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The paradox of fiction: Emotional response toward fiction and the modulatory role of self-relevance

Marco Sperduti [a,b,*,1], Margherita Arcangeli [c,1], Dominique Makowski [a,b], Prany Wantzen [a,b], Tiziana Zalla [c], Stéphane Lemaire [d], Jérôme Dokic [c], Jérôme Pelletier [c,e], Pascale Piolino [a,b,f]

[a] Paris Descartes University, Sorbonne Paris Cité, Institute of Psychology, Memory and Cognition Laboratory, Boulogne Billancourt, France
[b] INSERM UMR S894, Center for Psychiatry and Neurosciences, Paris, France
[c] Institut Jean Nicod (CNRS-EHESS-ENS), UMR 8129 Ecole Normale Supérieure, Paris, France
[d] Université de Rennes 1, Rennes, France
[e] Ecole des Haute Etudes en Sciences Sociales (EHESS), Paris, France
[f] Institut Universitaire de France (IUF), France

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A B S T R A C T

For over forty years, philosophers have struggled with the "paradox of fiction", which is the issue of how we can get emotionally involved with fictional characters and events. The few neuroscientific studies investigating the distinction between the processing of real and fictional entities have evidenced that midline cortical structures and lateral fronto-parietal regions are more engaged for real and fictional entities, respectively. Interestingly, the former network is engaged in autobiographical memory retrieval and self-reference, processes that are known to boost emotional reactivity, while the latter underpins emotion regulation. Thus, a possible modulation of the emotional response according to the nature (real or fictional) of the stimulus is conceivable. To test this hypothesis, we presented short emotional (negative and positive) and neutral video as fictional or real. For negative material, we found that subjective emotional experience, but not physiological arousal measured by electrodermal activity, was reduced in the fictional condition. Moreover, the amount of personal memories linked to the scenes counteracted this effect boosting the subjective emotional response. On the contrary, personal memories elicited by the scenes, but not fiction, modulate the emotional response for positive material. These results suggest that when a stimulus triggers a personal memory, the emotional response is less prone to be modulated by contextual factors, and suggest that personal engagement could be responsible for emotional reaction toward fiction. We discuss these results in the emotion regulation framework and underline their implications in informing theoretical accounts of emotion in the neuroscientific domain and the philosophical debate on the paradox of emotional response to fiction.

1. Introduction

Fictions of all kinds (e.g., novels, movies) generate strong emotional experiences in large audiences. For example, when reading *Anna Karenina* one may feel pity toward Anna. However, it seems that emotions toward fiction and emotions toward real-life events are not on a par. The former differ from the latter in at least three respects. First, they do not result in the full range of behaviours that emotions toward real-life people and events produce. For instance, in watching a scary movie, though we feel fear, we do not usually panic and run out of the cinema. Second, we lack obligations toward fictional characters and events. Arguably we do not feel any motivation to help Anna. Third, emotions triggered by fictions are directed toward characters and events that do not exist. These differences might lead to think that our affective responses toward fictional characters and events cannot be properly classified as emotions (e.g., Walton, 1978, 1990).

For over forty years, philosophers have struggled with the "paradox of fiction", which is the issue of how we can get emotionally involved with fictional characters and events (the explicit formulation of the paradox is due to Radford, 1975; Weston, 1975; Walton, 1978). Typically this paradox has been described as an inconsistent triad (see, among others, Gendler Szabó & Kovakovich, 2006): (a) response condition (e.g., I feel genuine pity toward Anna Karenina), (b) belief condition (e.g., I believe that Anna Karenina is a fictional character), (c) coordination condition (e.g., in order to feel a genuine emotion one should not believe that the object of the relevant emotion is fictional). Philosophers have tried to solve the paradox mainly by rejecting either (a), (e.g., Radford, 1975; Walton, 1978, 1990; Charlton, 1984; Neill, 1991; Siiatela, 1994; Hartz,

* Corresponding author at: UMR S894, Laboratoire Mémoire et Cognition, Centre de Psychiatrie et Neurosciences, Université Paris Descartes, 2 ter rue d'Alesia, 75014 Paris, France.
E-mail address: marcosperduti@yahoo.it (M. Sperduti).
[1] M.S. and M.A. are co-first authors.

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1999; Zemach, 2003) or (c) (e.g., Carroll, 1990, 2010; Moran, 1994; Gaut, 2007).

A recent turn in the philosophical debate exploits neuropsychological data in order to address the paradox. Authors following this approach (e.g., Gendler Szabó & Kovakovich, 2006; Weinberg & Meskin, 2006) take for granted that our emotional reactions to fictions are phenomenologically and physically robust, and are primarily concerned with what grounds them, more than with rejecting either (a) or (c). Moreover, their analyses are based on studies not directly focused on emotional reactions to fictions (e.g., studies on emotions in practical reasoning, research on the cognitive architecture of imagination). Our work fits in this line of research, by proposing an experimental study that *directly* assesses this issue. Our hypothesis is that even if emotions toward fiction can be classified as genuine, the aforementioned peculiar aspects would result in a phenomenological/subjective difference.

Besides emotional processing, there are a handful of neuroscientific studies about the distinction between real and fictional events. These studies reported that real characters or events described as such engage to a greater extent cortical midline structures, especially the ventromedial prefrontal cortex (Abraham, von Cramon, & Schubotz, 2008; Han, Jiang, Humphreys, Zhou, & Cai, 2005), while fiction recruits lateral prefrontal cortex and anterior cingulate cortex (Abraham et al., 2008; Altmann et al., 2014; Metz-Lutz, Bressan, Heider, & Otzenberger, 2010). The first set of regions is linked to autobiographical memory and self-referential processing (Martinelli, Sperduti, & Piolino, 2013; Northoff et al., 2006) that, in turn, has been shown to boost emotional response (Herbert, Pauli, & Herbert, 2010, Herbert, Herbert, & Pauli, 2011; Fields & Kuperberg, 2012). The latter underpins cognitive control and emotion regulation (Hermann et al., 2009; Ochsner and Gross, 2005; Ochsner, Silvers, & Buhle, 2012), in particular emotional down-regulation (for a recent meta-analysis see Buhle et al., 2014).

These findings strongly suggest that contextual information about the nature (real or fictional) of an event could influence the related emotional response. Nevertheless, to our knowledge there are only two studies that tried to directly investigate this possibility. Goldstein (2009) did not report any difference in subjective rating of sadness and anxiety between films that were presented either as based on real or fictional stories. However, participants that have experienced in their lives an event similar to that experienced by the protagonist of the clip (self-relevance) scored the films as sadder and more anxious, independently of the nature of the clip. On the contrary, LaMarre and Landreville (2009) showed that participants felt guiltier, but no difference was evident for disgust rating, after a documentary compared to a fictional film of the same historical fact (e.g., the Rwanda genocide).

Even if these results give some interesting information about the modulation of emotion by the fictional context, several methodological issues hinder clear conclusions. First, both studies only employed subjective self-report of emotion. Second, in the study of Goldstein (2009) the manipulation of reality could not have been effective. Indeed, while the scenes were presented as based on real or invented facts, they had clear fictional features, since they were extracted from popular films (e.g., Kramer vs. Kramer, 1979), and this could have led subjects to ignore the nature of the scene. Concerning LaMarre and Landreville (2009)'s study, it is not clear if the difference reported is due to the nature of the stimulus (documentary or film) or just to a difference in the stimulus itself.

The aim of the present work was twofold: to the one hand, we wanted to investigate the modulation of the emotional response by the nature of stimulus (real or fictional) with a rigorous methodological approach. To the other hand, we aimed at understanding the impact of self-relevance on the emotional response, and the interaction between the two factors. To this end we used pre-validated emotional videos that were presented either as real or fictional. We recorded both the subjective rating of emotional response (intensity and valence), and an objective measure of autonomic arousal, the electrodermal activity (EDA). The rationale of this choice was that EDA is considered as a good indicator of the arousal dimension of emotions, and it has been reported to correlate with subjective rating of emotional arousal (Sequeira, Hot, Silvert, & Delplanque, 2009). Moreover, we asked subjects to indicate to what extent each scene evoked a personal memory.

Our two main hypotheses, based on the aforementioned studies were: 1) a diminished emotional responses elicited by scenes presented as fictional compared to real scenes, due to a down regulation in the former condition, and 2) a greater intensity in the emotional responses for scenes associated to personal memories regardless of fictional and real scenes.

2. Materials and methods

2.1. Subjects

Twenty-nine healthy young volunteers (20 females; mean age 21.97 ± 2.44 years participated in the study. All participants took part in the experiment after signing an informed written consent in accordance with the declaration of Helsinki and the local ethics committee of the Paris Descartes University.

2.2. Procedure

The study took place in a quiet experimental room whose temperature was kept at about 24 degrees. Since all the scenes were very realistic we made up a story to present the scenes either as real or fictional. Participants were explained that they would see a sequence of short videos, the content of which could be either real (documentary or amateur video) or fictional (mokumentary — films depicting fictional events as real and shot in a documentary style). All subjects were asked to read the French definition of "mokumentary" on Wikipedia (http://fr.wikipedia.org/wiki/Faux_documentaire) and were given two examples of famous "mokumentaries": The Blair Witch Project (1999) and Paranormal Activity (2007).

The experiment was divided in two phases. In the first phase we presented 36 scenes in 4 blocks of 9 scenes (3 negative, 3 positive, 3 neutral). Scenes were extracted from films, documentaries, YouTube, and private *amateur* videos. The criteria for selecting the videos were the following: I) color video, II) containing at least one human character, III) not containing evident camera movements or cuts, IV) having a plausible and realistic content, V) emotion should be conveyed by the global context of the scene and not by specific details (e.g., facial expression). To this end we avoided scenes containing "close up". The rationale of these criteria was that we wanted a homogeneous material (criteria I and II), that would be perceived as realistic (criteria III and IV), since we reasoned that realistic scenes could be presented as fictional, but the opposite would be more difficult. Finally, we would avoid automatic and fast emotional reaction prompted by emotional expression of faces (e.g., Tamietto et al., 2009; criterion V). All videos were selected by the agreement of two among the authors (M.S., and M.A.). Audio was removed from all scenes. All selected scenes were previously validated on an independent sample (detailed information about the validation and the selection of the experimental material see Supplementary material 1). The final 36 scenes were selected based on this preliminary validation. The scene had a mean duration of 4.61 s (range 3.48–5.99 s) for negative, 4.68 s (range 3.44–5.30 s) for positive, and 4.39 (range 3.28–5.32 s) for neutral scenes. The duration of the scenes did not differed between the three valences ($F(2,33) = 0.67$, $p > 0.05$, $\eta^2_p = 0.04$). For an example of one scene for each valence see Supplementary material 2–4.

Each block was preceded by a word cue (FICTION or REAL) indicating the "nature" of the scenes in the block. The presentation of the scenes in the two conditions (fiction and real) was counterbalanced among subjects, as well as the order of blocks (i.e., some subjects saw a "real" block first and others a "fictional" block first). The two real and two fictional blocks were alternated. Presentation of the scenes in each block was randomized. Subjects were simply asked to pay attention to the cues preceding each block and to the scenes.

For each block the sequence of events was as follows: a word cue (FICTION or REAL) was presented at the beginning of each block for 3 s, then a baseline (randomly moving colored dots) of 20 s was presented between each scene, and finally a scene was presented. The interval between each block was 5 s. For a schematic representation of the protocol see Fig. 1. During the first phase, EDA was continuously recorded.

At the end of the first phase, the same scenes were presented randomly in a single block without any cue. This time, subjects were asked to rate each scene on a scale ranging from 0 to 7 on four features: the intensity of perceived emotion (0 = not intense, 7 = very intense), the valence of perceived emotion (0 = very negative, 7 = very positive), the degree of personal memory linked to the scene (0 = no memory, 7 = a very precise memory), and the nature of the scene (0 = real, 7 = fictional) that was used as a control for our experimental manipulation.

Stimuli presentation, data recording and synchronization between stimuli presentation and electrophysiological data acquisition were automatically accomplished using PsychoPy (Peirce, 2007, 2008).

2.3. Data acquisition

Electrodermal activity (EDA) was recorded using the BIOPAC MP150 system (Biopac Systems, Goleta, CA, USA), and AcqKnowledge Software (Version 4.3; Biopac Systems) at 1000 Hz. EDA was measured using two Ag–AgCl electrodes attached to the intermediate phalanx of the index and ring fingers of the nondominant hand. Isotonic paste (BIOPAC Gel 101) was used as the electrolyte. Electrodes were attached prior to the beginning of the task, and at least 5 min of activity were recorded before starting the experiment in order to allow participants to adapt to the recording equipment, and to allow EDA levels to stabilize (see Fowles et al., 1981).

2.4. Data analysis

The analysis of the EDA signal was carried out using AcqKnowledge Software (Version 4.3; Biopac Systems). Tonic EDA signal was first down sampled at 15.7 Hz, then a low-pass filter at 1 Hz was applied. Phasic EDA was derived from the tonic signal with the AcqKnowledge function Smoothing baseline removal with a baseline window of 8 s. Then, we extracted the peak of EDA activity for each stimulus in a time window starting 1 s after stimulus presentation and ending 6 s after stimulus offset. Extracted EDA peak values were finally transformed using the square root function to approach normal distribution (for a similar method see Silvert, Delplanque, Bouwalerh, Verpoort, & Sequeira, 2004).

2.5. Statistical data analysis

For each variable of interest we conducted a 2 nature (real-fiction) × 3 valence (negative–positive–neutral) repeated measures ANOVA. Bonferroni correction was applied to post-hoc comparisons if not otherwise specified. Effect sizes are reported as partial eta-squared (η^2_p). Descriptive statistics for all the variables are reported in Table 1.

In order to test our second hypothesis on the impact of personal memory on the emotional response, and its interaction with the nature of the scene, we used linear mixed-effects models (LMMs). We report 95% confidence intervals based on the estimated local curvature of the likelihood surface (Bates, Mächler, Bolker, & Walker, 2014). We fitted three full linear mixed effects models in order to predict EDA, the subjective intensity and the subjective valence. As fixed effects, we entered personal memory (this variable was preliminary centered around 0 and treated as a continuous predictor), the nature of scenes (real–fiction), and the valences (neutral–negative–positive) as categorical factors. Items and participants were entered as random factors. Following recent recommendation (Barr, Levy, Scheepers, & Tily, 2013), fixed factors were modelled as random slopes. In particular, the valence and nature were added as random slopes over participants, and the nature as

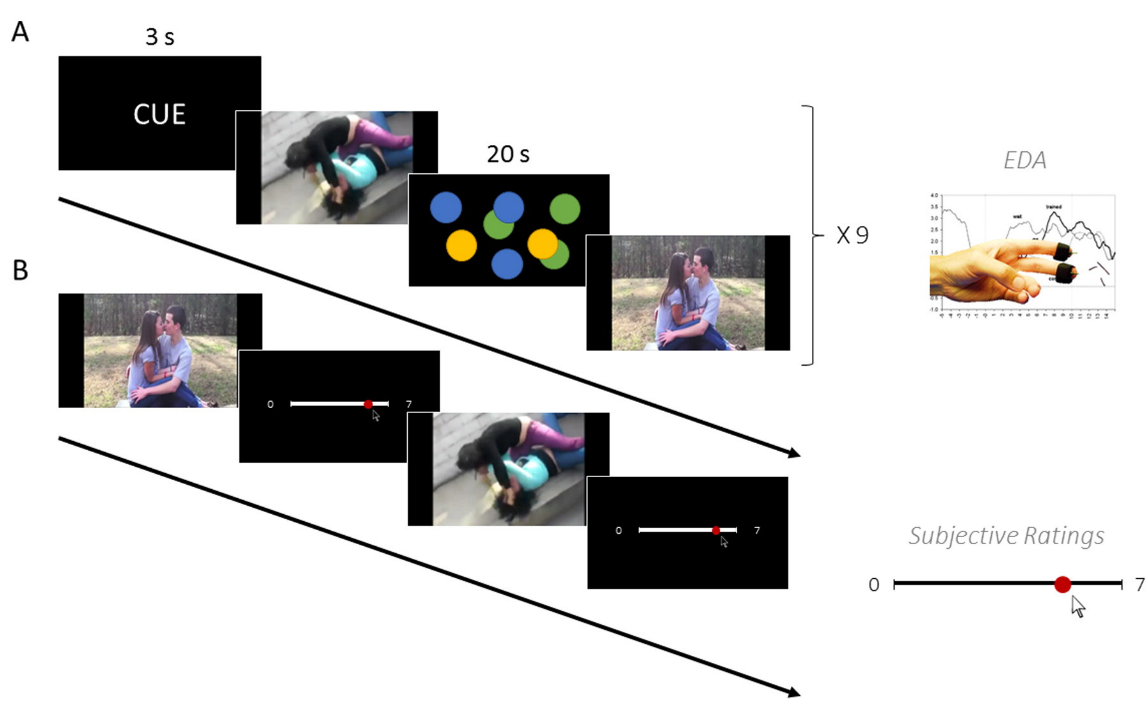

Fig. 1. Schematic representation of the experimental protocols. A) Presentation of scenes was organized in 4 blocks, each containing 9 scenes (3 for each emotional valence). Each block started with the presentation of a cue (Real or Fiction) that lasts 3 s. After a baseline of 20 s a scene was presented, and the sequence was repeated for the 9 scenes in the block. An interval of 5 s separated each block. In this first phase electrodermal activity (EDA) was continuously recorded. B) In the second phase of the experiment, participants were showed the same scenes. After each scene, subjects were asked to rate their subjective emotional experience (intensity and valence), the degree of personal memory evoked by the scene, and the nature of the scene (real or fictional).

Table 1
Descriptive statistics for all the variables of interest.

	Real	Fiction
INT-NEG	5.48 [1.18]	5.02 [1.25]
INT-POS	4.69 [0.86]	4.49 [0.83]
INT-NEU	1.37 [0.81]	1.41 [1.06]
VAL-NEG	0.67 [0.49]	0.88 [0.57]
VAL-POS	5.97 [0.62]	5.79 [0.63]
VAL-NEU	3.69 [0.55]	3.65 [0.49]
MEM-NEG	2.14 [1.66]	2.15 [1.68]
MEM-POS	3.81 [1.16]	4.15 [1.19]
MEM-NEU	2.29 [1.03]	1.69 [0.93]
NAT-NEG	1.46 [1.04]	2.15 [1.53]
NAT-POS	1.54 [1.12]	2.13 [1.27]
NAT-NEU	1.98 [1.32]	2.80 [1.42]
EDA-NEG	0.44 [0.46]	0.42 [0.41]
EDA-POS	0.43 [0.44]	0.39 [0.41]
EDA-NEU	0.34 [0.38]	0.33 [0.45]

In the table are reported the mean and the standard deviation (in brackets) for all the variables of interest in the real and fiction conditions. INT = intensity, VAL = valence, MEM = personal memories, NAT = nature of the scene, EDA = electrodermal activity, NEG = negative, POS = positive, NEU = neutral.

random slope over items. Correlations between random effects were also modelled. We also specified additional models in which the nature factor, personal memory and their interaction were nested in the valence factor. The R code for the linear mixed-effects models is provided in Supplementary material 5.

3. Results

3.1. EDA results

We only found a significant main effect of valence ($F(2,56) = 11.45$, $p < 0.001$; $\eta^2_p = 0.29$), due to the fact that negative ($p < 0.001$) and positive ($p < 0.01$) scenes elicited a stronger EDA activity compared to neutral scenes, whereas the difference between negative and positive scenes was not significant ($p > 0.5$). The main effect of the nature ($F(1,28) = 1.25$, $p > 0.05$; $\eta^2_p = 0.04$) as well as the interaction ($F(2,56) = 0.12$, $p > 0.05$; $\eta^2_p = 0.004$) between the two factors were not significant. For a graphical representation of the results see Fig. 2.

3.2. Behavioral results

For the intensity, we observed a significant main effect of valence ($F(2,56) = 247.7$, $p < 0.001$; $\eta^2_p = 0.88$), that was further characterized by a significant valence x nature interaction ($F(2,56) = 3.98$, $p < 0.05$; $\eta^2_p = 0.12$), while the main effect of the nature was not significant ($F(1,28) = 1.83$, $p > 0.05$; $\eta^2_p = 0.06$). Post-hoc revealed that independently of the nature of the scenes, negative scenes were judged more intense than positive ($p < 0.01$) and neutral ($p < 0.001$) ones, and positive scenes were judged more intense than neutral ones ($p < 0.001$). Moreover, negative scenes were judged more intense in the real condition compared to the fictional condition ($p < 0.01$). For a graphical representation of the results see Fig. 3.

For the valence, we found similar results, with a significant main effect of the valence of the scene ($F(2,56) = 746.85$, $p < 0.001$; $\eta^2_p = 0.96$), that was further characterized by a significant valence × nature interaction ($F(2,56) = 3.58$, $p < 0.05$; $\eta^2_p = 0.11$). Post-hoc revealed that positive scenes were judged more positive than neutral and negative ones (both $p < 0.001$), and neutral scenes were judged more positive than negative ones ($p < 0.001$). The interaction was due to the fact that negative scenes were judged more negative in the real condition compared to the fictional condition ($p < 0.05$ using Fisher's LSD), while for positive and neutral scenes the judgment of valence did not differ between the two conditions. The main effect of the nature ($F(1,28) = 0.005$, $p > 0.05$; $\eta^2_p = 0.0002$) was not significant. For a graphical representation of the results see Fig. 4.

For personal memories, we obtained a main effect of the valence of the scene ($F(2,56) = 58.65$, $p < 0.001$; $\eta^2_p = 0.68$) that was due to the fact that positive scenes elicited more personal memories compared to negative and neutral ones (both $p < 0.001$). We also found a significant interaction between the nature of the scene and the valence ($F(2,56) = 7.36$, $p < 0.01$; $\eta^2_p = 0.21$). The interaction was due to the fact that the difference between the real and the fictional conditions was only observed for neutral scenes, the former were associated with higher personal memory scores ($p < 0.05$).

For the nature, we observed a main effect of the nature of the scene ($F(1,28) = 12.07$, $p < 0.01$; $\eta^2_p = 0.3$) that was due to the fact that scenes presented as real were also later judged as more real by the participants. We also found a main effect of the valence of the scene. Post-hoc revealed that neutral scenes were judged more fictional than negative ($p < 0.01$) and positive ($p < 0.05$) ones, while there was no difference between these last two categories.

3.3. Mixed model

3.3.1. EDA

The overall model predicting EDA successfully converged and explained 79% of the variance (the conditional R^2, see Barton, 2015). The variance explained by fixed factors was rather small (marginal $R^2 = 0.008$). The intercept, corresponding to the EDA in the neutral valence and real nature, was of 0.29. Compared to this, both negative and positive valence lead to a significant increase (respectively, $\beta = 0.11$, 95% CI [0.03, 0.18], $p < 0.01$; $\beta = 0.08$, 95% CI [0.01, 0.15], $p < 0.05$). Compared to the intercept (i.e., in the neutral valence), the fiction nature did not modulate the EDA ($\beta = 0.00$, 95% CI [−0.06, 0.06], $p > 0.05$). There was no interaction between fiction and the positive and negative valence (respectively, $\beta = -0.03$, 95% CI [−0.11, 0.06], $p > 0.05$; $\beta = -0.02$, 95% CI [−0.11, 0.06], $p > 0.05$). The effect of personal memory was not significant ($\beta = -0.01$, 95% CI [−0.02, 0.01], $p > 0.05$). Personal memory did not interact with the negative and the positive valences (respectively, $\beta = 0.01$, 95% CI [−0.01, 0.03], $p > 0.05$; $\beta = 0.01$, 95% CI [−0.01, 0.03], $p > 0.05$), neither with the effect of fiction

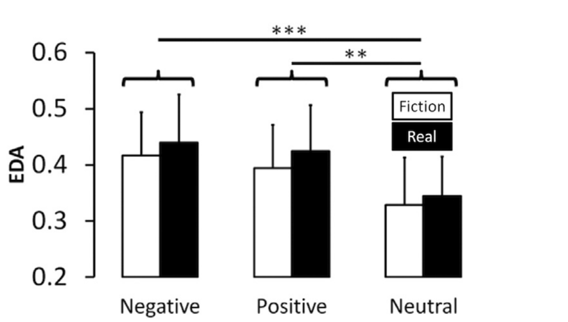

Fig. 2. EDA results showing the main effect of the valence, greater EDA activity was observed for negative and positive scenes compared to neutral ones. Errors bars represent SEM. ** $p < 0.01$, *** $p < 0.001$.

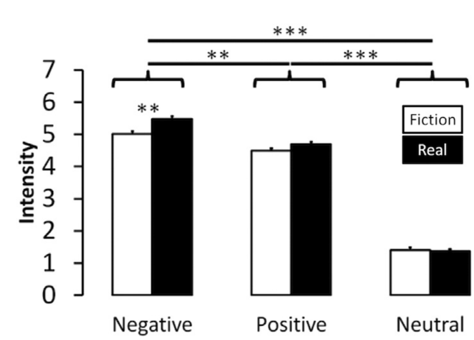

Fig. 3. Subjective rating of the emotional intensity for each experimental condition. Errors bars represent SEM. ** $p < 0.01$, *** $p < 0.001$.

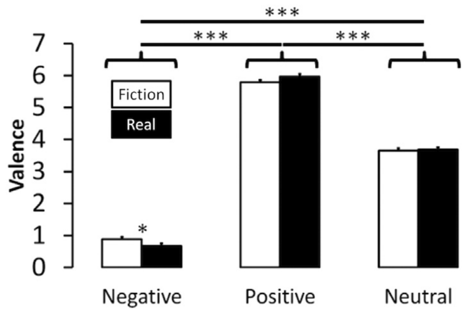

Fig. 4. Subjective rating of the emotional valence for each experimental condition. Errors bars represent SEM. *p (uncorrected) < 0.05, **$p < 0.01$, ***$p < 0.001$.

($\beta = 0.01$, 95% CI [−0.01, 0.04], $p > 0.05$), nor with the effect of interactions between fiction and the negative and positive valences (respectively, $\beta = -0.01$, 95% CI [−0.04, 0.02], $p > 0.05$; $\beta = -0.02$, 95% CI [−0.05, 0.01], $p > 0.05$).

The nested model did not reveal any significant effect of fiction, personal memories or their interaction in the neutral, the negative or the positive valence (respectively, $\beta = 0.00$, 95% CI [−0.06, 0.03], $p > 0.05$; $\beta = -0.03$, 95% CI [−0.09, 0.04], $p > 0.05$; $\beta = -0.02$, 95% CI [−0.08, 0.03], $p > 0.05$; $\beta = -0.01$, 95% CI [−0.02, 0.01], $p > 0.05$; $\beta = 0.00$, 95% CI [−0.01, 0.02], $p > 0.05$; $\beta = 0.00$, 95% CI [−0.02, 0.02], $p > 0.05$; $\beta = 0.01$, 95% CI [−0.01, 0.04], $p > 0.05$; $\beta = 0.00$, 95% CI [−0.02, 0.03], $p > 0.05$; $\beta = -0.01$, 95% CI [−0.03, 0.01], $p > 0.05$).

3.3.2. Subjective intensity

For the subjective intensity, the overall model successfully converged and explained 66% of the variance of the endogen, and 52% was explained by the fixed factors. The intercept, corresponding to the Subjective Intensity (measured on a 0–7 scale) in the neutral valence and real nature, was of 1.42. Compared to this, both negative and positive valence lead to a significant increase of subjective intensity (respectively, $\beta = 4.09$, 95% CI [3.45, 4.74], $p < 0.001$; $\beta = 3.06$, 95% CI [2.52, 3.60], $p < 0.001$). Compared to the intercept (i.e., in the neutral valence), the fiction nature did not modulate the subjective intensity ($\beta = 0.21$, 95% CI [−0.20, 0.61], $p > 0.05$). However, the effect of fiction interacted with the effects of negative valence ($\beta = -0.61$, 95% CI [−1.06, −0.16], $p < 0.01$), and showed a trend toward significance for positive valences ($\beta = -0.46$, 95% CI [−0.95, 0.02], $p = 0.063$). In both cases the interaction leaded to a decrease of subjective intensity when the scenes were presented as fictional. The main effect of personal memory was significant ($\beta = 0.12$, 95% CI [0.03, 0.22], $p < 0.05$). The effect of personal memories did not interact with the negative and the positive valences (respectively, $\beta = -0.06$, 95% CI [−0.21, 0.08], $p > 0.05$; $\beta = 0.07$, 95% CI [−0.07, 0.21], $p > 0.05$), neither with the effect of fiction ($\beta = 0.10$, 95% CI [−0.05, 0.25], $p > 0.05$), nor with the interactions between fiction and the negative and positive valences (respectively, $\beta = 0.01$, 95% CI [−0.19, 0.21], $p > 0.05$; $\beta = -0.11$, 95% CI [−0.30, 0.09], $p > 0.05$).

The nested model showed that the effect of fiction was only significant in the negative valence, but not in the positive or the neutral one (respectively, $\beta = -0.40$, 95% CI [−0.81, 0.00], $p = 0.053$; $\beta = -0.26$, 95% CI [−0.63, 0.12], $p > 0.05$; $\beta = 0.21$, 95% CI [−0.20, 0.62], $p > 0.05$). Personal memories was significantly linked with the outcome variable in the neutral and positive valence, but not in the negative one (respectively, $\beta = 0.12$, 95% CI [0.03, 0.22], $p < 0.05$; $\beta = 0.19$, 95% CI [0.09, 0.29], $p < 0.001$; $\beta = 0.06$, 95% CI [−0.05, 0.17], $p > 0.05$). Finally, the interaction between the effect of fiction and personal memories did not reach significance for none of the valences (neutral, $\beta = 0.10$, 95% CI [−0.05, 0.25], $p > 0.05$; negative, $\beta = 0.11$, 95% CI [−0.03, 0.26], $p > 0.05$; positive, $\beta = -0.01$, 95% CI [−0.14, 0.13], $p > 0.05$).

3.3.3. Subjective valence

For the subjective valence, the overall model successfully converged and explained 82% of the variance of the endogen, and 79% was explained by the fixed factors. The intercept, corresponding to the subjective valence (measured on a 0–7 scale) in the neutral valence and real nature, was of 3.69. Compared to this, negative valence lead to a significant decrease and the positive valence to a significant increase (respectively, $\beta = -3.04$, 95% CI [−3.39, −2.70], $p < 0.001$; $\beta = 2.16$, 95% CI [1.87, 2.44], $p < 0.001$). Compared to the intercept (i.e., in the neutral valence), neither the fiction nature nor personal memories did modulate the subjective valence (respectively, $\beta = 0.02$, 95% CI [−0.28, 0.32], $p > 0.05$; $\beta = 0.01$, 95% CI [−0.06, 0.07], $p > 0.05$). The effect of fiction did not interact with the effects of negative and positive valences (respectively, $\beta = 0.18$, 95% CI [−0.21, 0.57], $p > 0.05$; $\beta = -0.32$, 95% CI [−0.75, 0.10], $p > 0.05$). The effect of personal memory significantly interacted with the positive valence, leading to an increase of subjective valence ($\beta = 0.11$, 95% CI [0.01, 0.20], $p < 0.05$). No interaction was found with the negative valence ($\beta = -0.04$, 95% CI [−0.14, 0.06], $p > 0.05$), the effect of fiction ($\beta = 0.06$, 95% CI [−0.05, 0.16], $p > 0.05$), nor with the interactions between fiction and the negative and positive valences (respectively, $\beta = -0.07$, 95% CI [−0.22, 0.07], $p > 0.05$; $\beta = 0.00$, 95% CI [−0.14, 0.15], $p > 0.05$).

The nested model showed that the effect of fiction lead to a decrease of subjective valence in the positive valence, but not in the negative or the neutral one (respectively, $\beta = -0.31$, 95% CI [−0.59, −0.02], $p < 0.05$; $\beta = 0.02$, 95% CI [−0.28, 0.32], $p > 0.05$; $\beta = 0.20$, 95% CI [−0.05, 0.45], $p > 0.05$). Personal memories was significantly linked with the outcome variable in the positive valence, but not in the neutral or the negative one (respectively, $\beta = 0.11$, 95% CI [0.04, 0.18], $p < 0.05$; $\beta = 0.01$, 95% CI [−0.06, 0.07], $p > 0.05$; $\beta = -0.03$, 95% CI [−0.10, 0.04], $p > 0.05$). Finally, the interaction between the effect of fiction and personal memories did not reach significance in none of the valences (neutral, $\beta = 0.06$, 95% CI [−0.05, 0.16], $p > 0.05$; negative, $\beta = -0.02$, 95% CI [−0.11, 0.08], $p > 0.05$; positive, $\beta = 0.06$, 95% CI [−0.04, 0.16], $p > 0.05$).

4. Discussion

Here we investigated the difference of emotional response toward video clips that were presented as real or fictional. In agreement with our first hypothesis, the main findings of our work, confirmed by both repeated measure ANOVA and mixed-effects models, showed that in the fictional condition the emotional response was weaker than in the real condition. This effect was only evident for the subjective intensity and valence rating, and not for the physiological arousal. Moreover, this difference was more pronounced for negative emotions. Importantly, the effectiveness of our experimental manipulation was supported by the fact that participants subjectively rated as more fictional scenes that were presented as such, compared to those presented as real. In line with our second hypothesis, we found that scenes that elicited more personal memories were also scored more emotionally intense regardless of the condition. This effect seemed to be more robust for positive material. Again, this result was only evident for the subjective report of emotional experience and not for the physiological arousal.

As suggested in the introduction these findings could be explained by a diminished emotional response induced by some form of emotion regulation when facing fiction. Emotion regulation refers to the dynamic process of influencing the nature of our emotional response, and could intervene at different stages of the emotional generative process. Cognitive change is a widely studied regulatory strategy defined as a change in one of the features of a stimulus such as the meaning ("reappraisal") or the psychological distance ("distancing"). The first mechanism is believed to be one of the most efficient and adaptive for regulating emotional response (Gross, 2002). While cognitive change is often studied in the framework of emotion regulation in the form of reappraisal, it can be at stake in emotional generation per se in the form of the initial appraisal of a given situation. Appraisal or reappraisal is thought to impact emotion in an early phase of the emotion generating process, before a full-fledged response takes place (Gross & Thompson, 2007).

Neuroimaging studies showed that reappraisal recruits prefrontal regions, and is concomitantly linked to reduced insula and amygdala activity (Eippert et al., 2007; Goldin, McRae, Ramel, & Gross, 2008). Since correlations between amygdala activity and autonomic nervous system response are often reported (e.g., Phelps et al., 2001), we would have expected to find decreased EDA in the fiction condition. Nevertheless, Eippert et al. (2007) showed, during down regulation of emotion using reappraisal, a trend toward an increase of the EDA response. Unfortunately, the authors did not report whether reappraisal influenced subjective judgment of emotional intensity. On the contrary, Goldin et al. (2008) showed that reappraisal was effective in reducing subjective emotional experience.

We suggest that while watching fiction, cognitive change is at stake. Nevertheless, in previously cited studies an increase of EDA has been reported (importantly during down regulation), while we did not find any EDA modulation. One explanation is that most of the studies investigating emotional control used explicit emotion regulation strategies. These strategies could be cognitively effortful, and it has been shown that increasing task difficulty, thus engaging more cognitive resources, results in increased EDA activity (Hartley, Maquestiaux, Brooks, Festini, & Frazier, 2012). Conversely, modulation of emotional response toward fiction could be more implicit and automatic. Interestingly, a recent study (Burklund, Creswell, Irwin, & Lieberman, 2014) compares two emotion regulation strategies, namely reappraisal and affect labeling — which can be considered respectively as an intentional and an incidental emotion regulation strategy. This study showed that affect labeling activated to a greater extent lateral prefrontal and parietal regions — broadly corresponding to regions that have been reported during processing of fictional characters (Abraham et al., 2008; Metz-Lutz et al., 2010). These data could suggest that probably, during fictional experience, people implicitly use semantic representations to label the emotional content of the stimulus that, in turn, would result in a modification of the emotional subjective response.

Even if we did not have any explicit hypothesis on the modulation of the emotional response by the nature of the stimulus according to the valence, we did report that this effect was more robust for negative scenes. Ever since Aristotle, negative emotions in fictional contexts have been considered peculiar. The first possible explanation is that reducing the affective response in the case of negative content has a greater functional value: after all we did not want to go out of the cinema with a psychological trauma. This could even explain why we can endure, or even enjoy watching dramatic movies. Another hypothesis could be linked to the fact that, in our experiment, negative scenes were also judged as more intense than positive ones. Thus, we cannot exclude that the specific effect for negative material is linked to the intensity and not to the valence of the scene. In line with this hypothesis, a recent study showed that when using reappraisal to down regulate emotion induced by negative material there was a greater decrease in negative affect for high-intensity scenes compared to low-intensity ones (Silvers, Weber, Wager, & Ochsner, 2014). Further studies are needed to clarify this issue.

Concerning modulation of emotional response by personal memories, neuroimaging studies have shown that activity in structures responsible for self-referential processing that are also activated during recollection of autobiographical memories (for a recent meta-analysis see Martinelli et al., 2013) modulates the response in limbic regions, eventually amplifying emotional response for self-relevant stimuli (Herbert et al., 2011; Yoshimura et al., 2009). Again, these findings are in analogy with studies on emotional regulation, even if there are much fewer studies on emotion up-regulation. For example, Eippert et al. (2007) showed that up-regulation of the emotional response to negative images through the instruction of imagining that the situation depicted was real and involved the participant, produced an increase of activity in frontal areas, and in the amygdala. The authors also reported an increased EDA activity. Again this increased EDA response during voluntary control of emotion, independently of the direction of the modulation, could be linked to the cognitive effort more than to the emotion modulation *per se* (Hartley et al., 2012). Our data are in agreement with these findings. Indeed, we found that positive scenes (regardless of the condition) that were linked to a greater amount of personal memories were also judged more intense.

We suggest that when confronted with fiction some kind of implicit emotion regulation, resulting by cognitive change due to knowledge of the fictional nature of the stimulus, would take place resulting in a weaker subjective emotional response. However, stimuli that elicit personal memories in both fiction and real conditions, in line with the findings of Goldstein (2009), could prompt emotion up-regulation. Thus, self-engagement through personal memory recollection could be one of the processes responsible of our emotional engagement toward fiction. Regarding the philosophical debate about the nature of emotion toward fiction our data seem to suggest that the fiction-directed emotions are physically robust, as witnessed by a physiological arousal comparable to real material, and can be seen as genuine emotions. The answer to the paradox of fiction should probably be sought not in emotion *per se*, but in factors and mechanisms modulating it. Our study suggests that two candidates are emotion regulation and self-referential processes.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.actpsy.2016.02.003.

References

Abraham, A., von Cramon, D. Y., & Schubotz, R. I. (2008). Meeting George Bush versus meeting Cinderella: The neural response when telling apart what is real from what is fictional in the context of our reality. *Journal of Cognitive Neuroscience*, *20*(6), 965–976.

Altmann, U., Bohrn, I. C., Lubrich, O., Menninghaus, W., & Jacobs, A. M. (2014). Fact vs fiction—How paratextual information shapes our reading processes. *Social Cognitive and Affective Neuroscience*, *9*(1), 22–29.

Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, *68*(3), 255–278. http://dx.doi.org/10.1016/j.jml.2012.11.001.

Barton, K. (2015). MuMIn: Multi-model inference. R package version 1.15.1. http://CRAN.R-project.org/package=MuMIn.

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects models using lme4. arXiv preprint arXiv:1406.5823.

Buhle, J. T., Silvers, J. A., Wager, T. D., Lopez, R., Onyemekwu, C., Kober, H., ... Ochsner, K. N. (2014). Cognitive reappraisal of emotion: a meta-analysis of human neuroimaging studies. *Cerebral Cortex*, *24*(11), 2981–2990.

Burklund, L. J., Creswell, J. D., Irwin, M. R., & Lieberman, M. D. (2014). The common and distinct neural bases of affect labeling and reappraisal in healthy adults. *Frontiers in Psychology*, *5*.

Carroll, N. (1990). *The philosophy of horror; or, paradoxes of the heart.* New York: Routledge.

Carroll, N. (2010). *Movies, the moral emotions, and sympathy*. Midwest Studies in Philosophy, XXXIV, 1-19.

Charlton, W. (1984). Feeling for the fictitious. *British Journal of Aesthetics*, *24*(3), 206–216.

Eippert, F., Veit, R., Weiskopf, N., Erb, M., Birbaumer, N., & Anders, S. (2007). Regulation of emotional responses elicited by threat-related stimuli. *Human Brain Mapping*, *28*(5), 409–423.

Fields, E. C., & Kuperberg, G. R. (2012). It's all about you: An ERP study of emotion and self-relevance in discourse. *NeuroImage*, *62*(1), 562–574.

Fowles, D. C., Christie, M. J., Edelberg, R., Grings, W. W., Lykken, D. T., & Venables, P. H. (1981). Publication recommendations for electrodermal measurements. *Psychophysiology*, *18*(3), 232–239.

Gaut, B. (2007). *Art, emotion and ethics*. Oxford: Oxford University Press.

Gendler Szabó, T., & Kovakovich, K. (2006). *Genuine rational fictional emotions*. In M. Kieran (Ed.), *Contemporary debates in aesthetics and the philosophy of art* (pp. 241–253). Malden, MA: Blackwell.

Goldin, P. R., McRae, K., Ramel, W., & Gross, J. J. (2008). The neural bases of emotion regulation: Reappraisal and suppression of negative emotion. *Biological Psychiatry*, *63*(6), 577–586.

Goldstein, T. R. (2009). The pleasure of unadulterated sadness: Experiencing sorrow in fiction, nonfiction, and "in person". *Psychology of Aesthetics, Creativity, and the Arts*, *3*(4), 232.

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, *39*(3), 281–291.

Gross, J. J., & Thompson, R. A. (2007). *Emotion regulation: Conceptual foundations*. *Handbook of emotion regulation*, *3*, 24.

Han, S., Jiang, Y., Humphreys, G. W., Zhou, T., & Cai, P. (2005). Distinct neural substrates for the perception of real and virtual visual worlds. *NeuroImage*, *24*(3), 928–935.

Hartley, A. A., Maquestiaux, F., Brooks, R. D., Festini, S. B., & Frazier, K. (2012). Electrodermal responses to sources of dual-task interference. *Cognitive, Affective, & Behavioral Neuroscience*, *12*(3), 543–556.

Hartz, G. (1999). How we can be moved by Anna Karenina, Green Slime, and a Red Pony. *Philosophy*, *74*, 557–578.

Herbert, C., Pauli, P., & Herbert, B. M. (2010). Self-reference modulates the processing of emotional stimuli in the absence of explicit self-referential appraisal instructions. *Social Cognitive and Affective Neuroscience*, *nsq082*.

Herbert, C., Herbert, B. M., & Pauli, P. (2011). Emotional self-reference: Brain structures involved in the processing of words describing one's own emotions. *Neuropsychologia*, *49*(10), 2947–2956.

Hermann, A., Schäfer, A., Walter, B., Stark, R., Vaitl, D., & Schienle, A. (2009). Emotion regulation in spider phobia: Role of the medial prefrontal cortex. *Social Cognitive and Affective Neuroscience*, *nsp013*.

LaMarre, H. L., & Landreville, K. D. (2009). When is fiction as good as fact? Comparing the influence of documentary and historical reenactment films on engagement, affect, issue interest, and learning. *Mass Communication and Society*, *12*(4), 537–555.

Martinelli, P., Sperduti, M., & Piolino, P. (2013). Neural substrates of the self-memory system: New insights from a meta-analysis. *Human Brain Mapping*, *34*(7), 1515–1529.

Metz-Lutz, M. N., Bressan, Y., Heider, N., & Otzenberger, H. (2010). What physiological changes and cerebral traces tell us about adhesion to fiction during theater-watching? *Frontiers in Human Neuroscience*, *4*.

Moran, R. (1994). The expression of feeling in imagination. *The Philosophical Review*, *103*, 75–106.

Neill, A. (1991). Fear, fiction and make-believe. *The Journal of Aesthetics and Art Criticism*, *49*, 47–56.

Northoff, G., Heinzel, A., de Greck, M., Bermpohl, F., Dobrowolny, H., & Panksepp, J. (2006). Self-referential processing in our brain—A meta-analysis of imaging studies on the self. *NeuroImage*, *31*(1), 440–457.

Ochsner, K. N., & Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Sciences*, *9*(5), 242–249.

Ochsner, K. N., Silvers, J. A., & Buhle, J. T. (2012). Functional imaging studies of emotion regulation: A synthetic review and evolving model of the cognitive control of emotion. *Annals of the New York Academy of Sciences*, *1251*(1), E1–E24.

Peirce, J. W. (2007). PsychoPy—Psychophysics software in Python. *Journal of Neuroscience Methods*, *162*(1), 8–13.

Peirce, J. W. (2008). Generating stimuli for neuroscience using PsychoPy. *Frontiers in neuroinformatics*, *2*.

Phelps, E. A., O'Connor, K. J., Gatenby, J. C., Gore, J. C., Grillon, C., & Davis, M. (2001). Activation of the left amygdala to a cognitive representation of fear. *Nature Neuroscience*, *4*(4), 437–441.

Radford, C. (1975). How can we be moved by the fate of Anna Karenina? *Proceedings of the Aristotelian Society*, *49*, 67–80.

Sequeira, H., Hot, P., Silvert, L., & Delplanque, S. (2009). Electrical autonomic correlates of emotion. *International Journal of Psychophysiology*, *71*(1), 50–56.

Siiatela, S. (1994). Fiction, make-believe and quasi emotions. *British Journal of Aesthetics*, *34*, 25–34.

Silvers, J. A., Weber, J., Wager, T. D., & Ochsner, K. N. (2014). Bad and worse: Neural systems underlying reappraisal of high and low intensity negative emotions. *Social Cognitive and Affective Neuroscience*, *nsu043*.

Silvert, L., Delplanque, S., Bouwalerh, H., Verpoort, C., & Sequeira, H. (2004). Autonomic responding to aversive words without conscious valence discrimination. *International Journal of Psychophysiology*, *53*(2), 135–145.

Tamietto, M., Castelli, L., Vighetti, S., Perozzo, P., Geminiani, G., Weiskrantz, L., & de Gelder, B. (2009). Unseen facial and bodily expressions trigger fast emotional reactions. *Proceedings of the National Academy of Sciences*, *106*(42), 17661–17666.

Walton, K. (1978). Fearing fictions. *The Journal of Philosophy*, *75*, 5–27.

Walton, K. (1990). *Mimesis as make-believe: On the foundations of the representational arts*. Cambridge, Mass: Harvard University Press.

Weinberg, J., & Meskin, A. (2006). *Puzzling over the imagination: Philosophical problems, architectural solutions*. In S. Nichols (Ed.), *The architecture of the imagination new essays on pretence, possibility and fiction* (pp. 175–202). Oxford: Clarendon Press.

Weston, P. (1975). How can we be moved by the fate of Anna Karenina? *Proceedings of the Aristotelian Society*, *49*, 81–93.

Yoshimura, S., Ueda, K., Suzuki, S. I., Onoda, K., Okamoto, Y., & Yamawaki, S. (2009). Self-referential processing of negative stimuli within the ventral anterior cingulate gyrus and right amygdala. *Brain and Cognition*, *69*(1), 218–225.

Zemach, E. M. (2003). Fiction and Metaphysics. *Philosophical Review*, *112*, 427–431.