

## Affective responses to dance



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### ABSTRACT

The objective of the present work was the characterization of mechanisms by which affective experiences are elicited in observers when watching dance movements. A total of 203 dance stimuli from a normed stimuli library were used in a series of independent experiments. The following measures were obtained: (i) *subjective measures* of 97 dance-naïve participants' affective responses (Likert scale ratings, interviews); and (ii) *objective measures* of the physical parameters of the stimuli (motion energy, luminance), and of the movements represented in the stimuli (roundedness, impressiveness). Results showed that (i) participants' ratings of *felt* and *perceived* affect differed, (ii) *felt* and *perceived* valence but not arousal ratings correlated with physical parameters of the stimuli (motion energy and luminance), (iii) roundedness in posture shape was related to the experience of more positive emotion than edgy shapes (1 of 3 assessed rounded shapes showed a clear effect on positiveness ratings while a second reached trend level significance), (iv) more impressive movements resulted in more positive affective responses, (v) dance triggered affective experiences through the imagery and autobiographical memories it elicited in some people, and (vi) the physical parameters of the video stimuli correlated only weakly and negatively with the aesthetics ratings of beauty, liking and interest. The novelty of the present approach was twofold: (i) the assessment of multiple affect-inducing mechanisms, and (ii) the use of one single normed stimulus set. The results from this approach lend support to both previous and present findings. Results are discussed with regards to current literature in the field of empirical aesthetics and affective neuroscience.

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*"Just how to categorize the emotion triggered by [aesthetic] stimuli remains a challenging issue, as it appears distinct from mere happiness."*

[Adolphs (2002)]

### 1. Introduction

Art works elicit affective responses in spectators. Empirical aesthetics has demonstrated this extensively for paintings (Belke, Leder, & Augustin, 2006; Cupchik, Vartanian, Crawley, & Mikulis, 2009; Kawabata & Zeki, 2004; Russell, 2003; Vartanian & Goel, 2004) and music (Blood & Zatorre, 2001; Boso, Politi, Barale, & Emanuele, 2006; Brown, Martinez, & Parsons, 2004; Salimpoor, Benovoy, Longo, Cooperstock, & Zatorre, 2009). Listening to music induces measurable changes at many levels of an individual's affective response (behavioral, physiological, neural). Subjective liking-ratings correlate with changes in people's galvanic skin response (GSR) in anticipation of chills induced by pleasurable music (Salimpoor et al., 2009). Favoured music increases neural activity in limbic structures of the brain (Blood & Zatorre, 2001), and triggers the release of pleasure-related neurotransmitters

(increased endogenous dopamine release; Salimpoor, Benovoy, Larcher, Dagher, & Zatorre, 2011). These mechanisms underlying affective experiences in perceivers have been described for music (Juslin & Västfjäll, 2008), but only scarcely for the art form *dance*.

The objective of the present work was to investigate some of these mechanisms for dance. This is an extension of previous work in our lab (review: Christensen & Calvo-Merino, 2013; stimuli library norming study: Christensen et al., 2014a, b; empirical work using the library: Christensen et al., 2014a, b; Christensen, Gomila, Gaigg, Sivarajah, & Calvo-Merino, 2016). In a series of independent experiments, we present quantitative and qualitative data on the affective experiences elicited in observers by the dance movements using one and the same movement library (Christensen et al., 2014a, b). The overall aim is to contribute to the characterization of different affective mechanisms implied in the affective experience of watching a dance.

In traditional cognitive neuroscience, dance has been used primarily as a suitable movement pattern for research on the neural underpinnings of action perception and action expertise (Brown, Martinez, & Parsons, 2006; Brownlow, Dixon, Egbert, & Radcliffe, 1997; Calvo-Merino, Glaser, Grèzes, Passingham, & Haggard, 2005; Calvo-Merino, Grèzes, Glaser, Passingham, & Haggard, 2005; Cross, Hamilton, & Grafton, 2006; Cross, Kirsch, Ticini, & Schütz-Bosbach, 2011; Cross, Kirsch, Ticini & Schütz-Bosbach, 2011; Grosbras, Tan, &

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Pollick, 2012; Miura et al., 2010; Orgs, Dombrowski, Heil, & Jansen-Osmann, 2008). Such research using dance requires highly controlled stimuli, understandably at the expense of the artistic quality and ecological validity of stimulus materials (Christensen & Calvo-Merino, 2013). For neuroaesthetics research (i.e., neuroscientific work targeting specifically the aesthetic experience of art), this may or not be a hindrance. To what extent, remains an open question. Therefore, if previous results were reproduced with an artistically more ecologically valid stimuli library, this would lend support to both present and previous results.

Only recently the aesthetic experience observers derive from dance movements has become the objective of empirical research (Calvo-Merino, Jola, Glaser, & Haggard, 2008; Calvo-Merino, Urgesi, Orgs, Aglioti, & Haggard, 2010; Cross et al., 2011; Jang & Pollick, 2011). Yet, such research is normally confined to 'aesthetic judgments'; i.e., participants ratings of, for example, beauty, liking or interest in an artwork (Leder et al., 2004). This means that the actual affective experience an observer has as a result of the expressive intention in the dance is rarely the objective of study (exceptions, cf., Camurri, Lagerlof, & Volpe, 2003; Christensen et al., 2014a, b, Christensen et al., in press; Grosbras et al., 2012; Jola, Pollick, & Grosbras, 2011; Kirsch, Drommelschmidt, & Cross, 2013, Kirsch, Dawson, & Cross, 2015). For the present work, a newly developed movement library of 5–6 s long video clips of expressive ballet dance movements was used (Christensen, Nadal, Cela-Conde & Gomila, 2014a). For this library, stimuli were selected from genuine live performances. Each stimulus comprises a sequence of affective ballet movement danced by a female world class dancer. Faces are blurred, color removed and soundtrack deleted from all clips.

See Fig. 1 for an example of a stimulus and the Supplementary material for sample videos.

In the norming study of this stimuli library all stimuli were rated by both dance professionals and by individuals who were dance naïve. The normative ratings from this study include technical variables such as *meaningfulness of movement editing*, *technical correctness of the movement execution*, and different *movement parameters* (ratings by dance professionals), and variables related to the observers' affective experience; i.e., *felt affective valence*, *arousal*, *beauty*, *liking* and *interest* (ratings by dance-naïve participants). A list of norming values for each stimulus for each of these ratings accompanies the stimuli library. These values were used to complement the analyses of the present work. In the subsequent sections of the paper it is stated explicitly when and which data from the norming study is being used.

As a crucial addition to the norming study, for the present piece of research 'motion energy' and 'luminance' data was obtained for each stimulus. These data allowed us to explore whether the physical properties of the stimuli correlate with participants' subjective experience of the clips (ratings of affective response; *valence*, *arousal*; and aesthetic experience; *beauty*, *liking*, *wanting*) as suggested by previous literature (Cross, Kirsch, Ticini and Schütz-Bosbach, 2011).

In the first experiment (Section 2), we extended the data from the norming study by replicating the same experiment with one important variation: participants were asked to rate the *perceived* affect (*valence* and *arousal*) in the movement. In the norming study, participants had been asked to rate their *felt* affect. This was to establish that participants do indeed distinguish between the two types of affective tasks (*felt* vs. *perceived*). It has been described as difficult to determine whether participants in affect rating tasks actually report what they *feel* or merely what they *perceive* or recognise in the movement (Bastiaansen, Thioux, & Keysers, 2009; Levenson, 2014). Therefore it is particularly relevant to establish whether the ratings of *felt* affective *valence* and *arousal* can indeed be used as reflecting participants' affective experience. Participants' *perceived* affect ratings (experiment 1) were therefore compared to the *felt* affect ratings (from the norming study). Participants' *felt* ratings were expected to be lower than *perceived* affective ratings. Furthermore, in experiment 1, these subjective ratings were related to objective measures of motion energy and luminance present in the video stimuli. We expected these objective measures of physical stimulus properties to be independent of the affective ratings of the participants. Subsequently, we investigated how participants' *felt* affective responses (i.e., using the *felt* affect ratings from the norming study, available online) to affective expressive body movements were modulated by (i) particular basic movement features such as *roundedness* (rounded movements were expected to elicit more positive affective responses than edgy displays; cf., Aronoff, 2006; Section 3), and by (ii) impressive movement features (impressive movements were expected to be rated more positively than less impressive ones; cf., Cross et al., 2011; Daprati, Iosa, & Haggard, 2009; Section 4). By means of a semi-structured interview we then explored whether dance elicited affective experiences in observers through the imagery and autobiographical memories it provokes (this is common in the case of music; cf., Juslin & Västfjäll, 2008); it was expected that also dance would elicit these cognitive phenomena of affective engagement; Section 5). Finally, to investigate the influence of the physical parameters of the stimuli on the aesthetic experience spectators derive from these dance video stimuli, in the final section we correlated the subjective aesthetics ratings of *beauty*, *liking* and *interest* (i.e., using the ratings from the norming study, available online) with the measures of motion energy and luminance (it was expected that higher motion energy and luminance would correlate with increased aesthetics ratings; Cross, Kirsch, Ticini and Schütz-Bosbach, 2011; Section 6). The overall aim of the analyses outlined in these six sections was to contribute to the understanding of the mechanisms which contribute to the aesthetic and emotional experience when watching dance.

## 2. Experiment 1: *felt* vs. *perceived* affective responses to dance

Objective: Assess the difference between *felt* and *perceived* ratings of affective *valence* and *arousal* and relate these subjective ratings to

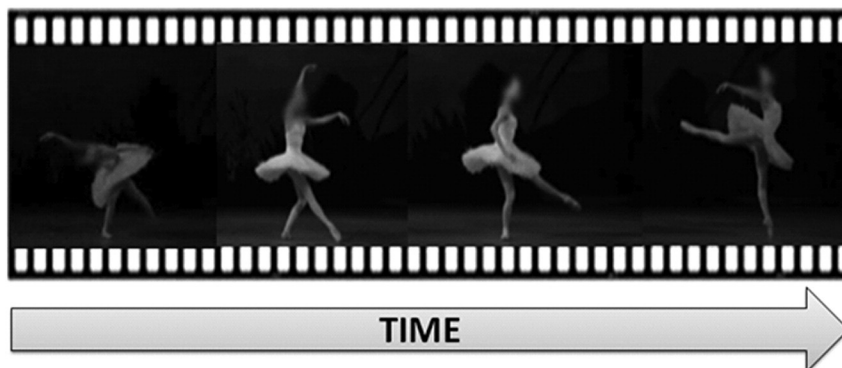


Fig. 1. Example of stimulus of 5 s of duration; 8 counts in ballet theory.

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