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## RESEARCH ARTICLE

# Elementary motion perception interferes with Film-induced emotions

Alhadi Chafi<sup>\*†</sup>, Boris Gambet<sup>\*†</sup>, Sarah Crespel<sup>\*†</sup>, Loris Schiaratura<sup>\*†</sup>, and Stéphane Rusinek<sup>\*†</sup>

Many authors showed that dynamism in images increases emotional responses whether they were objectively or subjectively measured (Simons, Detenber, Reiss, & Shults, 2000; Ravaja, 2004). The aim was to investigate the effects of three elementary motions on emotional films' perception, given that these motions involved changes in the perception of static emotional images (Chafi, Schiaratura, & Rusinek, 2012) and in the memorization of emotional words (Podevin, Chafi, Rusinek, & Békaert, 2012). Participants were shown short films validated by Schaefer, Nils, Sanchez, and Philippot (2010) in which were inlaid motion patterns from Chafi *et al.* (2012). Results indicated that a wave-like, translational and parabolic motion do not have the same effects on emotional self-reports. More precisely, data suggest that the translational motion increased positive film-induced feelings of happiness and agitation compared to the parabolic motion. Further research shall be directed towards more objective ways of investigation.

**Keywords:** cognitive processes; emotion - mood; perception and cognition

## Introduction

Without even clearly stating that "Moving is Living" as prominent Brazilian author Paulo Coelho says it on his blog (see <http://paulocoelhoblog.com/2009/05/28/moving-is-living/>), it has become obvious from research that motion and emotional experiences are almost consubstantial. For example, if one takes a look at the theories of embodied cognition (Barsalou, 2008, 2010), most experiments showed that symbolism

and metaphors such as "God is in the Sky" or "I fell in Hell" implicitly link an up position as good and a down position as bad. These experiments investigated the position-emotion relationships via implicit tasks like pulling vs. pushing a lever in reaction to emotional words (*i.e.*, positive vs. negative) appearing in separate parts of the screen (*i.e.*, up vs. down). It is usually found that people are faster in pulling the lever towards them when shown positive words compared to negative words and vice versa for pushing the lever away from their body (Brouillet, Heurley, Martin, & Brouillet, 2010). Another recurrent finding is that movements towards the upper part of the visual field are associated with positive words whereas movements towards its lower part are related to negative ones (Casasanto & Dijkstra, 2010).

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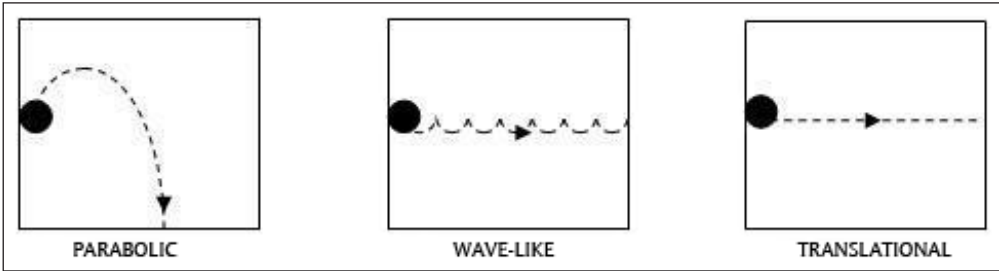
In a literature review, Casasanto and Dijkstra (2010) defined three dimensions as being affective monitors of motor action: (i) verticality (e.g., their own study), (ii) horizontality (e.g., Phaf & Rotteveel, 2009) and (iii) executed movements of flexion/extension (e.g., Alexopoulos & Ric, 2007).

In the present paper, authors will not be interested in the direction of motion but rather in the type of motion as it is the case in studies investigating simple perception of dynamic stimuli. For instance, Dittrich, Troscianko, Lea, and Morgan (1996) showed that individuals are able to recognize emotionality from dancers only by viewing point-light displays. According to Ravaja (2004), motion is a presentation's attribute which can significantly influence the emotional and attention-related responses. This author showed that a newscaster elicited higher self-reports of arousal and pleasure while improving memory performances for positive messages when he displayed a dynamic face rather than a static one. This interaction effect showed that face motion improved the memorization for positive messages but not for negative ones.

Concerning non-human motion, Heider and Simmel (1944) showed that depending on the random motion patterns of a single object (e.g., a triangle), individuals attributed different intentions, attitudes and emotions to the moving object. Later on, Rimé, Boulanger, Laubin, Richir, and Stroobants (1985) showed that it is the kinetic structure of motion which is important in the involvement of an emotional perception, as was found by Heider and Simmel (1944),

and not the shape of the displayed object. More recently, Podevin, Chafi, Rusinek, and Békaert (2012) investigated eleven elementary patterns of motion and discovered that only three of them were related to the emotional process. According to their results in adults, a wave-like motion is linked to positive emotions whereas a parabolic motion is related to negative emotions and a translational motion is neutral/slightly positive (see motion patterns in **Figure 1**). In line with these findings, Chafi, Schiaratura, and Rusinek (2012) showed that out of the three above-mentioned patterns, the wave-like motion: (i) is the most arousing motion, (ii) increases the arousal induced by a happy face, (iii) impairs the recognition of a disgusted face, (iv) increases the intensity of surprised and happy faces, and (v) decreases the intensity of an angry face. The authors also found interesting results concerning the parabolic motion which: (i) is the least arousing motion, (ii) increases the recognition of a fearful face, and (iii) increases the intensity of a sad face.

In short, Chafi *et al.* (2012) showed that the wave-like motion decreased the perception of negative faces whereas the parabolic motion decreased the perception of positive faces. This finding is in accordance with previous data from Podevin *et al.* (2012). Nevertheless, in both studies, stimuli were static presentations: either static words or static pictures taken from the Karolinska Directed Emotional Faces (KDEF; Lundqvist, Flykt, & Öhman, 1998). According to late studies (Ambadar, Schooler, & Cohn, 2005; Detenber, Simons, & Bennett, 1998; Ravaja,



**Figure 1:** Motion patterns from Podevin (2009), Podevin *et al.* (2012), and Chafi *et al.* (2012)

2004; Simons, Detenber, Reiss, & Shults, 2000), the difference between static and dynamic displays is huge in emotional experiences, whether the measures were objective (e.g., skin conductance) or subjective (*i.e.*, self-reports). An example of ecological dynamic situation in which the wave-like and parabolic motion can be differentiated is definitely sports' perception. During the development of Chafi's Ph.D., this latter was conducting an unpublished small survey in his Taekwondo club (*i.e.*, Ecole de Taekwondo Monsoise). The results of this survey showed that kicks which involved multiple jumps (especially the double kicks which resemble the wave-like motion) were esthetically far more appreciated than other types of kicks. Also, the axe kick (which resembles the parabolic motion) was seen as scarier than other kicks, and potentially more damaging (Chafi, unpublished observations). The same kind of results was also shown by Shafir, Taylor, Atkinson, Langenecker, and Zubietta (2013). These authors' data gave a strong neurological support to the jumping/positive and slumped-down/negative links. According to Hanjalic and Xu (2005), audiovisual multimedia is a strong emotional elicitor. For that very same reason, the use of dynamic visual information coupled with audio information seems the most appropriate for studying the motion-emotion bonds. The effects of motion on visual scenes were also shown with plain moving objects (Visch & Tan, 2009). Their results indicated that emotional ratings for a chase between two abstract inanimate blocks are influenced by the objects' moving parameters (e.g., velocity, fluency, etc.), which will in turn help participants in categorizing films into different genres.

Hence, the present study investigated the effects of above-mentioned three elementary motions on two film excerpts (*i.e.*, Positive vs. Negative) which were taken from the validated database of Schaefer, Nils, Sanchez, and Philippot (2010). It is hypothesized that the same type of congruence found by Chafi *et al.* (2012) will appear, namely, (i) the Wave-like motion shall increase the perceived

intensity and positive emotions related to the Positive film, and (ii) the Parabolic motion shall increase the perceived intensity and negative emotions related to the Negative film. If expected outcomes were obtained, the authors aim to generalize these patterns of movement and they could be used as a priming stimulus in camera and object motion for eliciting emotions or certain cognitive abilities (Chafi, Rusinek, Schiaratura, Delescluse, & Brouillet, in press) or in movies showing abstract shapes such as those of Michotte (1946) and Heider and Simmel (1944). Noteworthy, many *Pixar* movies use abstract shapes (see Porter & Susman, 2000).

## Method

A Pre-experiment that is not detailed here was conducted so as to make sure that French (our study) and Belgians (Schaefer *et al.*, 2010) assessed emotional excerpts in the same way. This Pre-experiment gave conclusive outcomes.

## Participants

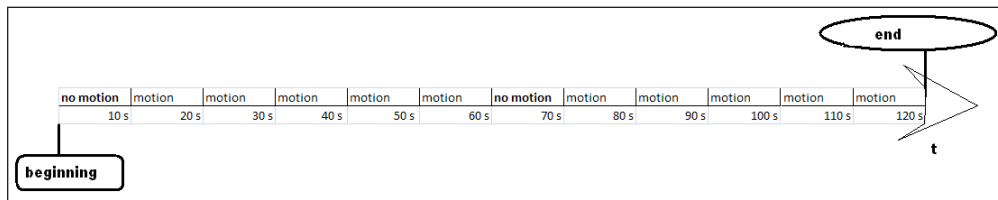
One hundred and eighty undergraduate students (90 women and 90 men) in many University's fields (*i.e.*, Psychology, History, Sociology, English, Spanish and History of Arts) took part in the present study (*Mean Age*=20.44; *SD*=3.57). They were randomly recruited in the buildings of their University and the only inclusion criterion was to have a normal or corrected-to-normal vision. All the participants gave their written consent.

## Material and Apparatus

### Film excerpts

Emotional films used were a Positive excerpt ["There is Something about Mary – Hair gel"; Self-Reported Emotional Intensity=3.84, Positive Affect=1.81, Negative Affect=1.13] and a Negative one ["Dangerous minds"; SREI=5.25, PA=1.83, NA=1.52] taken from Schaefer *et al.* (2010).

For each film, one of three patterns of motion (*i.e.*, wave-like, parabolic or translational motion) was encrusted in the excerpt



**Figure 2:** Summarizing Outline of motion appearances during film excerpts

with the Serif MoviePlus 5 Video Editing Software. Motion patterns were superimposed on film excerpts in a way that the first motion was shown up at the 10<sup>th</sup> second of film clips. Then, it appears five times until the 60<sup>th</sup> second where it will not get displayed during 10 seconds again. At the 70<sup>th</sup> second, motion makes its occurrence over new and is rehearsed five times until the end of film clips (see **Figure 2**).

#### Motion patterns

Motion patterns are executed by a small dark disk, which has exactly the same size (a diameter of 4.1 centimeters) and speeds as in other research investigating the three specific motions studied here (Chafi *et al.*, 2012; Podevin, 2009; Podevin *et al.*, 2012). Concerning trajectories, the Translational motion is not associated to any emotional facial expression (Chafi *et al.*, 2012). Furthermore, it does not disrupt cognitive resources of an individual and was assessed as neutral or very slightly positive (Podevin, 2009). This motion pattern is used as the control condition for every film excerpt in the present study and its speed is 5.10 cm/s. It consists in a left-to-right rectilinear translation. The above-mentioned authors also noted that the Parabolic motion is associated to certain negative emotional faces (*i.e.*, fearful and sad) and when shown alone, this motion was assessed by participants as negative itself. The speed of the parabolic motion is 3.20 cm/s and it is composed of a 42° angle in the ascending way and a 42° angle in the descending one. A third trajectory depicting the Wave-like motion is strongly associated to positive emotional faces (*i.e.*, happy and

surprised) and was assessed by participants in the research of Podevin *et al.* (2012) as positive when displayed alone. Its speed is 5.88 cm/s and this motion is composed of seven isosceles triangles which means the angles are 60° in the descending and ascending ways.

Each motion lasted 5 seconds. Thus, the dark disk appeared ten times per film excerpt as it came every 10 seconds. When asked orally, participants did not explicit any important watching disturbance due to the crossing of the screen by that dark disk.

#### Measurements

In order to assess self-reported emotions, every participant was given a brochure composed of three questionnaires after watching one film clip. These questionnaires are respectively: (I) a Self-Reported Emotional Intensity scale (SREI), (II) the Differential Emotions Scale (DES) which is said to be more distinguishing between discrete emotions than the (III) Positive Affect Negative Affect Schedule (PANAS), mostly used to assess global valence.

- (I) The *Self-Reported Emotional Intensity* scale was taken from Schaefer *et al.* (2010). It consists in an estimation of the global emotional intensity activated during the retrieval stage through an analogical 7-points scale: "While I was watching the film... 1 = I felt no emotion at all, 7 = I felt very intense emotions". The experimenter indicated to participants they had to answer what they really felt like and not a standard response.

- (II) This questionnaire, which differentiates between very specific emotions, is here utilized to verify the tonality of displayed film clips. Indeed, it is a modified version of the *Differential Emotions Scale* from Izard, Dougherty, Bloxom, and Kotsch (1974, cited by Schaefer *et al.*, 2010), which was translated in French by Philippot (1993).

Each item is made of groups of emotional adjectives:

- (1) interested, concentrated, alert; (2) fearful, scared, afraid; (3) anxious, tense, nervous; (4) moved; (5) angry, irritated, mad; (6) ashamed, embarrassed; (7) warmhearted, gleeful, elated; (8) joyful, happy, amused; (9) sad, downhearted, blue; (10) satisfied, pleased; (11) surprised, amazed, astonished; (12) loving, affectionate, friendly; (13) guilty, remorseful; (14) disgusted, turned off, repulsed; (15) disdainful, scornful, contemptuous; (16) calm, serene, relaxed.

For every group of adjectives, participants had to quote a 7-points scale: "1 = not at all, 7 = certainly" to rate the extent to which they felt each state as they were watching the film excerpt.

It is noteworthy that the DES, exactly as the PANAS, can be divided in two mean scores: the Positive DES (PDES) and the Negative DES (NDES), giving the possibility to study general positivity and negativity of stimuli-induced emotions.

- (III) The original PANAS is an English-language test created by Watson, Clark, and Tellegen (1988). These authors made a principal component analysis in order to extract factors. Their beginning point was a set of 60 emotional adjectives taken from Zevon and Tellegen (1982, cited by Watson & Clark, 1994). The PANAS constitutes a list of self-assessed emotional adjectives composed of two 10-item subscales.

Those subscales evaluate two dimensions: Positive Affect (PA: active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud and strong) and Negative Affect (NA: afraid, ashamed, distressed, guilty, hostile, irritable, agitated, nervous, scared and upset). For each of the 20 items, participants had to fill in a 5-points scale so as to indicate to which extent they were affected by the film. A French version (Gaudreau, Sanchez, & Blondin, 2006) was used in the present study.

### Procedure

Participants were recruited and came individually in the Laboratory. The experimenter asked students if they had about 10 minutes to assess an emotional film. When an individual accepted, he then was brought to the compound where the experiment's computer was located. Following the entering of the compound, instructions could be said:

"After a short relaxing exercise, you will see a film excerpt. When the film is finished, you will have to answer a brochure of questionnaires concerning what you effectively felt about this film and not about your day's mood. Responses are anonymous and you can stop your participation to the study if you want and when you want."

After ensuring that the participant is ready, the experimenter switched off the lights, asked the participant to close his eyes, to relax every muscular group, including his face, and to deeply and regularly breathe during about 2.5 minutes. When the relaxing sequence was finished, participant was informed that a film was going to be displayed. Experimenter then asked him to watch the whole film excerpt carefully, without taking his staring and attention off the computer screen. Films were seen on a 17 inches screen. Each participant only saw one type of film with one type of motion pattern. Questionnaires were always filled in after the film was seen, and in the same order

(i.e., SREI, DES, PANAS) as in the research of Schaefer *et al.* (2010). This stage consisted in “paper-pen” tests, so pens were available to participants. Finally, a debriefing step was made in order to clarify the experiment’s hypotheses and aims to participants.

### **Experimental Design**

The experimental design was fully between-subjects but each participant filled in the three questionnaires. The analyses were mainly done at two levels: a) the first level consisted in looking at the mean scores of each emotional scale, namely, it considered the perceived intensity (SREI) and global emotional valence (i.e., PDES, NDES, PA, and NA) as dependent variables; b) the second level consisted in investigating effects of the independent variables (i.e., the type of Motion and the type of Film) on discrete emotions (i.e., every emotional adjective from the scales). The PDES was calculated as following: (interested + moved + warmhearted + joyful + satisfied + loving + calm)/7 while the NDES was calculated as following: (fearful + anxious + angry + ashamed + sad + surprised + guilty + disgusted + disdainful)/9. Whereas the choice of considering “surprised” as a negative item can seem astonishing, this would-be oddity was justified by the participants’ subjective responses when asked about the “moving element” for which they all qualified an inconvenience linked to that “surprise”.

## **Results**

### **a) Manipulation Checks**

Manipulation checks essentially consisted in verifying that the PANAS and DES were correlated in the way they were believed to (*degrees of freedom*=179,  $p=.84$ ). The correlations were all not statistically significant. However, looking into them was necessary so as to understand the links between the different scales of measurement. NA was positively correlated to NDES,  $r = .75$ , and seemed not to be correlated to PDES,  $r = -.052$ , even though the link of this relationship was negative.

PA was positively correlated to PDES,  $r = .67$ , and seemed not to be correlated to NDES,  $r = .041$ . It therefore seems that the used instruments were valid.

Noteworthy, in order to control the multiple ANOVAs we used in statistical analyses,  $p$ -values were corrected to  $\alpha = .02$  rather than the usual significance level in scientific literature, i.e.  $\alpha = .05$ . Increasing the significance level equals increasing the tests’ power while decreasing the chance of obtaining false positives. Also, it is here relevant to indicate that Post-hoc tests were Scheffé ones as they are more powerful than both Tukey’s HSD and Fisher’s LSD.

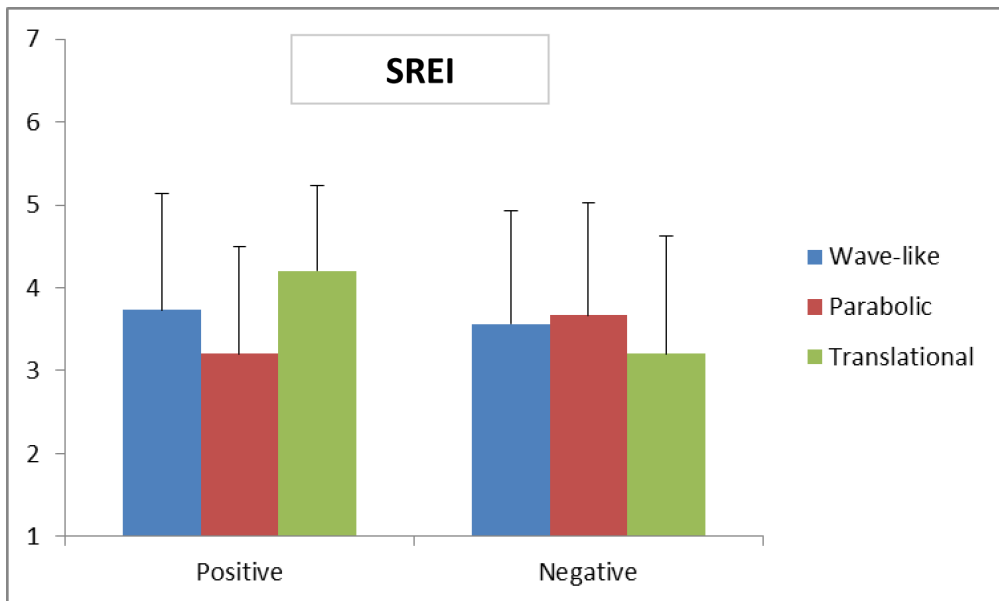
### **b) The Level of Global Valence**

A  $2 \text{ (Film)} \times 3 \text{ (Motion)}$  ANOVA was performed using a between-subjects design for the following dependent variables: the emotional intensity (SREI), and the sub-scales related to positive and negative emotionality (PDES, NDES, PA, and NA).

Concerning the SREI, findings revealed that the Film  $\times$  Motion interaction was significant,  $F(2, 174) = 4.67$ ;  $p < .02$  (see **Figure 3**). Post-hoc tests were performed and were not significant. Yet, one could interpret this interaction as an improvement of emotional intensity when people watched a translational motion associated to the positive film.

Concerning the PDES, a main effect of the Film was found,  $F(1, 174) = 40.92$ ;  $p < .0001$ , showing that the Positive film ( $M=3.56$ ;  $SD=.94$ ) was more positive than the Negative one ( $M=2.81$ ;  $SD=.59$ ),  $p < .001$ , Cohen’s  $d=.98$ . Results also indicated a main effect of Motion,  $F(2, 174) = 4.21$ ;  $p < .02$ . This effect showed that the Parabolic motion ( $M=2.99$ ;  $SD=.87$ ) was the least related to positive emotions and its difference with the Translational motion ( $M=3.41$ ;  $SD=.68$ ) was significant,  $p < .02$ , Cohen’s  $d=.54$ . No such difference was found between the Translational and Wave-like patterns,  $p=.20$ .

For the PANAS, not any result came out of the analysis which was a stunning outcome,  $F(2, 174) = .11$ ;  $p=.89$ ,  $\eta^2=.0012$  for the Film



**Figure 3:** Means and standard deviations for the Film × Motion interaction on “Self-Reported Emotional Intensity”

× Motion interaction. In effect, we expected to have significant effects on the PA or NA scales as the PANAS is a questionnaire which is believed to measure emotional activation and the studied motions were thought to lead to different arousals (see Chafi *et al.*, 2012). The lack of outcomes for PANAS is potentially due to the number of participants who probably had a response strategy that led them to score moderately every item. Those findings encouraged authors to go further and investigate the effects of motion on the assessment of emotional films through the angle of discrete emotions.

### c) The Level of Discrete Emotions

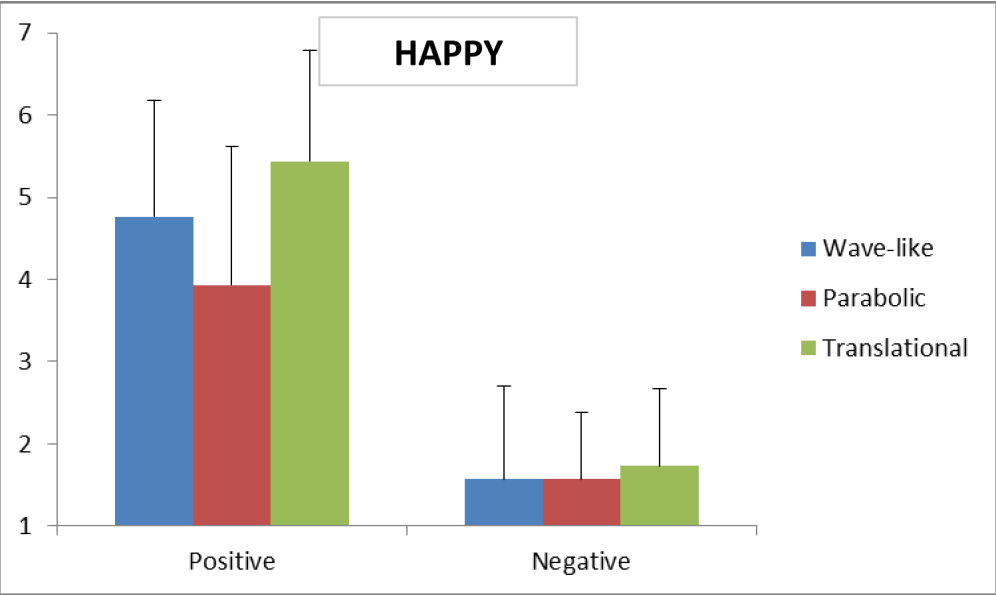
A 2 (Film) × 3 (Motion) ANOVA was performed using a between-subjects design for every emotional adjective, *i.e.*, the 16 items from the DES and the 20 items from the PANAS represented the dependent variables.

Regarding the “Happy” item, main effects of Film and Motion were found, respectively,  $F(1, 174) = 271.47$ ;  $p < .0001$  and  $F(2, 174) = 6.59$ ;  $p < .002$ . The main effect for Film’s factor indicated that the Positive film ( $M=4.71$ ;

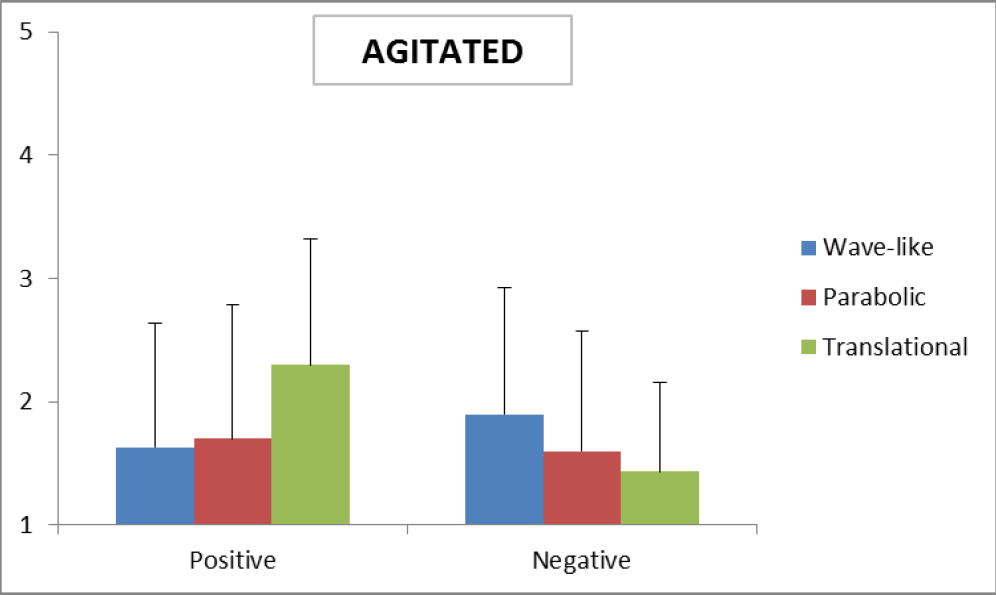
$SD=1.48$ ) involved more happiness than the Negative one ( $M=1.62$ ;  $SD=.96$ ),  $p < .0001$ , Cohen’s  $d=2.53$ . Concerning the Motion’s factor, Post-hoc tests indicated that the Translational pattern ( $M=3.58$ ;  $SD=1.15$ ) was more related to happiness than the Parabolic one ( $M=2.75$ ;  $SD=1.25$ ),  $p < .002$ , Cohen’s  $d=.69$ . The Film × Motion interaction was also obtained for this item,  $F(2, 174) = 4.30$ ;  $p < .02$  (see **Figure 4**).

Concerning the “Enthusiastic” item, a main effect of Film was obtained,  $F(1, 174) = 16.74$ ;  $p < .0001$ , showing that the Positive film ( $M=2.99$ ;  $SD=1.11$ ) involved more enthusiasm than the Negative one ( $M=2.31$ ;  $SD=1.09$ ),  $p < .0001$ , Cohen’s  $d=.62$ . A tendency for main effect of Motion was also found,  $F(2, 174) = 3.29$ ;  $p=.039$ ,  $\eta^2=.033$ .

Regarding the “Alert” item, a tendency for main effect of Motion was found,  $F(2, 174) = 3.67$ ;  $p=.027$ ,  $\eta^2=.039$ . As this result was close to significance, authors went on doing Post-hoc tests which indicated that the Translational motion ( $M=2.95$ ;  $SD=.84$ ) seemed more alerting than the Parabolic one ( $M=2.45$ ;  $SD=1.03$ ),  $p < .03$ , Cohen’s  $d=.53$ .



**Figure 4:** Means and standard deviations for the Film × Motion interaction on “Happy”



**Figure 5:** Means and standard deviations for the Film × Motion interaction on “Agitated”

Concerning the “Agitated” item, the Film × Motion interaction was significant,  $F(2, 174) = 5.23$ ;  $p < .007$  (see **Figure 5**). Further analyses did not emphasize any difference between motion patterns using Post-hoc tests. Yet, one could interpret this interaction as the increase in agitation when people watched a translational motion associated with the positive film.

All other interactions for discrete items were found not to be significant (see **Table 1**).

**Discussion**

Results did partly confirm the authors’ hypotheses as the three patterns of motion used in this experiment had different effects on emotional films’ perception. In effect, the

DES Item	p	Eta-squared
interested	0,63	0,005
fearful	0,52	0,007
anxious	0,74	0,003
moved	0,83	0,002
angry	0,61	0,005
ashamed	0,93	0,0008
warmhearted	0,35	0,009
sad	0,83	0,001
satisfied	0,07	0,021
surprised	0,18	0,016
loving	0,58	0,006
guilty	0,62	0,005
disgusted	0,67	0,004
disdainful	0,22	0,017
calm	0,81	0,002
PANAS Item		
active	0,86	0,001
attentive	0,22	0,016
determined	0,91	0,001
excited	0,44	0,006
inspired	0,59	0,006
interested	0,27	0,014
proud	0,83	0,002
strong	0,18	0,018
afraid	0,23	0,016
ashamed	0,85	0,002
distressed	0,92	0,0009
guilty	0,77	0,003
hostile	0,74	0,003
irritable	0,64	0,005
nervous	0,94	0,0006
scared	0,15	0,02
upset	0,54	0,007

**Table 1:** P-values and Eta-squared for non-significant interactions on discrete items from the DES and PANAS

translational motion increased the SREI and PDES related to the positive film in comparison with its parabolic counterpart. Also, the translational motion increased happiness and agitation compared to the parabolic motion. Concerning the wave-like motion, it seems undetermined contrary to the authors' expectations. It is noteworthy that the two items of discrete emotions that led to significant differences between motions or valence conditions are of high arousal. The comparison effects between translational and parabolic motion could therefore be due to the fact that translation added arousal to already high-arousal pleasant emotions.

The biggest limitation to our study is, with no contest, the weakness of observed statistical results in contrast with the high number of participants. Thus, our alpha correction made the threshold more stringent but we were unable to apply conventional alpha corrections due to the lack of data's power. This limitation can be explained by the fact that the effects of motion in an image are automatic and probably imply unconscious processing. Therefore, even obtaining tiny statistical results is, in itself, an important outcome as cognitive rather than behavioural responses were at stake in our study. Another limitation to the Experiment's findings is that contrary to the hypotheses, it was not the wave-like motion that was associated to film-induced positive emotions, but the translational pattern. Besides, the quasi-systematic opposition between the parabolic motion's effects and the translational ones reinforces the hypothesis that the parabolic motion is related to negative emotions (Chafi *et al.*, 2012; Podevin, 2009; Podevin *et al.*, 2012). Another new result is the translational motion's cogency to increase agitation compared to the parabolic one. The whole pattern of results from present research gets along with the idea that the translational motion's connotation in the present paper replaced the wave-like motion's connotation in previous studies using the same paradigm. Effectively, this pattern of motion was before thought to be

neutral according to certain theorists (e.g., Tagiuri, 1960) and simply neglected by others (e.g., Visch & Tan, 2009) which definitely strengthen the idea that the translational motion was considered as an unlikely emotional trigger. Nevertheless, some authors from the embodied cognition movement tended to consider the translational motion as rather positive. For instance, Phaf and Rotteveel (2009) showed that Dutch left-to-right readers evaluated more easily an arrow in the reading direction (*i.e.*, from left-to-right) than an arrow in the opposite direction (*i.e.*, from right-to-left). Moreover, participants experienced positive emotions when exposed to the left-to-right arrow whether the evaluation task was explicit (*i.e.*, a self-report scale) or implicit (*i.e.*, arm flexion vs. arm extension). In accordance with their data, Phaf and Rotteveel (2009) hypothesized that as a simple static left-to-right arrow produced positive emotions and positive emotional processing, a left-to-right motion from an object would probably induce more positive emotions. This assumption may have been verified by the present study as the translational motion was somehow related to film-induced positive emotions.

An alternative explanation of present data could be quite simpler. For example, it is likely that having one's view of an interesting film disrupted by a moving black disk would have some effect on one's emotional response and it is likely that some movement's trajectories may be more annoying than others. If it was the case, the parabolic motion, which is not rectilinear, was probably more annoying than the translational one and should have impaired the view of emotional films, hence giving rise to bad emotions compared to its translational counterpart. Nevertheless, two questions would still have to be raised: 1) why did not the wave-like motion imply the same effects as the parabolic motion ones on the perception of emotional films? 2) why did the deleterious effects of the parabolic motion's presentation did not happen for the negative film?

Improvements in the study's design could also lead to more outspoken Results and could help the authors in verifying the effects of each pattern of motion. For instance, projecting the images on a larger screen might have enhanced the observed effects as the size of the screen has an essential impact on emotions linked to motion pictures (Ravaja, 2004). Noteworthy, the observed effects do only generalize to films presented via a computer screen of more or less 17 inches. Effectively, presenting the very same films through a smartphone or an LCD video projector would probably not bring to present study's outcomes. Thus, larger size projections could render superimposed stimuli more annoying. Another parameter which is important to movements and motion pictures presentations is speed. The effects of different speeds could also be questioned: speeds were the same in the present study as in previous research investigating these three elementary motions. Yet, one could say that the translational motion's effect on a positive film's perception could be due to its fastness compared to the parabolic motion, which was the slowest pattern. If speed was the main factor rendering a stimulus positive, then the wave-like motion, which was the fastest pattern, should have been the most related to positive films as authors hypothesized. Nevertheless, it could be interesting to change the speed of motion patterns in further studies in order to verify that this parameter (known for being important in emotional experience, see Visch & Tan, 2009) is less substantial than the trajectory of displayed motions.

Future research shall be directed towards a more concrete aim in terms of behavioral implications. For example, the dependent variable could become the emotion apparently expressed by the movie rather than the emotion felt by participants, as the perceived emotional meaning may be much more affected by the manipulation than felt affect. Also, a possible trial could be to use the above-mentioned motion-emotion congruence in order to help sub-clinical anxious

people or stressed individuals in their regulation of emotions in an exercise or a memory task (see Chafi *et al.*, in press). Attempts of this kind have already been experimented in another field of Psychology and showed that playing TETRIS could help counter-regulating motivational-emotional negative dynamics (Wentura, Voss, & Rothermund, 2009) and bad moods related to trauma (Holmes, James, Coode-Bate, & Deeprose, 2009). Another possibility could be to study the effects of elementary motion's presentation on reaction times of executed motion, which is a typical Embodiment's paradigm (Alexopoulos & Ric, 2007; Chen & Bargh, 1999). As a conclusion, one can say that the links between the perception of elementary motions and subsequent actions, whether they are cognitive operations or effective movements, still need to be investigated.

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