophysiological Study

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**Abstract** Film clips are an important tool for evoking emotional responses in the laboratory. When compared with other emotionally potent visual stimuli (e.g., pictures), film clips seem to be more effective in eliciting emotions for longer periods of time at both the subjective and physiological levels. The main objective of the present study was to develop a new database of affective film clips without auditory content, based on a dimensional approach to emotional stimuli (valence, arousal and dominance). The study had three different phases: (1) the pre-selection and editing of 52 film clips (2) the self-report rating of these film clips by a sample of 113 participants and (3) psychophysiological assessment [skin conductance level (SCL) and the heart rate (HR)] on 32 volunteers. Film clips from different categories were selected to elicit emotional states from different quadrants of affective space. The results also showed that sustained exposure to the affective film clips resulted in a pattern of a SCL increase and HR deceleration in high arousal conditions (i.e., horror and erotic conditions). The resulting emotional movie database can reliably be used in research requiring the presentation of non-auditory film clips with different ratings of valence, arousal and dominance.

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## Introduction

Research on the affective processing of pictures and the use of the International Affective Picture System (IAPS) has had a significant impact for the study of emotions and attention during the last decades. Nonetheless, several problems have been reported that may limit the utility of this emotional database, namely habituation related reactions of presenting the same picture to the same subject (Dan-Glauser and Scherer 2011). One of the most problematic limitations is the attenuation of the emotional impact of the stimulus as exposure time increases (Koukounas and Over 2000). This is the reason why sustained tasks tend to use blocks of several pictures (Gomez and Danuser 2010).

The use of emotionally arousing film clips, instead of pictures, may help to overcome this limitation (Rottenberg et al. 2007). First, film clips seem to be more effective in sustained affective processing for longer periods of time at both the subjective and physiological levels. Second, with film clips it is possible to expose participants to potential real-life scenarios without the ethical constraints that in vivo exposure techniques may create (Schaefer et al. 2010).

Despite the advantages mentioned above, the use of film clips may also present disadvantages compared to the use of affective pictures. First, the camera angle (i.e. framing, viewpoint, angle of the shot, movement) or light levels may differ within the film clip. Second, because a film clip is a succession of images presented at a variable rate per second, repetitive exposure of the images that make up a film

clip may also produce sensitization or habituation. Third, some of the real life situations depicted can be perceived by the observer as rather unusual, fantastic or unrealistic. Finally, most film clips are crossmodal and activate both auditory and visual systems.

In contrast to the abundance of reliable affective picture stimuli databases (e.g., International Affective Picture System—IAPS (Lang et al. 2008); The Geneva Affective Picture Database—GAPED (Dan-Glauser and Scherer 2011), only a few sets of affective film clips are currently available. Most of the existent film clips were often chosen to differentiate between discrete affective states (e.g., Gross and Levenson 1995; Lazarus et al. 1962; Philippot 1993) rather than to elicit a more diffuse state of positive or negative emotional activation (e.g., Watson 2000).

Although most of the affect-elicitating film clips available are defined on the basis of their capacity to elicit discrete emotional states, several studies have research questions that go beyond emotional discreteness and aim to elicit a broader emotional state, such as pleasantness and arousal levels.

Discrete emotions can be organized in terms of dimensions such as valence, arousal and dominance (e.g., Lang 1979; Osgood 1966). In this view, the emotional response reflects the initial evaluation of a stimulus eliciting either an approach or withdrawal reaction that may vary in terms of intensity. The direction of the response (toward or away from the stimulus) is mediated by two motivational brain systems: appetitive and defensive. The appetitive system is activated in contexts promoting approach behavior related to survival and pleasure (e.g., reproduction, feeding and caregiving). The defensive system is activated in contexts related to withdrawal, escape or attack behaviors (e.g., escape and threatening). The valence of the stimulus indicates which motivational system is engaged, while arousal indicates the level of activation during exposure (e.g. Bradley et al. 2001; Lang and Bradley 2010). The dominance indicates the power of the emotional state or degree in which the person feels dominated by the emotional activation (e.g., Lang 1979; Osgood 1966).

Dominance is thought to account for little variance in the evaluative judgment of symbolic stimuli (e.g. pictures, words) (Bradley and Lang 2007b). However, this dimension may have a more preeminent role in situations portraying some type of social interaction—such is often the case with film clips (Bradley and Lang 2007b).

So far, research based on this dimensional approach has demonstrated that emotional pictures [e.g., IAPS (Lang et al. 2008)], sounds [e.g., the International Affective Digitized Sound (IADS) (Lang et al. 1999)] and words [e.g., the Affective Norms for English Words (ANEW) (Bradley and Lang 1999)] effectively activate the two major motivational brain systems in a broad affective space (e.g. Bradley and Lang 1994).

The above picture, sound, and word databases have been standardized (Bradley and Lang 1999; Lang et al. 1999, 2008). The standardization of emotional databases is instrumental in providing sufficient experimental control of emotional stimuli and allowing the replication of results across different laboratories and cultures (Lang et al. 2008).

In the past, pictures have been more frequently used than film clips. Static cues (see Lang et al. 2008) seem to be more suitable for highly sensitive temporal resolution methods, like event related potentials (ERP) or autonomic responses (e.g. eye blink reflex). However, the use of dynamic cues to investigate sustained emotional activation for longer periods call for the need of new film clips databases. In addition, the use of audio in film clips, while enhancing the emotional induction, may limit the scope for experimental manipulation (e.g., audio manipulation for emotional and cognitive tasks). The use of non-auditory film clips may allow the experimental manipulation of the auditory context, such as the introduction of an incongruent audio context in order to test incongruent cross modal affective interference. Additionally, the use of non-auditory film clips allows the possibility of the introduction of sound probes (such as acoustic startle probes and auditory oddball tasks) during the emotional exposure, which may be instrumental in EEG/ERP and fMRI studies.

More recently, there has been an increased effort for the standardization of film clip databases. For instance, Schaefer et al. (2010) have recently published a battery of 70 film clips specially developed to elicit discrete emotional states (fear, anger, sadness, disgust, amusement, tenderness and a neutral state) with different levels of arousal and valence. Nonetheless several differences are worth noting between previous databases and our current proposal. First of all, the current database aims to provide a tool for researchers allowing the study of the psychophysiological motivational organization of emotion, similarly to what has been done with the IAPS (Lang et al. 2008). In other words, this database was designed in order to activate (with different arousal levels) both the appetitive and the defensive motivational systems (e.g., Lang and Bradley 2010). Second, as psychophysiological data seems to be somewhat unspecific to discrete emotions (Cacciopo et al. 1993), the current film clips database is aimed for the elicitation of a variety of emotions on a multidimensional continuum. Third, as the auditory content seems to be a powerful source of affect induction, the removal of this modality in our database is intended to allow the possibility of additional experimental manipulations of (e.g. startle response; comparison between static and dynamic stimuli).

The aim of the current study is to develop a new film clips database without auditory content, based on a

dimensional approach to emotional stimuli (valence, arousal and dominance), using self-report (self-assessment manikin (SAM) (Lang 1980) and psychophysiological methods [skin conductance level (SCL) and the heart rate (HR)]. The SAM is a widely used measure requiring a self-report of graphic figures depicting a range of 9-point scale values along the three dimensions: valence (i.e., from a happy to an unhappy figure), arousal (i.e., from an excited, wide-eyed figure to a relaxed figure), and dominance. (i.e., from a smaller to a larger figure). This instrument has been found to be very reliable across individuals, as assessed by split-half coefficients for both valence and arousal. In the pencil-and-paper version, the Spearman rank-order correlation coefficients for both valence and arousal are also very high ($r = .94$). The instrument also seems to be highly reliable when the same pictures are rated across experiments with between-subject designs ($r = .99$ for valence and $r = .97$ for arousal ($p < .001$) (see Lang et al. 2008 for a detailed explanation). Other emotional databases have successfully used this self-report method as the main method of validation (e.g. Backs et al. 2005).

The present study uses the SAM questionnaire, allowing a crossover analysis of valence and arousal that maps better onto bidimensional models of emotions (e.g. Russell 1980). Another, less frequently addressed affective space dimension, is the subjective measure of dominance (i.e., level of control perceived by the subject during stimuli exposure, or the power of the emotional state induced). The selection of thematic categories follows a bidimensional approach in order to have several film clips that map onto the four quadrants of the affective space (positive and negative valence with low and high arousal).

Affective states are psychologically driven phenomena that represent adaptation to changing environments. Thus, studying psychophysiological responses such as heart rate and skin conductance can facilitate an understanding of the level of activation elicited by the film clips. Previous studies have assessed cardiovascular and electrodermal reactivity to different affective stimuli (e.g. Bradley et al. 2001; Turpin and Siddle 1983). Heart rate (HR) and skin conductance level (SCL) consistently varies with emotional arousal (e.g., Bradley et al. 2001). Initial processing of both pleasant and unpleasant film clips, when compared to neutral film clips, leads to a deceleration of the heart rate and increase in the galvanic skin response (Codispoti et al. 2008).

In sum, affective film clips are an important tool for eliciting emotions in the laboratory. The main objective of this study was to develop a new database of non- auditory, emotion-inducing film clips based on the current, established approach in which emotion-inducing stimuli are rated along the dimensions of valence, arousal and dominance. Additionally, the use of HR and SCL during the entire duration of the film clips could provide additional data illustrating psychophysiological changes associated with different levels of valence, arousal and dominance elicited by the film-clips.

## Method

### General Overview

The study was performed in three phases. (1) The selection and editing of 52 film clips from 100 original films. (2) The self-report rating of these film clips based on ratings collected from 113 participants. The categories chosen for this database are based on the two-dimensional affective space (e.g., Bradley and Lang 2000; Posner et al. 2005; Russell 1979, 1980): the hedonic valence (positive vs. negative) and arousal or emotional intensity (from low to high). The categories derived were the following: social negative; social positive; erotic; horror; scenery; object manipulation). Social negative and positive clips represent social interactions where the content is clearly positive or negative but with low appetitive or defensive motivation. Erotic and horror are clearly on the other end, with higher appetitive or defensive motivation. Scenery (landscapes without people and animal) and object manipulation film clips represent categories without clear appetitive or defensive motivation. (3) Psychophysiological recording during film clip viewing (i.e., affective state measured by peripheral variables like heart rate and electrodermal activity) in a different sample of 32 participants.

The study received prior approval by the local ethical review board and was in accordance with the declaration of Helsinki. All participants gave their written informed consent prior to their inclusion in the study.

## Film Clips Selection

### Phase 1

After selecting different thematic categories (erotic, horror, social positive, social negative, scenery and object manipulation) two researchers selected and edited 127 film clips from 100 commercial films and 2 original film clips of object manipulation produced by the research team. The criteria used in this phase were based on (a) the stability of the displayed context; (b) the continuous presence of people in the scene; and (c) hedonic valence which remained unchanged during the entire clip thus not eliciting at the same time positive and negative affection. Film clips were chosen because the context (emotional content) was maintained for the entire duration. Each 40-s clip was edited for consistency of acting scene and emotional content throughout its duration.

All the categories, with the exception of the scenery one, had the presence of human beings. The 127 film clips were rated by 11 participants using the SAM. Based on these ratings, 52 clips were selected, while 75 were discarded due to a high variability in terms of self-report ratings. The film clips were selected according to their valence and arousal ratings, in order to have film clips with different level of hedonic valence (positive-ratings close to 9; negative-ratings close to 1; and neutral-ratings close to 5) and different levels of arousal (low (ratings close to 1), and high (ratings close to 9). The erotic category consisted of 10 different film clips with heterosexual couples engaged in sexual intercourse (but with no genitalia exposure); the horror category consisted of 10 different film clips of life-threatening, aversive and horrifying situations; the social positive category consisted of 10 different film clips of happy social interactions (e.g., friends having fun at the beach); the social negative category consisted of sad or angry social interactions without threatening, aversive and horrifying situations (e.g., a man crying at the funeral of his mother); the scenery category consisted of 10 different film clips of natural scenery or landscapes (e.g., the aurora borealis) and the object manipulation category consisted of 2 film clips showing a human hand manipulating small objects on a table. Film clips were selected in order to obtain a total of 10 film clips per category with homogenous ratings by the research team on valence, arousal and dominance within each category.

## Film Clips Validation

### Phase 2: Self-Report Ratings

The objective of this phase was to provide ratings of arousal, valence and dominance for each of the selected film clips.

#### *Participants*

Participants were recruited from two major northwestern Iberian universities; 113 volunteers (75 females and 38 males; mean age = 21, 56; SD = 6, 30) participated. Of these individuals, 77 were Portuguese and 36 were Spanish. All of them were psychology students. Questionnaires were translated into the native language of each participant group (Portuguese or Spanish) by native speakers of the language.

## Materials

Participants viewed 52 40-s film clips with a resolution of 720 × 576. The film clips were presented in 4 random blocks of 13 film clips each, in a pseudorandom trial order. The participants performed the task in a room under similar light conditions and were seated at a 90°-angle arc facing the screen. The videos were displayed using a projector and a projector screen. The maximum image size displayed was 1.5 m wide and 1.2 m high. The procedure of self-report occurred in six sessions, with at least 20 people in each session. In each session, participants viewed film clips from 6 different categories: erotic, horror, social positive content, social negative content, scenery and object manipulation.

At the start of the procedure, participants were told that they would see several emotion-inducing film clips performed by professional actors. They were also informed that some film clips might portray potentially shocking scenes and were reminded that they were free to withdraw from the experiment at any time. After providing written informed consent, participants were given instructions for the rating scale used in the procedure. The scale was a paper and pencil version of the self-assessment manikin (SAM) (Lang 1980); ratings were made on a 9-point Likert scale for ratings of valence, arousal and dominance. For each film clip participants were also required to answer 2 questions: (1) "Have you watched this movie before?"; and (2) "Have you closed your eyes or look away during the clip presentation?". Participants were told to report their emotional reactions to each film clip by completing the questionnaire immediately after watching each excerpt. Following Philippot (1993), they were also instructed to report: (1) what they had actually felt in response to viewing the film clip, rather than what they believed they should feel; (2) what they felt at the time they viewed film clip, not their overall mood; and (3) if they recognized the movie the film clip. The latter was obtained in order to eliminate any clips from the database that had previously seen by 30 % or more of the participants.

A practice film clip was used to demonstrate how the rating should be performed. Instructions for the SAM procedure were adapted from Lang et al. (2008). Immediately after the practice clip, the film clips were presented in random blocks, in a pseudorandom trial order to ensure that identical categories were not presented consecutively. Each trial consisted of 40 s of viewing the film clip, followed by 20 s for the SAM ratings. Before presenting the next clip, a blue screen with the words "Get ready for the new trial" appeared on the screen for 1 s. Each 60-s trial was presented in a projector screen, controlled by a computer connected to a video projector.

### Phase 3: Psychophysiological Responses

The objective of this phase was to assess the psychophysiological response (namely SCL and HR) to the film clips in order to investigate their potential utility as a second measure of the activation of the appetitive and

defensive motivational systems. These measures were chosen because they are currently the most common autonomic nervous system markers of emotional processing (see Mauss and Robinson 2009 for review). The HR has been thought to be more responsive to the valence in affective pictures viewing (Greenwald et al. 1989; Lang et al. 1993) while the SCL seems to be more responsive to the level arousal, regardless of picture valence (e.g., Cuthbert et al. 2000). Combining both measures may prove useful to determine the different levels of arousal and valence induced by the emotionally laden film clips.

*Participants*

A total of 32 right-handed healthy volunteers, 16 females (mean age: 21, 73; SD: 2, 31) and 16 males (mean age: 24, 80; SD: 3, 90) participated in this phase and watched all the 52 film clips.

## Materials

The same film clips previously mentioned (i.e., self-report ratings) were presented in a 19 inches screen, in random blocks with a pseudo-randomized trial order (there were no two consecutive trials with film clips of the same category), with 6 s interval between trials.

The SCL and the HR were collected on a BIOPAC MP150 system with the AcqKnowledge 4.0 (BIOPAC Systems Inc). The SCL was assessed using two Ag–Ag–Cl electrodes attached to a conductance module. The electrodes were attached to the second and third finger of the left hand, between the first and second phalanges. This setup for the non-dominant hand was chosen because several experimental tasks that could be used in responding to these film clips may require a motor response typically performed by the dominant hand. SCL was analyzed offline using AcqKnowledge 4.0 software (BIOPAC Systems Inc.), as the mean value of consecutive 4 s epochs of the entire 40 s of exposure to the film clip. HR was assessed using a 3 lead ECG, with a lead II configuration. The average beat per minute was acquired as consecutive 4 s epochs during the entire 40 s of film clip exposure. Baseline was set as the 4 s prior to the film clip presentation, during the inter-trial interval.

### Data Analysis

*Self-Report Ratings*

The grand mean for each thematic category was calculated. A general linear model analysis was used. Three separate within-subject repeated measures ANOVA with 6 levels (horror, erotic, social positive, social negative, scenery and object manipulation) were performed for the valence, arousal and dominance dimensions. All the post hoc multiple pairwise comparisons were performed using Bonferroni's correction. The level of statistical significance was set at $p < .05$. Data analyses were performed using SPSS 19.0.1 (IBM®).

*Psychophysiological Responses*

Repeated measures ANOVAs (each predicting the SCL and the HR) were performed with six within subject levels (erotic, horror, social positive, social negative, scenery, object manipulation categories). The level for statistical significance was set at $p < .05$ and all analyses were performed using IBM SPSS 19.0.1 (IBM®).

## Results

### Self-Report Ratings

Table 1 presents a general description of the film clips, with the associated self- report ratings of valence, arousal and dominance. The ratings are presented separately for males and females, along with the percentage who reported recognizing the film clip. All clips are included because no film clip was familiar to more than 30 % of the participants.

Scores of the scales for valence, arousal and dominance assessed using the SAM (Lang 1980) are presented. The paper-and-pencil version consisted of graphic figures for each film clip with scores on 9 point Likert scale for each of the 3 dimensions (see Lang et al. 2008 for detailed explanation). Higher scores on the dominance subscale indicate the extent to which the participant reported the subjective feeling of being overwhelmed.

The Fig. 1 shows the distribution of the ratings of valence, arousal and dominance, suggesting that the chosen categories represent different quadrants of the affective space (pleasure and arousal) in both males and females.

### Category Comparison

The grand means for each category of film clip in each dimension were calculated to test the extent to which category scores differed in valence, arousal and dominance. No significant gender effects at the category level were found (i.e., valence, arousal and dominance).

### Valence Effects

A one-way repeated measures ANOVA revealed significant differences among valence ratings ($F(5,560) = 394.18$,

**Table 1** Self-report ratings for the EMDB

| Film clip content | No. | | Clip description | Valence mean (SD) | | | Arousal mean (SD) | | | Dominance mean (SD) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Overall | Men | Women | Overall | Men | Women | Overall | Men | Women |
| Horror | 1,000 | The ruins | Amputation scene on top of the ruins | 2.04 (1.98) | 2.79 (2.24) | 1.67 (1.64) | 7.11 (1.77) | 6.43 (2.02) | 7.45 (1.53) | 5.84 (2.71) | 4.92 (2.79) | 6.31 (2.57) |
| | 1,001 | Texas Chainsaw Massacre: The Beginning | Leatherface removing the face of Mathew Bomer | 1.68 (1.45) | 2.11 (1.74) | 1.47 (1.23) | 7.45 (1.77) | 6.97 (2.02) | 7.69 (1.59) | 5.75 (2.63) | 4.92 (2.66) | 6.17 (2.53) |
| | 1,002 | Midnight Meat Train | Vinnie Jones removing the eyes and the teeth of the victim | 1.67 (1.36) | 2.34 (1.86) | 1.33 (0.84) | 7.72 (1.67) | 7.11 (2.03) | 8.01 (1.38) | 6.12 (2.63) | 5.39 (2.81) | 6.48 (2.48) |
| | 1,003 | Hostel | Jay Hernandez is being tortured on a chair and fingers form his hand are amputated | 2.99 (2.00) | 3.81 (2.11) | 2.58 (1.84) | 6.19 (2.20) | 5.60 (2.17) | 6.49 (2.17) | 4.62 (2.69) | 3.79 (2.63) | 5.04 (2.64) |
| | 1,004 | Hostel 2 | Cannibalism scene | 2.07 (1.91) | 2.61 (2.11) | 1.80 (1.75) | 6.88 (1.95) | 6.29 (2.21) | 7.19 (1.74) | 5.17 (2.79) | 4.16 (2.76) | 5.68 (2.69) |
| | 1,005 | Midnight Meat Train | Leslie Bibb inside a carriage with bodies hanging from the ceiling | 2.06 (1.48) | 2.32 (1.60) | 1.93 (1.41) | 6.92 (1.74) | 6.38 (1.96) | 7.19 (1.56) | 5.03 (2.90) | 3.79 (2.69) | 5.65 (2.82) |
| | 1,006 | Canibal Holocaust | Savage attack from cannibal tribe to one anthropologist, dismembering him. Children start to eat parts of him | 1.98 (1.50) | 2.50 (1.72) | 1.72 (1.31) | 7.37 (1.88) | 6.81 (2.17) | 7.65 (1.67) | 5.64 (2.99) | 4.84 (2.98) | 6.04 (2.93) |
| | 1,007 | Texas Chainsaw Massacre: The Beginning | Jordana Brewster very scared, hidden on a box assists to a mutilation of her boyfriend | 1.81 (1.43) | 2.08 (1.60) | 1.67 (1.32) | 7.33 (1.91) | 7.00 (2.14) | 7.49 (1.79) | 5.56 (2.87) | 4.71 (3.00) | 5.99 (2.72) |
| | 1,008 | The Rest Stop | Jaimie Alexander giving a merciful shot to the head of a police | 1.94 (1.41) | 2.34 (1.70) | 1.73 (1.20) | 6.53 (2.05) | 6.00 (2.35) | 6.81 (1.84) | 4.99 (2.75) | 4.05 (2.67) | 5.47 (2.68) |
| | 1,009 | Midnight Meat Train | Vinnie Jones with a vicious attack direct to a woman that ends with the decapitation of the victim | 1.83 (1.24) | 2.21 (1.49) | 1.65 (1.06) | 6.88 (1.70) | 6.51 (1.90) | 7.07 (1.58) | 5.26 (2.52) | 4.50 (2.75) | 5.64 (2.33) |

**Table 1** continued

| Film clip content | No. | | Clip description | Valence mean (SD) | | | Arousal mean (SD) | | | Dominance mean (SD) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Overall | Men | Women | Overall | Men | Women | Overall | Men | Women |
| Erotic Couples | 2,000 | Underworld: Evolution | Sex scene between Kate Beckinsale and Scott Speedman | 6.70 (1.55) | 6.61 (1.64) | 6.75 (1.62) | 5.82 (1.87) | 5.76 (1.84) | 5.85 (1.90) | 3.93 (2.56) | 3.71 (2.60) | 4.04 (2.55) |
| | 2,001 | Playboy's Clip | Couple having sex: woman in astride position and with rear entry while the man is standing | 6.32 (1.71) | 6.46 (1.79) | 6.25 (1.69) | 6.06 (1.83) | 5.71 (1.92) | 6.24 (1.77) | 4.02 (2.78) | 3.39 (2.55) | 4.33 (2.85) |
| | 2,002 | 9 Songs | Margo Stilley and Kieran O'Brien having sex on the living room. She is sitting on the sofa while he is standing | 7.15 (1.50) | 7.03 (1.44) | 7.21 (1.54) | 5.99 (1.84) | 5.83 (1.81) | 6.06 (1.86) | 3.88 (2.89) | 3.18 (2.82) | 4.23 (2.82) |
| | 2,003 | Killing Me softly | Joseph Fiennes and Heather Graham having bondage sex near the fireplace | 6.11 (2.10) | 6.24 (1.95) | 6.04 (2.19) | 5.63 (2.22) | 5.33 (2.15) | 5.77 (2.26) | 4.02 (3.05) | 2.92 (2.76) | 4.57 (3.05) |
| | 2,004 | Kama Sutra: the sensual art of lovemaking | Couple having sex in arch position | 6.48 (1.70) | 6.18 (1.80) | 6.63 (1.63) | 6.00 (1.78) | 5.53 (1.93) | 6.24 (1.67) | 3.89 (2.91) | 3.39 (2.81) | 4.15 (2.94) |
| | 2,005 | Kama Sutra: the sensual art of lovemaking | Couple having sex in Variant yawning, namely Fixing nail | 6.51 (1.90) | 6.37 (2.11) | 6.59 (1.79) | 5.83 (1.83) | 5.61 (1.84) | 5.93 (1.84) | 3.76 (2.81) | 3.05 (2.73) | 4.12 (2.80) |
| | 2,006 | 9 Songs | Margo Stilley and Kieran O'Brien in oral sex | 6.40 (1.61) | 6.45 (1.50) | 6.37 (1.67) | 5.89 (1.81) | 5.49 (1.74) | 6.08 (1.83) | 4.05 (2.77) | 3.68 (2.90) | 4.24 (2.70) |
| | 2,007 | Monamour | Anna Jimskaia wearing a black silk dress having oral and intercourse with Riccardo Marino | 6.58 (1.79) | 6.68 (1.74) | 6.53 (1.82) | 6.10 (1.67) | 5.76 (1.76) | 6.26 (1.61) | 3.85 (2.74) | 3.50 (2.59) | 4.03 (2.82) |
| | 2,008 | Diary of a Nymphomaniac | Belén Favra having sex on the missionary position | 6.46 (1.88) | 6.39 (1.71) | 6.49 (1.97) | 5.51 (2.09) | 5.09 (2.21) | 5.73 (1.89) | 3.72 (2.74) | 2.95 (2.49) | 4.11 (2.79) |
| | 2,009 | Diary of a Nymphomaniac | Belén Favra having sex on the desk chair position | 6.54 (1.74) | 6.34 (1.71) | 6.64 (1.75) | 6.11 (1.85) | 5.73 (2.15) | 6.29 (1.68) | 3.88 (2.82) | 3.24 (2.75) | 4.20 (2.82) |

**Table 1** continued

| Film clip content | No. | | Clip description | Valence mean (SD) | | | Arousal mean (SD) | | | Dominance mean (SD) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Overall | Men | Women | Overall | Men | Women | Overall | Men | Women |
| Social negative interactions | 3,000 | Boogeyman | Barry Watson entering a church for his mom's funeral | 3.13 (1.62) | 3.82 (1.56) | 2.79 (1.55) | 3.64 (2.14) | 3.18 (2.12) | 3.89 (2.12) | 3.58 (2.58) | 2.87 (2.43) | 3.93 (2.60) |
| | 3,001 | The descent | Girl crying while her beloved died in her arms | 3.04 (1.67) | 3.34 (1.84) | 2.89 (1.57) | 4.79 (1.42) | 4.89 (1.43) | 4.75 (1.42) | 3.24 (2.45) | 2.58 (2.47) | 3.57 (2.40) |
| | 3,002 | The Pianist | Emilia Fox brings a cloth to Adrien Brody that is lying sick on the bed | 2.49 (1.45) | 2.74 (1.55) | 2.36 (1.39) | 3.87 (2.15) | 3.37 (2.01) | 4.12 (2.19) | 3.37 (2.63) | 2.74 (2.58) | 3.69 (2.61) |
| | 3,003 | Diary of a Nymphomaniac | Very sad Belén Fabra considering suicide | 2.65 (1.42) | 2.74 (1.48) | 2.60 (1.40) | 4.29 (2.02) | 3.68 (2.04) | 4.61 (1.95) | 3.70 (2.84) | 3.42 (3.00) | 3.84 (2.76) |
| | 3,004 | Mystic River | Marcia Gay Harden and Tim Robbins having an argument | 2.88 (1.27) | 3.03 (1.42) | 2.80 (1.19) | 3.79 (1.80) | 3.42 (1.65) | 3.97 (1.85) | 3.38 (2.61) | 2.89 (2.48) | 3.63 (2.65) |
| | 3,005 | Boogeyman 2 | Danielle Savre crying in the arms of Matt Cohen | 3.54 (1.53) | 3.84 (1.52) | 3.39 (1.52) | 4.05 (1.96) | 3.71 (2.10) | 4.22 (1.87) | 3.85 (3.04) | 3.63 (3.36) | 3.96 (2.89) |
| | 3,006 | Bridge to Tehabithia | Josh Hutcherson crying in the arms of Robert Patrick | 2.88 (1.36) | 3.13 (1.58) | 2.75 (1.23) | 4.25 (2.12) | 3.95 (2.25) | 4.41 (2.05) | 3.89 (2.50) | 3.26 (2.59) | 4.21 (2.41) |
| | 3,007 | American Beauty | Annete Benning and Thora Birch having an argument, in Thora's room | 3.20 (1.19) | 3.03 (1.20) | 3.29 (1.18) | 3.58 (1.84) | 2.86 (1.83) | 3.93 (1.75) | 3.74 (2.92) | 3.68 (3.25) | 3.77 (2.76) |
| | 3,008 | American Beauty | Wes Bentley and Chris Cooper having an argument | 3.33 (1.28) | 3.24 (1.34) | 3.37 (1.25) | 3.61 (1.69) | 3.47 (1.69) | 3.68 (1.70) | 3.40 (2.95) | 3.26 (3.19) | 3.47 (2.85) |
| | 3,009 | Mystic River | Sean Penn crying in the front porch | 3.30 (1.46) | 3.53 (1.52) | 3.19 (1.42) | 3.89 (2.05) | 3.51 (2.06) | 4.08 (2.03) | 3.41 (2.86) | 3.18 (3.06) | 3.52 (2.78) |
| Social positive interactions | 4,000 | This Girls Life | Kip Kardue having dinner with Juliette Marquis | 6.32 (1.47) | 6.11 (1.35) | 6.43 (1.52) | 2.39 (1.70) | 2.45 (1.70) | 2.36 (1.71) | 2.85 (2.64) | 2.47 (2.46) | 3.04 (2.73) |
| | 4,001 | My Best Friend's Girls | Dane Cook and Kate Hudson funny dance in the Promenade party | 7.13 (1.57) | 6.68 (1.74) | 7.36 (1.43) | 3.30 (1.79) | 2.87 (1.76) | 3.52 (1.78) | 3.12 (2.77) | 2.47 (2.52) | 3.45 (2.85) |
| | 4,002 | Good Luck Chuck | Dane Cook and Jessica Alba walking and talking at night | 6.58 (1.62) | 6.11 (1.59) | 6.81 (1.60) | 3.35 (2.06) | 2.79 (1.89) | 3.64 (2.09) | 3.00 (2.81) | 2.24 (2.33) | 3.39 (2.96) |

**Table 1** continued

| Film clip content | No. | | Clip description | Valence mean (SD) | | | Arousal mean (SD) | | | Dominance mean (SD) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Overall | Men | Women | Overall | Men | Women | Overall | Men | Women |
| | 4,003 | Ruins | Night scene at the beach, with happy people partying | 6.45 (1.47) | 6.13 (1.55) | 6.61 (1.41) | 3.09 (1.80) | 2.74 (1.69) | 3.27 (1.83) | 2.90 (2.79) | 2.47 (2.65) | 3.12 (2.85) |
| | 4,004 | Lie With Me | Lauren Lee Smith and Eric Dalfour riding a bike and then on a discotheque | 7.03 (1.68) | 6.63 (1.99) | 7.23 (1.48) | 4.19 (1.93) | 4.00 (2.14) | 4.28 (1.83) | 3.27 (2.75) | 2.84 (2.78) | 3.48 (2.74) |
| | 4,005 | Last Chance Harvey | Grooms dancing at the wedding reception | 6.70 (1.32) | 6.18 (1.18) | 6.96 (1.32) | 3.58 (2.03) | 3.21 (2.20) | 3.77 (1.93) | 3.62 (2.95) | 3.16 (3.03) | 3.85 (2.90) |
| | 4,006 | Ruins | Scene in the pool, where they are deciding if they will go to the ruins | 6.66 (1.33) | 6.47 (1.22) | 6.76 (1.38) | 3.42 (1.94) | 3.13 (2.04) | 3.57 (1.88) | 3.12 (2.83) | 2.87 (2.89) | 3.24 (2.81) |
| | 4,007 | Diary of a Nymphomaniac | Belén Favra happy entering her new home for the first time | 6.58 (1.44) | 6.53 (1.57) | 6.61 (1.38) | 3.38 (1.79) | 2.86 (1.78) | 3.64 (1.76) | 3.44 (3.12) | 3.29 (3.32) | 3.52 (3.03) |
| | 4,008 | Diary of a Nymphomaniac | Happy Belén Favra remembering romantic scenes while talking to her friend | 5.75 (1.59) | 5.47 (1.47) | 5.89 (1.64) | 3.34 (1.83) | 3.00 (1.85) | 3.51 (1.81) | 3.07 (2.83) | 2.68 (3.00) | 3.27 (2.75) |
| | 4,009 | The Rest Stop | Couple on top of a car with violet flowers surrounding them | 7.01 (1.48) | 6.74 (1.35) | 7.15 (1.53) | 4.26 (1.09) | 3.95 (1.93) | 4.42 (1.91) | 3.37 (2.91) | 3.24 (3.04) | 3.44 (2.86) |
| Scenery | 5,000 | Disney's Earth | Desert and polar scenes | 5.88 (1.99) | 6.00 (1.92) | 5.81 (2.03) | 2.99 (2.25) | 2.84 (2.28) | 3.07 (2.25) | 2.88 (3.05) | 2.42 (2.83) | 3.12 (3.15) |
| | 5,001 | Disney's Earth | Mountains with ice | 5.83 (1.67) | 6.05 (1.94) | 5.72 (1.52) | 2.72 (2.03) | 2.87 (2.17) | 2.65 (1.97) | 2.94 (2.90) | 2.63 (2.76) | 3.09 (2.97) |
| | 5,002 | Disney's Earth | Scenery with polar scenes and the dusk | 5.68 (1.70) | 5.92 (1.68) | 5.56 (1.70) | 2.51 (1.86) | 2.45 (1.97) | 2.55 (1.81) | 2.88 (2.94) | 2.34 (2.63) | 3.15 (3.07) |
| | 5,003 | Disney's Earth | Waterfalls | 6.53 (1.73) | 6.58 (1.65) | 6.50 (1.78) | 3.52 (2.12) | 3.65 (2.69) | 3.45 (2.15) | 3.61 (2.91) | 3.63 (3.13) | 3.60 (2.82) |
| | 5,004 | Disney's Earth | Flowers and trees | 6.57 (1.56) | 6.47 (1.52) | 6.61 (1.59) | 2.99 (1.82) | 2.79 (1.68) | 3.09 (1.88) | 3.65 (3.26) | 3.71 (3.42) | 3.61 (3.20) |
| | 5,005 | Disney's Earth | Sandstorm and desert | 5.32 (1.06) | 5.37 (0.97) | 5.29 (1.11) | 2.86 (1.97) | 2.50 (1.81) | 3.04 (2.03) | 3.50 (3.03) | 3.39 (3.20) | 3.55 (2.97) |
| | 5,006 | Disney's Earth | Several takes of trees | 6.23 (1.63) | 6.26 (1.66) | 6.21 (1.62) | 2.86 (2.17) | 2.76 (2.06) | 2.92 (2.24) | 2.80 (2.78) | 2.55 (2.76) | 2.92 (2.81) |
| | 5,007 | Disney's Earth | A scenery overview including trees, waterfalls and sand | 6.28 (1.57) | 6.55 (1.64) | 6.15 (1.52) | 3.20 (2.36) | 3.46 (2.45) | 3.07 (2.32) | 3.17 (2.96) | 3.24 (3.25) | 3.13 (2.83) |
| | 5,008 | Disney's Earth | Several scenes from a jungle and in the end mushrooms start to grow | 5.73 (1.54) | 5.82 (1.56) | 5.68 (1.54) | 2.54 (1.95) | 2.63 (2.09) | 2.50 (1.89) | 3.23 (3.15) | 3.13 (3.14) | 3.28 (3.18) |

**Table 1** continued

| Film clip content | No. | Clip description | Valence mean (SD) | | | Arousal mean (SD) | | | Dominance mean (SD) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Overall | Men | Women | Overall | Men | Women | Overall | Men | Women |
| | 5,009 | Disney's Earth | 6.17 (1.44) | 6.24 (1.46) | 6.13 (1.44) | 2.79 (1.80) | 2.83 (1.90) | 2.77 (1.77) | 3.23 (3.12) | 3.34 (3.32) | 3.17 (3.03) |
| Objects | 6,000 | Own footage | 4.90 (1.82) | 5.24 (2.15) | 4.73 (1.62) | 2.44 (2.23) | 2.08 (2.10) | 2.61 (2.28) | 2.58 (2.83) | 2.29 (2.56) | 2.72 (2.97) |
| | 6,001 | Own footage | 4.74 (1.51) | 5.05 (1.27) | 4.59 (1.60) | 2.33 (1.97) | 2.05 (1.97) | 2.47 (1.97) | 3.14 (3.23) | 3.24 (3.46) | 3.09 (3.13) |

Clouds swirling

Moving objects on a table

Moving objects on a table

$p < .001$, $\varepsilon = .74$, $\eta_p^2 = .78$). Post hoc Bonferroni pairwise comparisons found no difference in the valence ratings of social positive and erotic categories of film clips ($p$ = n.s.), although the other categories differed significantly in valence ratings (see Table 2). Horror, Social Negative, Scenery and Objects are significantly different in terms of valence ratings from all the other categories ($p < .001$). With the exception of erotic, social positive clips was rated as significantly more pleasant than the remaining categories ($p < .001$). Apart from the already mentioned exception, erotic film clips were also significantly rated as more pleasant than horror, social negative and objects ($p < .001$) as well as from scenery clips ($p = .003$).

### Arousal Effects

A one-way repeated measures ANOVA revealed a significant effect of arousal ($F(5,560) = 271.82$, $p < .001$, $\varepsilon = .64$, $\eta_p^2 = .71$). Post hoc Bonferroni pairwise comparisons indicated that category arousal ratings differed significantly from each other (see Table 2). Horror, erotic, social negative and social positive were significantly different in terms of arousal ratings from each other ($p < .001$), with the following gradation: Horror > Erotic > Social Negative > Social Positive ($p < .001$). These categories were also rated as more arousing than both Scenery and Object Manipulation ($p < .001$). Additionally, Scenery was rated as more arousing than Object Manipulation clips ($p = .046$).

### Dominance Effects

A one-way repeated measures ANOVA showed a significant effect of dominance ($F(5,560) = 38.77$, $p < .001$, $\varepsilon = .44$, $\eta_p^2 = .26$). Horror clips had significantly higher ratings than other thematic categories for this dimension ($p < .001$). Erotic clips showed larger dominance ratings than social positive and negative categories ($p < .001$) and the scenery category ($p = .028$). The social negative category also had significantly higher dominance ratings than social positive category ($p = .002$). Post hoc Bonferroni corrected pairwise comparisons found no differences between the erotic and social negative categories ($p$ = n.s.) or between the social positive, scenery and object manipulation categories ($p$ = n.s.).

## The Psychophysiological Responses Variation

### Heart Rate (HR)

The repeated-measures ANOVA showed a statistically significant effect of the factor film clip categories

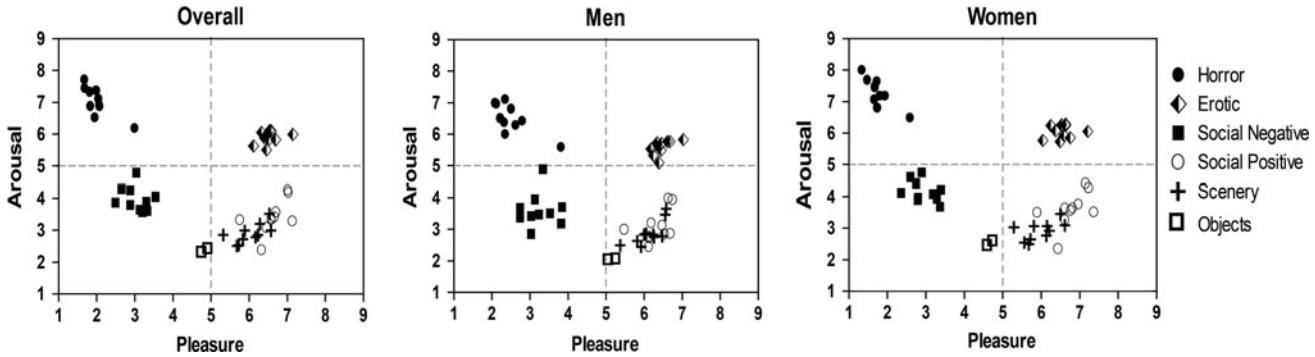


**Fig. 1** Distribution of the film clips in the affective space (mean values for pleasure on the *horizontal axis* and arousal on the *vertical axis*). The self-report ratings distribution seems to support the grouping of the film clips within categories, revealing some consistency in terms of valence and arousal ratings for each thematic

**Table 2** Self report ratings per category

| Valence | Mean | SEM | 95 % CI | | Arousal | Mean | SEM | 95 % CI | | Dominance | Mean | SEM | 95 % CI | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | LB | UB | | | | LB | UB | | | | LB | UB |
| Erotic | 6.526 | .104 | 6.321 | 6.731 | Erotic | 5.734 | .137 | 5.463 | 6.731 | Erotic | 3.899 | .219 | 3.465 | 4.333 |
| Horror | 2.015 | .107 | 1.802 | 2.227 | Horror | 6.998 | .137 | 6.727 | 2.227 | Horror | 5.396 | .197 | 5.005 | 5.788 |
| Social negative | 3.043 | .076 | 2.893 | 3.194 | Social negative | 3.969 | .114 | 3.743 | 3.194 | Social negative | 3.555 | .175 | 3.208 | 3.902 |
| Social positive | 6.621 | .081 | 6.461 | 6.782 | Social positive | 3.427 | .118 | 3.194 | 6.782 | Social positive | 3.176 | .195 | 2.789 | 3.563 |
| Scenery | 6.023 | .079 | 5.865 | 6.180 | Scenery | 2.914 | .134 | 2.648 | 6.180 | Scenery | 3.188 | .220 | 2.751 | 3.624 |
| Objects | 4.823 | .132 | 4.561 | 5.085 | Objects | 2.434 | .191 | 2.056 | 5.085 | Objects | 2.858 | .239 | 2.384 | 3.333 |

*SEM* standard error of the mean, *CI* confidence interval, *LB* lower bound, *UB* upper bound

($F(5,155) = 8.449$, $p = .000$, $\varepsilon = .684$, $\eta_p^2 = .214$). The post hoc Bonferroni corrected pairwise comparisons revealed that the horror film clips significantly decreased HR compared to social positive ($p = .027$), social negative ($p = .007$) and object manipulation ($p = .002$) film clips. No statistically significant differences were found between horror film clips and both erotic ($p =$ n.s.) and scenery ($p =$ n.s.) film clips. The erotic film clips significantly decreased HR compared social positive ($p = .024$), social negative ($p = .029$), and object manipulation ($p = .013$) film clips. No statistical significant differences were found between erotic film clips and scenery ($p =$ n.s.) film clips. No other statistical significant differences were found between the remaining pairwise comparisons ($p =$ n.s.) (see Fig. 2; Table 3).

Skin Conductance Level (SCL)

The repeated-measures ANOVA showed a significant effect of the factor film clip categories ($F(5,155) = 12.155$, $p = .000$, $\varepsilon = .339$, $\eta_p^2 = .289$). The post hoc comparisons revealed that the horror film clips significantly increased the SCL compared to social positive ($p = .011$), social negative ($p = .005$), object manipulation ($p = .016$) and scenery ($p = .005$) film clips. No difference was found between horror film clips and erotic film clips ($p =$ n.s.). Also, the erotic film clips significantly increased the SCL compared to social positive ($p = .009$), social negative ($p = .006$), object manipulation ($p = .015$) and scenery ($p = .012$) film clips. No statistically significant differences were found between the remaining pairwise comparisons ($p =$ n.s.) (see Fig. 2; Table 3).

## Discussion

The present study presents the development of a new database of affective film clips without auditory content, based on a dimensional approach to emotional stimuli (valence, arousal and dominance).

The current database provides a set of 52-film clips that were found to effectively cover the four subquadrants of the affective space, based on the multidimensional model of emotion. At the same time, this database provides the

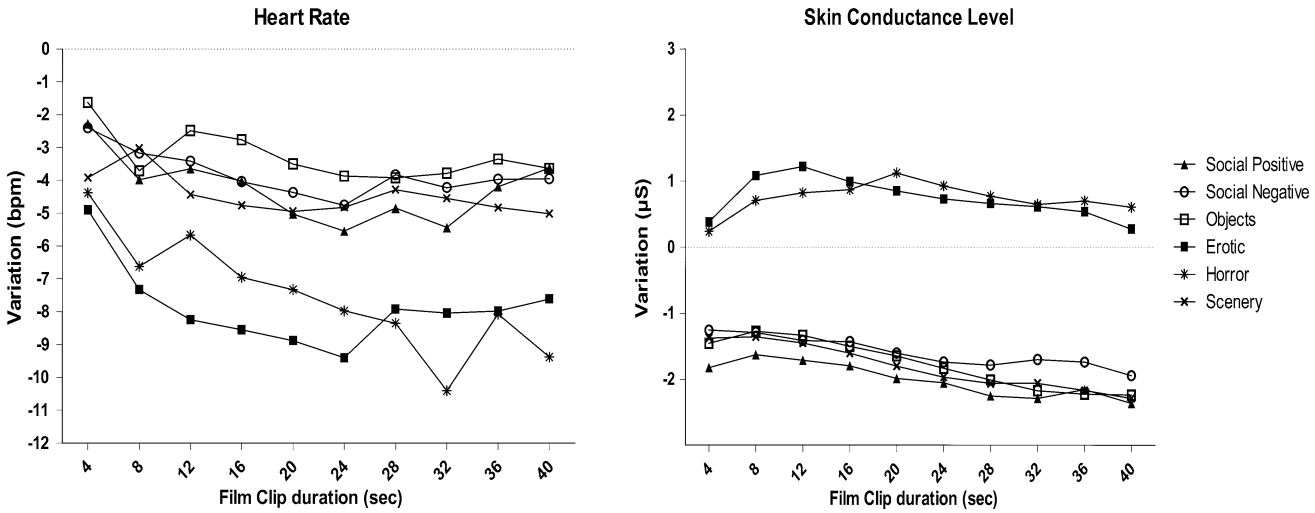


**Fig. 2** Heart rate (bpm) and skin conductance level (μS) in 4 s epoch for the entire duration of each film clip. The value represents the variation of each epoch to the 4 s epoch immediately prior to the presentation of the film clip. These measures seem to differentiate better between low and high arousal, than between valence

**Table 3** Physiological responses (HR and SCL variation)

| HR variation (bpm) | Mean | SEM | 95 % CI | | SCL Variation (μS) | Mean | SEM | 95 % CI | |
|---|---|---|---|---|---|---|---|---|---|
| | | | LB | UB | | | | LB | UB |
| Erotic | −7.887 | 1.305 | −10.549 | −5.226 | Erotic | .734 | .384 | −.049 | 1.518 |
| Horror | −7.514 | 1.179 | −9.918 | −5.110 | Horror | .742 | .228 | .276 | 1.208 |
| Social negative | −3.816 | .745 | −5.335 | −2.298 | Social negative | −1.591 | .450 | −2.508 | −.673 |
| Social positive | −4.264 | .645 | −5.580 | −2.948 | Social positive | −2.007 | .585 | −3.199 | −.815 |
| Scenery | −4.460 | .636 | −5.757 | −3.162 | Scenery | −1.813 | .485 | −2.802 | −.824 |
| Objects | −3.271 | .728 | −4.755 | −1.787 | Objects | −1.770 | .539 | −2.868 | −.672 |
| Baseline[a] | 83.404 | 4.244 | 74.749 | 92.509 | Baseline[a] | 28.482 | 2.677 | 23.023 | 33.941 |

*HR* heart rate, *SCL* skin conductance level, *SEM* standard error of the mean, *CI* confidence interval, *LB* lower bound, *UB* upper bound

[a] Baseline represents the absolute value from which each category variations were calculated

data from HR and SCL variation in response to the different film clips. As mentioned before, this database can be used along with the experimental manipulation of auditory content, thus allowing to study, for instance, startle effects, or even auditory oddball effects (e.g., Carvalho et al. 2011).

In order to classify and compare film clips both, self-report ratings and psychophysiological responses were used. The self-report responses provided ratings of valence, arousal and dominance for each of the 52 selected film clips, indicating that they could be organized in six categories (or subgroups), as each category are more likely to elicit different emotional states in the laboratory (see Table 1).

The erotic, social positive, and scenery categories were rated as pleasant in valence, whereas the horror and social negative categories were rated as unpleasant. Object manipulation was rated on the center of the scale for valence/pleasantness (mean scores close to 5) and with low mean scores of arousal (less than 3), suggesting some emotional neutrality. The erotic and social positive categories were not significantly different from each other, but all the other categories were significantly different from each other. In addition, the erotic and social positive clips were rated significantly as more pleasant than the remaining categories.

Thus, these affective judgments of pleasantness and unpleasantness could be used as part of an initial evaluation to determine whether they activate the appetitive or defensive motive systems and consequently approach or withdrawal behaviors (e.g. Lang et al. 1990).

Arousal ratings occurred along a gradient, with reported arousal ratings being the highest for horror film clips, and followed by the erotic, social negative and social positive

film clips, with the lowest rating for object manipulation clips. All these categories were also rated as more arousing than both scenery and object manipulation and, finally, scenery were rated as more arousing than object manipulation film clips. Arousal has been conceptualized as an index of the intensity of an emotional reaction that is directly related to the degree to which approach or withdrawal behaviors will occur (e.g. Cuthbert et al. 2000; Schupp et al. 2004). Horror film clips had higher arousal ratings than erotic film clips. A similar pattern was found when comparing social negative to social positive clips. In both comparisons, unpleasant film clips were rated as more arousing than pleasant ones. Several other databases of emotional stimuli showed higher levels of arousal for negative stimuli [e.g. IAPS (Lang et al. 2008)]. This seems to be consistent with previous studies finding evidence for the existence of greater attentional allocation to negative stimuli (Carretié et al. 2001, 2006; Delplanque et al. 2004; Smith et al. 2003). This may be thought to reflect the motivational function of adaptive utility of certain stimulus characteristics (Ito et al. 1998) and/or the process of sensitization effect due to a repetitive or prolonged exposure to the stimuli (Bradley et al. 1996; Smith et al. 2005). Another possible explanation could rely on the specific content selected for each category—the negative stimuli could (by definition this is probably true) induce a larger activation of the defensive motivational system than the positive stimuli induces of the appetitive motivational system.

Object manipulation film clips may be particularly appropriate for use as a control category, as its valence scores were near to the midline of the pleasant- unpleasant scale and had the lowest arousal scores. In contrast, the scenery category, despite its relatively low arousal score, was clearly rated as pleasant in valence, thus not being appropriate to be used as a neutral category.

In the third affective dimension, dominance (i.e. the degree in which participants felt dominated by the content of the film clip), the horror category exhibited the highest rating score when compared to all the other categories. The erotic film clips showed larger dominance ratings than social positive, social negative and the scenery film clips. In addition, the social negative clips also had significantly higher dominance ratings when compared with social positive film clips. The dominance dimension typically accounts for the least variance when compared to both the valence and arousal dimensions (e.g. Bradley and Lang 1994) and sometimes may be prone to confounders: the main problem is what is really being rated—the stimulus itself or the subjective feeling it elicits (Bradley and Lang 1994). This third dimension has been somewhat neglected, due to its least unique variance within the affective space. Further investigation is required before the dimension will be fully understood. However, in this study the dominance dimension clearly shows a pattern. Higher levels of dominance appear after exposure to high arousal film clips when compared to low arousal ones, and this is especially the case for those rated with negative valence. This is not consistent with what was found in previous studies when using affective pictures (Bradley and Lang 2007b). A possible explanation for this difference may be the fact that there was a social interaction content in four of the six categories of our database.

The third phase of this study investigated if the categories built based on the self-report ratings, produced significant alterations in the cardiac and the skin conductance responses. The aim of this phase was to assess if there was a differential pattern of psychophysiological activation associated with the different emotional categories. The results showed that the highly arousing film clips (horror and erotic) elicited differentially cardiac and SCL responses, compared to less arousing film clips (social positive, social negative and scenery) and neutral ones (object manipulation). The post hoc Bonferroni corrected multiple pairwise comparisons revealed that both horror and erotic film clips significantly decreased HR and significantly increased the SCL compared to social positive, social negative and objects film clips. These results are consistent with previous studies (Codispoti et al. 2008), suggesting that highly arousing affective film clips prompt orienting and sustained attentions as reflected by heart rate deceleration and larger skin conductance level. These result are also consistent with previous studies using few seconds of static pictures presentation, where erotic and horror pictures prompted larger HR deceleration and larger SCL, compared to other valence and neutral contents (e.g. Bradley et al. 2001; Sánchez-Navarro et al. 2006). Concerning the low arousing film clip categories, no significant differences were found in terms of both HR and the SCL responses. Thus, both HR and SCL showed a pattern of action (HR deceleration and increase of SCL) that differentiates clearly the high arousing categories from all the low arousing ones. Consistent with other studies, where the level of arousal was controlled, no significant different psychophysiological responses were found in terms of film clip valence (Codispoti et al. 2008). The present results seem to indicate that the affective film clips related to primary reinforcers [also known as hedonic valence (see Bradley and Lang 2007a; Lang and Bradley 2010)] seem to strongly activate primary motive systems, prompting greater orienting, sustained attention and action preparation as reflected by HR and SCL (Bradley and Lang 2007a; Codispoti et al. 2006, 2008). Thus the EMDB was able to provide film clips that were subjectively rated with different levels of arousal, valence and dominance, as well eliciting differential variations for arousal at the psychophysiological levels.

The use of the EMDB is not without its limitations, which must be addressed. The aim of the database is to provide stimuli that activate both appetitive and defensive systems, which vary in the level of arousal. However, the differences found between the arousal ratings of erotic and horror film clips, and between social negative and social positive clips, indicate that negative categories have higher arousal scores than positive ones.

Previous research has focused primarily on negative emotions. Methodologically, it seems easier to induce negative states (Fredrickson 2004; Fredrickson and Cohn 2008), and the negativity bias theory (e.g. Cacioppo and Berntson 1994; Cacioppo et al. 1997, 1999) has led to a focus on negative emotions, especially in the context of clinical populations. This bias toward negative emotions is found in many databases. Although the EMDB seems successful in providing a category (object manipulation) with neutral valence ratings and low arousal ratings, it does not provide the same number of pleasant and unpleasant categories because the scenery film clips were viewed as pleasant. As a result, currently the database exhibits an asymmetry towards more pleasant and lower arousal film clips.

Using film clips presents several methodological challenges. Film clips may be very different in terms of complexity, illumination, movement and the number of people onscreen. Having this in mind, in the current study an effort was made in choosing film clips with similar complexity and representing homogenous emotional content during the entire 40-s clip. However, despite these efforts, not all the film clips had a similar camera angle or an identical number of people present across film clips, which may represent a potential limit of the present database.

Even though the use of film clips without auditory content have the advantage of allowing for experimental manipulation of sound probes, one should not ignore that watching social interaction without sound may introduce some degree of artificiality.

The inter-trial interval could also be too short. Although the data are presented as 40 s mean and there was a pseudo-randomization between trials, this could be a potential limitation. Future studies on this database may be improved by utilization of the same amount of film clip presentation, and the same amount of inter-trial interval.

The current study cannot be considered a normative study due to sample limitations. The present data requires replication, with larger samples and including, for instance, different range of ages and socioeconomic status.

Also, as the aim of this study was to develop film clips to elicit different emotional states for each subquandrant of the affective space on a multidimensional continuum, the discrete emotions elicited during film clips exposure were not assessed. The film clips were selected in order to elicit a diffuse emotional state and probably several emotions and not a specific emotion. As these underlying discrete emotions play a crucial part in emotional activation, future studies should assess the discrete emotions elicited by each film clip.

Finally, the use of a single self-report questionnaire can also represent a limitation of the present study. Although the SAM is a very reliable and established questionnaire, it is restricted to the dimensions of valence, arousal and dominance. However, the choice of this instrument was appropriate given the aim of the study and the general interest of affective science in these dimensions. Nonetheless a measure of affect, like the Positive and Negative Affect Schedule (PANAS-X) (Watson and Clark 1999), could also be a valuable addition for assessing more long term affect induction. Using other instruments together with increasing the sample size, as well as doing a cross-cultural study, would certainly improve the reliability of the EMDB.

Future studies should also add new thematic categories to the EMDB database. For instance, erotic film clips with genital exposure and explicit intercourse could induce higher levels of arousal than the erotic ones. Also, film clips with threat cues but without life-threat content could provide an aversive category with similar levels of arousal to our current erotic category. This could also help to have, for instance, film clips that can elevate arousal, without modifying the valence level. Additionally, due to the randomization between blocks, in this study it was not possible to establish if there were temporal or emotional response attenuation order effects. In order to control those possible effects, as well as controlling for possible confounders inherent to a repeated measures design (e.g. fatigue), future studies should maintain the pseudo-randomization within film clip blocks, but using a non-randomized order between film clips blocks.

In this study, both HR and SCL were not effective in discriminating film clips in terms of valence. Indeed, it seems that most if not all psychophysiological measures used in this context appear to differentiate better between low and high arousal than positive and negative valence. However, future studies could use other psychophysiological measures that have been proven more sensible to valence [like the electromyographic (EMG) human startle response (e.g., Leite et al. 2012)]. Nonetheless, as there seems not to be any psychophysiological measure that can assess valence effects for longer than few seconds, the EMDB could be potentially useful in order to locate such measure.

Despite these limitations and the variability due to self-reporting, the thematic categories in the database may be useful for research on emotions because they seem to clearly differentiate, by self-report measures, among

different levels of arousal, valence and dominance in the four quadrants of the affective space.

This database provides response ratings that can be reliably used in research requiring the presentation of non-auditory film clips that vary in valence, arousal and dominance. Researchers can use these ratings or re-rate them for their specific research designs and populations of interest. The film clips can be used individually or as a thematic category. Additionally, more studies focusing on the dominance dimension of affect are necessary in order to improve the understanding of this affective dimension.

The results showed also that sustained exposure to the affective film clips resulted in similar SCL and HR pattern according to the level of arousal, resulting in a SCL increase and HR deceleration for the two high arousing conditions (erotic and horror), independently of their valence.

Because this movie database is composed of non-auditory film clips, researchers who use the database to visually induce emotions will also be able to develop crossmodal tasks by adding auditory stimuli relevant to the experimental design. This may be especially useful in studies that employ event related potentials (ERPs) or functional magnetic resonance imaging (fMRI), where the auditory channel can be used to introduce other experimental tasks (e.g., cognitive tasks like auditory oddball or Flanker paradigms).

Finally, as in the IAPS (Lang et al. 2008), the present database can be used to compare research across laboratories or simply as a source of experimental materials. Future research may extend this database by increasing the number and categories of film clips.

## Supplemental Material

The database film clips described in this article may not be used for commercial purposes. They are available, free of charge, by request at EMDB@psi.uminho.pt. When submitting a request to use the database, you will be asked to confirm that it will be used solely for non-profit scientific research and that the database will not be reproduced or broadcasted in violation of international copyright laws. The Self Report Ratings are also available with this article.

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