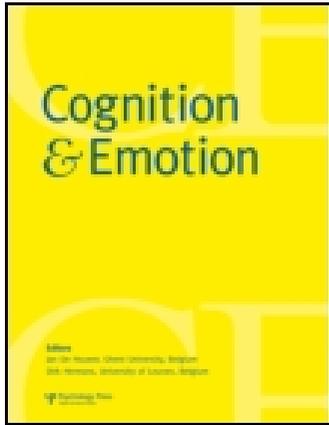


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## BRIEF REPORT

# The emotional and cognitive effect of immersion in film viewing

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This brief report presents an experiment testing the effect of immersion on emotional responses and cognitive genre categorisation of film viewers. Immersion of a film presentation was varied by presenting an animated movie either in a 3D-viewing condition (low immersive condition) or in a CAVE condition (high immersive condition, comparable to virtual reality experience). Viewers rated their emotions and categorised the movies into four basic film genres (action, drama, comedy, and non-fiction). Two distinct types of emotion were measured: Fictional World emotions (e.g., sadness) in response to the presented fictional events and Artefact emotions in response to the film as an artefact (e.g., fascination). Results showed that stronger immersion led to more intense emotions but did not influence genre categorisation. In line with expectations, both types of emotional response were intensified by high immersion. The results are explained by suggesting that highly immersive cinema has its impact on a basic dimension of emotion, namely arousal that underlies both types of emotions.

*Keywords:* Immersion; Emotion; Cognition; Genre; Virtual reality.

## INTRODUCTION

Film is a medium reputed for its potential to enhance the response to emotional stimuli due to its immersive capacities (e.g., Gross & Levenson, 1995). However, empirical evidence on the effect

of cinematic immersion is scarce. The following paper presents a first experiment testing the effect of cinematic immersion on two central-processing mechanisms: emotional experience and genre categorisation. Immersion was manipulated by comparing the effect of an animated movie either

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in a virtual reality theatre (CAVE) or in a less immersive 3D projection.

Viewers of feature films usually experience a mixture of emotions (Hemenover & Schimmack, 2007): when a villain is killed by the protagonist, they might feel *pain* for the villain, *joy* for the protagonist, and *fascination* for the movie. Tan (1996) distinguished two types of viewer emotions differing as to the appraised object. The first is based on the illusion of being physically present in a fictional world. Viewers are witnesses of events happening in that world. Fictional events have a seeming reality that helps in provoking strong emotions. These include fear, sympathy and joy and will be called F(ictional) W(orld) emotions. The second type of emotions is based on viewers' awareness that the fictional world is presented by way of an artefact. The artefact is an object of emotional responses as well. For instance, viewers are fascinated by movies and enjoy them, or they may admire the acting. These emotions will be called A(rtefact) emotions. The present study aimed at investigating the effect of viewer immersion on FW and A emotions.

Following Slater and Wilbur (1997) immersion may be defined as a feature of display technology determined by inclusion (the degree to which environmental influences are excluded from experience), extension (the number of sensory modalities addressed), surround effect (panoramic width of sensory impressions) and vividness (display resolution). Slater and Wilbur proposed that immersion as a property of a device is by definition associated with "presence", a conscious feeling on the part of the viewer of being in a virtual world, caused by unconscious spatial perception processes (cf. Schubert, 2009). Wirth et al. (2007) add to Slater and Wilbur's definition of presence that this state includes perceived self-location in the virtual world. The corresponding requirement for presence would be that the device enables the viewer to mentally construct a spatial model in which the viewer's ego-reference has a central place. Finally, Lee (2004) mentions a lack of medium-awareness as a defining element of presence. Immersed viewers experience the virtual world as immediate and present.

With regard to the FW and A emotions, it can be predicted that immersion intensifies the experience of the represented events, and thus FW emotions. A emotions, in contrast, require some cognitive distance of the viewer to the presented events in order to evaluate the film as a constructed artefact. It could therefore be predicted that immersion impairs A emotions. However, such a prediction misses the point that appraisal of the artefact in A emotions depends on FW emotions: a film can be beautiful or fascinating *because* it elicits FW emotions so well. Moreover, the experience of *presence* can be expected to boost *all* viewer emotion (Wirth et al., 2007) since it increases the emotional dimension of arousal (Codispoti & de Cesarei, 2007). For the current experiment we predicted (H1) that all viewer emotions, whether they had fictional events or the film artefact as their object, would be enhanced by increasing viewer immersion.

Like A emotions, genre categorisation also requires specific cognitive capabilities of the viewer. Viewers may be expected to categorise films despite the cognitive effort, because genre recognition is essential for proper comprehension: genre primes viewers' attention (Roskos-Ewoldsen, Roskos-Ewoldsen, & Dillman-Carpentier, 2002), generates narrative expectations (Grodal, 1997) and emotional moods (Tan, 1996). We have conducted a series of studies showing that genre categorisation is influenced by stylistic cues, deviations from reality and emotions. Visch and Tan (2008) compared the influence on genre recognition of two fundamental cue families, narrative event cues and stylistic cues. They showed that stylistic cues had a significantly stronger effect than narrative event cues—at least with regard to genre recognition of brief film fragments. The dominance of stylistic cues over narrative cues held true for the recognition of all genres except for drama where both cues had similar influence. The effect of object-movement, belonging to the family of stylistic cues, was structurally investigated in Visch and Tan (2009). Using 3D animation, it was shown that movement parameters like *velocity*, *efficiency*, *fluency*, *detail*, and *deformation* could predict genre categorisation. In addition it appeared that

categorisation of films as fiction depended on the degree of deviation from realism. With regard to emotions, the experiment showed that categorisation of films in fiction genres is intimately associated with displayed and experienced emotions. Each of the fiction genres, comedy, drama, and action, correlated with FW emotions: funny, sad, and impressive, respectively. However non-fiction is an exception to the rule that genre is associated with typical emotions.

With regard to effects of immersion on categorisation, it may be expected (H2) that viewer immersion will increase categorisation of films as non-fiction. This is because the experience of reality, of being present in the fictional world, is enhanced by immersion. Concerning categorisation as fiction, two opposing mechanisms may be at work. On the one hand, fiction categorisation will be increased by immersion because of the influence of increased genre-typical FW emotions (Visch & Tan, 2009). On the other hand, fiction categorisation may be decreased by immersion, because viewers may find it difficult to rely on the genre categorisation strategy of realism deviation (Visch & Tan, 2009). The experienced realism of virtual reality may be so high, in fact reaching a ceiling effect, that all genre-specific deviations from it will be minimal and decrease all

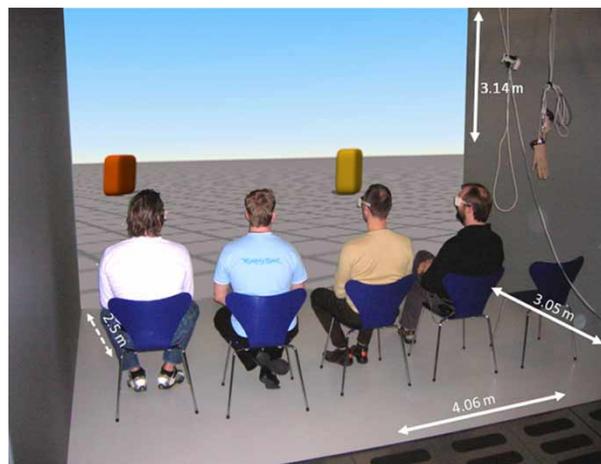
genre categorisation. Assuming that the effects of the two fiction categorisation mechanisms will cancel each other out, we expected (H3) that viewer immersion would not influence fiction categorisation.

## METHOD

### Materials

A 3D, animated movie lasting approximately 20 seconds created in Maya by the first author was used. The movie showed two blocks, one chasing the other in an open space across a grid, see Figure 1. Twenty-one versions of the base movie were made, differing as to genre-specific movement cues only. Previous tests had shown that versions reliably differed as to viewer-assigned genre categories and emotions (Visch & Tan, 2009). For the present study we were not interested in the particular effects of the movement cues but only in the differences between viewing conditions. We therefore collapsed the movement variables across movie versions in the analysis.

Participants were seated in groups of four to five in a darkened three-wall theatre (Figure 1) wearing polarisation filter stereo masks. Distance



**Figure 1.** CAVE interior illustrating 3D condition and stimulus frame. In the 3D condition, the projected image covered the rear wall only whereas in the CAVE condition it covered part of the theatre floor and the side walls as well. [To view this figure in colour, please visit the online version of this Journal.]

to the rear wall was about 2.5 meters. Immersion was manipulated by enhancing inclusion and surround effect as follows. In one condition (3D) the projected image covered the rear wall only as in a stereo movie show; in the other (CAVE) viewers were surrounded by the image as in a virtual reality environment. Compared to the 3D condition, the CAVE condition inherently increased Slater and Wilbur's (1997) immersion parameters *inclusion*, *surround effect*, and *vividness*, and strengthened auto-location in space due to an increase in apparent ego motion.

### Dependent measures

The categorisation task consisted of rating the degree to which participants recognised the movie as an instance of a genre. Each of the four genres *non-fiction*, *drama*, *action*, and *comedy* had to be rated on 5-point scales for all 21 movie versions. Fictional World emotions in response to the chase event were measured using 5-point rating scales "funny", "sad", "impressive", and "scary". These emotions had been tested to fit with appraisals of the chase event presented in the stimulus movies, and all but one (namely scary–non-fiction) correlated with genre categorisation of the stimulus movies in four basic genres in a previous study (Visch & Tan, 2009). As to Artefact emotions, interest was measured by the item "fascinating" and enjoyment by the items "surprising" and "beautiful".

### Participants and procedure

Students of the University of Amsterdam and Amsterdam Polytechnic ( $N = 61$ , males = 45) participated in the study on a voluntary basis. Participants were divided randomly across the two viewing conditions (3D:  $N = 29$ , males = 22; CAVE:  $N = 32$ , males = 23), serving as a first between-subject variable. Each stimulus was shown twice, followed by the ratings. In the first half of the session the participants had to rate the genre fittingness of the stimuli. In the second, presenting the stimuli in a different order, participants rated the emotional effects. Subjects were randomly assigned to one of two presenta-

tion-order conditions, which served as a second between-subject variable in the analysis. In all we had two random orders, each consisting of two random sets of the 21 stimuli.

## RESULTS

### Effect of viewing condition on emotion and genre intensities

A multivariate analysis of variance (MANOVA) showed that immersion had a main effect on the emotional responses. The control variables order and gender showed no significant effect. The overall level of emotion intensities was significantly higher in the CAVE condition than in the 3D condition,  $F(2, 100) = 5.55$ ,  $MSE = 411.38$ ,  $p = .005$ . Additional post hoc Games–Howell tests showed that all separate emotions had higher intensities,  $p < .03$ , in the CAVE condition; see Figure 2.

The ranking of intensities for the various emotions appeared to be roughly the same in the two viewing conditions. The results were in line with our first hypothesis that all viewer emotions, regardless of their being FW or A emotions, increase with increasing viewer immersion.

In line with our third hypothesis, viewing condition did not affect genre categorisation,  $F(4, 56) = 1.70$ ,  $MSE = 14.72$ ,  $p = .163$ . However, the second hypothesis predicting an increase of non-fiction categorisation was not met, since there was a negligible increase only of non-fiction in the immersive condition,  $t(59) = 0.71$ ,  $p = .48$ .

## DISCUSSION

It was found that higher immersion led to an increase in intensity of all viewer emotions, be they either Fictional World emotions or Artefact ones. We expected this in the case of emotional responses to FW emotions (funny, sad, impressive, scary) as the high immersive condition led to increased feeling of being in the fictional world (Lee, 2004; Schubert, 2009; Wirth et al., 2007). The cues relevant for the appraisal of presented events are

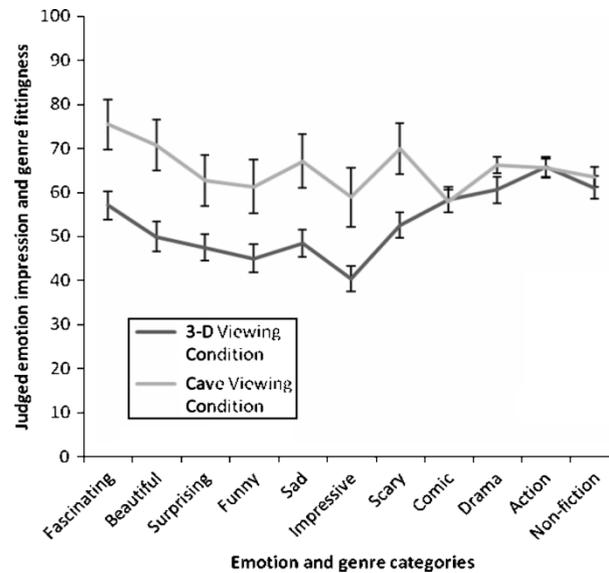


Figure 2. Means of emotion impression and genre fittingness judgement for each viewing condition. Confidence intervals (95%) are plotted around each mean.

likely to become more salient in immersive conditions. For instance when a rapidly approaching object, as in our chase movie, is presented with higher immersion, the threat adhering to it will be more pronounced, enhancing the viewers' fear response. More generally, the salience of emotional stimuli can be increased by immersion due to Slater and Wilbur's (1997) immersive parameters such as *inclusion* (e.g., attention filtering), *extension* (converging impact of impressions from various senses), *surround conditions* (stereo-sound effects), and *vividness* (a general condition of perceptual salience). Emotional effects of one immersion-related factor namely picture size, affecting inclusion, surrounding and vividness, have been documented in the literature: increased picture size enhanced viewer attention and emotional viewer arousal (Codispoti & de Cesarei, 2007). In line with Lang, Bradley, and Cuthbert (1997) it can be proposed that heightened arousal reflects emotional action tendencies due to an experience of "proximity". Immersed viewers sense to closer to events as a witness in the fictional world and experience stronger emotions towards these events than less immersed viewers.

Our results showed that higher immersion increased not only FW emotions but A emotions as well. Our initial explanation for this finding is that viewers attribute their FW responses to the artefact, to the effect that an increase in FW emotions is accompanied by one in A emotions. A more profound explanation may be that immersion influences viewer emotions on a basic dimension directly related to emotional intensity, i.e., the arousal dimension (Codispoti & de Cesarei, 2007). The increase of emotional arousal seems to increase *all* emotional viewer responses (Wirth et al., 2007), regardless of the emotional type differentiation. Due to the increased error rates of the emotions in the high immersive condition, the results even suggest that the intensity of the emotions in the immersive condition is increased at the expense of emotional differentiation.

A final explanation for the observed parallel increase of Fictional World and Artefact emotions is that the use of off-line measurement by questionnaires has confounded the distinction between the two emotion categories. As noted in the introduction, A emotions require a cognitive

distance to evaluate the artefact. Immersion would decrease the cognitive distance and would thus impair judgements of the artefact. However, this cognitive distancing might not occur immediately, that is during its presentation, but only *afterwards*, that is just before or while rating responses through the questionnaire. Moreover, as described in the introduction, the experienced FW emotions could have positively influenced the artefact appraisal (“I find the movie so beautiful because it turned me sad in such a nice way”). A future follow-up study, using on-line measurement tools, could possibly decide if the immersive-increased A emotions are also experienced during the perception of the stimulus and not only *after*—as we showed in this experiment. On-line measurement could also bring to light a third kind of emotional response, Kant’s well-known “immediate” experience of beauty (see Crowther, 1996), an aesthetic response that would emotionally and cognitively precede both FW emotions and artefact-based emotions.

Genre categorisation remained at the same level for all genres. This was expected for fiction genres but not for non-fiction. Our prediction was that non-fiction categorisation would increase because of an enhanced feeling of presence in immersive environments. Our results suggest, in contrast, that film viewers differentiate between experienced reality and the non-fiction genre. Subsequent experiments are needed to decide whether immersed viewers continually relate their VR presence to previous experiences in reality, or if they just experience a similarity between the degree of immersion in VR and reality. In other words, is immersed presence experienced as a connected copy of reality or as a separate alternative to reality? Our results suggest the latter.

The nature and background of the emotional experience in highly immersive cinema remain to be investigated. We hypothesise that the experience is at the same time emotionally arousing and attractive, because all emotion intensities were relatively high. It may also be that counter to expectation, more complex cognitive processes are not impeded. For instance, high immersion may make viewers wonder about what exactly one feels and what sort of movie one is watching. Alternatively, viewers

may adopt an entertainment attitude towards the presentation, and use the discrepancy between fiction and reality in an emotion-regulation strategy (Koole, 2009) geared towards analytic coping and playing with possibly overwhelming emotions.

As to future research, a comparison of 2D and 3D presentations is necessary to include all relevant variants of immersion in the comparison. Furthermore, an on-line measurement experiment has to decide if FW and A emotions are processed in a sequential order involving an increase in cognitive distance. Also, such an on-line physiological measurement might provide information about the effect of arousal on experienced emotions and cognitive categorisation in immersive environments. Our study made a first attempt by showing that immersion effects viewer emotions at a fundamental arousal level that might be more difficult to regulate than emotions in traditional cinema.

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