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Effects of emotional videos on postural control in children

Arthur de Freitas Brandão [a], Estelle Palluel [a,b,*], Isabelle Olivier [a,b], Vincent Nougier [a,b]

[a] University Grenoble Alpes, TIMC-IMAG, Grenoble F-38000, France
[b] CNRS, TIMC-IMAG, Grenoble F-38000, France

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ABSTRACT

The link between emotions and postural control has been rather unexplored in children. The objective of the present study was to establish whether the projection of pleasant and unpleasant videos with similar arousal would lead to specific postural responses such as postural freezing, aversive or appetitive behaviours as a function of age. We hypothesized that postural sway would similarly increase with the viewing of high arousal videos in children and adults, whatever the emotional context. 40 children participated in the study and were divided into two groups of age: group 7–9 years ($n = 23$; mean age = 8 years ± 0.7) and group 10–12 years ($n = 17$; mean age = 11 years ± 0.7). 19 adults (mean age = 25.8 years ± 4.4) also took part in the experiment. They viewed emotional videos while standing still on a force platform. Centre of foot pressure (CoP) displacements were analysed. Antero-posterior, medio-lateral mean speed and sway path length increased similarly with the viewing of high arousal movies in the younger, older children, and adults. Our findings suggest that the development of postural control is not influenced by the maturation of the emotional processing.

1. Introduction

Darwin already suggested that emotional states and posture or movement are linked [1]. Currently, there are very few data for children about the link between emotions and posture. Kujawa et al. [2] demonstrated that behavioural performances are altered (i.e., longer reaction time, less accuracy) in response to such affective stimuli in children and adolescents. Longuet et al. [3] showed that voluntary movement was impaired in autistic children during an aversive emotional context. The efficiency of postural stability improves non-linearly during childhood (age ~4–10) with a turning point occurring at 7–8 years [4–6]. Postural improvement is generally characterized by a decrease in magnitude and frequency of postural sway [5]. Different factors such as a better integration of sensory information, the reduction of the attentional cost allocated to posture or the selection of more appropriate strategies account for this improvement [7]. The Adult-like integration has been described around 7–8 years for a simple postural task and depends on the complexity of the postural task.

Emotional responses are commonly evaluated with pictures of the International Affective Picture System (IAPS) [8] and more recently with videos databases [9] because they provide a set of normative pleasant, unpleasant, and neutral stimuli. Two dimensions are generally used: The valence (pleasantness) and the arousal (or intensity). Different and sometimes inconsistent behavioural and physiological responses have been described in the literature during the viewing of these affective stimuli. In adults, influence of the emotional context on whole-body movements has been defined in some studies by an approach-oriented behaviour for pleasant pictures and an avoidance-oriented behaviour for unpleasant stimuli [10,11]. However, Perakakis et al. [12] did not support this observation and showed that either pleasant or unpleasant pictures induced a posterior drift of the centre of foot pressure (CoP) that significantly deviated from baseline. There is also some evidence to suggest that humans demonstrate 'postural freezing' behaviours (i.e. immobility) in response to threatening stimuli [13,14]. Attacks and mutilation stimuli resulted in a decrease of the CoP antero-posterior (AP) displacements in order to preserve the equilibrium [13–15]. Physiological changes such as cardiac deceleration, or electrodermal increase are often observed for unpleasant stimuli [13,14,16]. Women seem also to be more sensitive to negative events (i.e. threat or trauma) [17]. All these studies demonstrated an effect of positive and negative contexts on postural control in adults but

* Corresponding author at: Laboratoire TIMC-IMAG, Equipe Santé, Plasticité, Motricité, Faculté de Médecine de Grenoble – Bâtiment Jean Roget, F-38706 La Tronche cedex, France. Tel.: +33 04 76 63 74 91.
E-mail address: estelle.palluel@ujf-grenoble.fr (E. Palluel).

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there is a wide range of postural responses for a similar emotional context: This effect still remains unclear.

It is possible that the divergent results are simply due to the type of emotion and arousal of the videos or pictures selected [18]. Another limitation of the aforementioned studies is that they manipulated both valence and intensity without considering the effect of each variable, independently. For instance, some authors did not control arousal at all [13,19]. Azevedo et al. [14] attempted to select a set of likewise arousing pleasant and unpleasant pictures but both sets contained low- and high-arousal stimuli [14]. There is evidence from other paradigms that postural control and arousal evolve in the same way [20,21]. Horslen and Carpenter [22] examined the independent effects of arousal and valence and found that antero-posterior CoP frequency and electrodermal activity both increased with arousal, but not with valence while observing pictures. They found no significant leaning effect on the AP axis. Codispoti et al. [18] showed a similar skin conductance increase and cardiac deceleration during the viewing of high arousal pleasant and unpleasant films. Neurological data also suggested that the cerebral activity measured when viewing affective and neutral pictures clearly vary with emotional arousal [23]. Therefore, arousal seems to influence many behavioural, physiological, and neurological parameters independently of valence.

In the present experiment, we investigated the effects of pleasant, unpleasant, and neutral emotional contexts on postural control in healthy children and adults. We determined whether the projection of pleasant and unpleasant videos with equivalent arousal would lead to specific postural responses such as postural freezing, aversive or appetitive behaviours as a function of age. We hypothesized that postural sway would similarly increase with the viewing of high arousal videos in children and in adults, whatever the emotional context, and with no differences between males and females [22].

2. Materials and methods

2.1. Participants

40 healthy children aged 7 to 12 years (mean age = 9.3 years ± 1.6) were divided into two groups. The group 7–9 years old involved 16 males and 7 females ($n = 23$; mean age = 8 years ± 0.7) and the 10–12 years group encompassed 8 males and 9 females ($n = 17$; mean age = 11 years ± 0.7). All children were recruited from a sport association of our University. 19 healthy adults (adults group) (10 females and 9 males; mean age = 25.8 years ± 4.4) were also included in the study. All adults were students and all participants were fluent French speakers. Each adult and the parents of each child – who also gave their verbal consent-signed the written consent form of the study as required by the Declaration of Helsinki (1964). The study was approved by the local ethical committee CERNI (no. 2012-11-13-8).

2.2. Emotional stimuli

Nine videos of 30 s each were selected from the database of Leupoldt et al. [24] for children and nine other videos from the database of Schaefer et al. [25] for adults. The authors selected these videos based on the ratings (i.e. high arousal for the pleasant and unpleasant context) provided in the databases. There were three videos per emotional context (pleasant, neutral and unpleasant) for each population. All videos were evaluated by each participant with the Self-Assessment Manikin (SAM) according to their valence (unpleasant to pleasant) and arousal (low to high) on a 9-points rating scale at the end of each postural trial [8]. High scores indicated a pleasant or arousing video and low scores indicated an unpleasant or non-arousing video. For example, an extremely unpleasant yet very exciting video would have a valence score of 1 and an arousal score of 9. The average scores of the three videos per condition were highly different between the three groups of age. We finally selected one video per emotional context and per population in order to get a similar valence (Fig. 1a) and arousal (Fig. 1b) between groups, as Codispoti et al. [18]. These valence and arousal were obtained from each participant after each postural trial. Therefore, six emotional videos were finally used and randomly projected (Table 1).

2.3. Data collection

A force platform (OR6-AMTI® USA) was used to analyse the antero-posterior (AP) and medio-lateral (ML) displacements of the CoP. Data were collected at a frequency of 100 Hz [26] and were filtered with a second order Butterworth filter with a cutoff frequency of 10 Hz. The videos were projected on a 2 m × 1.6 m screen that was placed at a distance of 3 m and positioned at eyes height in front of the force platform. The video projector had a resolution of 1920 pixel × 1080 pixel. All videos had the same resolution.

Four dependent variables of CoP displacements were calculated: The mean speed on the AP and ML axes (in mm/s), the total sway path length of CoP (in mm) and the AP CoP mean position.

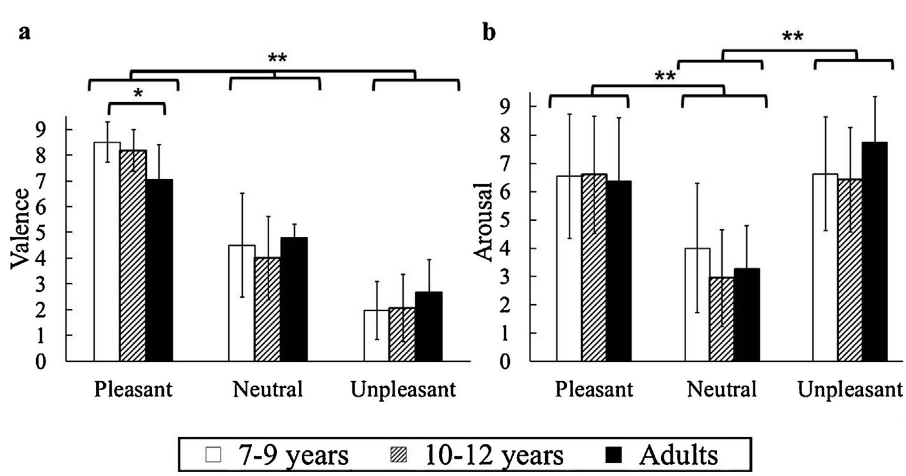

Fig. 1. Mean and ±SD of the valence (a) and arousal (b) scores for all groups. ($^{*}p < 0.01$ and $^{**}p < 0.001$).