

## Emotional Influences on the Center of Pressure Trajectory during Gait Initiation

Jessica Joyner, Kelly Gamble, Kim Fournier, Chris J. Hass, and Christopher Janelle  
Department of Kinesiology and Applied Physiology, University of Florida  
Email: [kmgamble@hhp.ufl.edu](mailto:kmgamble@hhp.ufl.edu), Web: <http://www.hhp.ufl.edu/apk/ces/affil/pp/index.php>  
Web: <http://www.hhp.ufl.edu/apk/ces/affil/nm/index.php>

### INTRODUCTION

A growing body of literature supports the long held notion that human emotion and motor actions are largely intertwined. In general unpleasant emotions prime avoidance behaviors, whereas pleasant emotions prime approach behaviors [1]. Additionally, research has shown that emotions modulate the force and speed of single joint hand and arm movements [2, 3]. However, important questions remain concerning how emotion influences whole body movements, such as gait initiation.

The purpose of the current study was to determine the impact of emotional state on the preparatory phase (center of pressure (COP) displacements and velocities) of gait initiation in healthy young adults. Given that gait initiation in our experimental task was an approach behavior, we hypothesized that exposure to pleasant pictures would facilitate gait initiation as indexed by increased displacement and velocity of the COP trace in effort to propel the person in the forward direction when moving toward the projected image. Conversely, exposure to unpleasant pictures, which prime avoidance behaviors and hinder approach-related behavior, should impede gait initiation as indexed by reduced COP displacement and velocity.

### METHODS

Fifteen females (age =  $20.53 \pm 1.69$  years), free of any lower extremity injuries, participated in this study. Participants completed two practice trials and 20 gait initiation trials. As is common in the affective sciences, pictures selected from the International Affective Picture System (IAPS) were used to manipulate emotional states during each gait trial. The IAPS provides standardized emotional stimuli, and serves as a worldwide measurement

standard for the study of emotion [4]. Presented stimuli included 15 digitized photographs including 5 unpleasant (attacking people), 5 pleasant (erotic couples) and 5 neutral (neutral faces) pictures. Five trials were completed with no picture (blank) as a control condition. Pictures (36 x 50 cm) were presented on a 2m x 1.5m screen located 6 m in front of participants. See Figure 1 for experimental set-up. Each trial began with the presentation of a fixation cross on the video screen for 2 s, which was



**Figure 1.** Experimental setup. Location of screen relative to participants' initial start position for each trial.

replaced by an IAPS image for 2-4s. Participants were instructed to look at the picture for the entire time it was on the screen. Participants immediately initiated walking with their preferred limb at picture offset and continued walking for several steps at their self-selected pace. Magnitude and velocity of the COP displacement in the mediolateral (ML) and anteroposterior (AP) directions during the 3 periods of the COP trace (S1, S2, S3) were compared across picture type.

### RESULTS AND DISCUSSION

Three separate multivariate analysis of variances (MANOVA) were conducted to determine the effect of valence (pleasant, unpleasant, neutral, blank) on the dependent variables during the 3 COP trace

periods. The MANOVA revealed a significant effect of valence ( $p = .002$ ) for the variables in the S1 region of the COP curve. Analysis of variance (ANOVA) was conducted on each dependent variable as a follow-up test. Valence category differences were significant for AP COP displacement ( $p = .05$ ), AP COP velocity ( $p = .007$ ), and ML COP velocity ( $p = .05$ ). The Bonferroni post hoc analysis revealed a significant reduction in the AP COP displacement following exposure to the unpleasant pictures relative to the pleasant pictures and control condition (See Figure 2). A significant reduction in the AP COP velocity was also observed following exposure to unpleasant pictures relative to all other conditions (See Figure 3). Finally, the ML COP velocity was significantly reduced following exposure to unpleasant relative to the neutral pictures (See Figure 4). No significant differences were found in the S2 or S3 region of the COP trace.

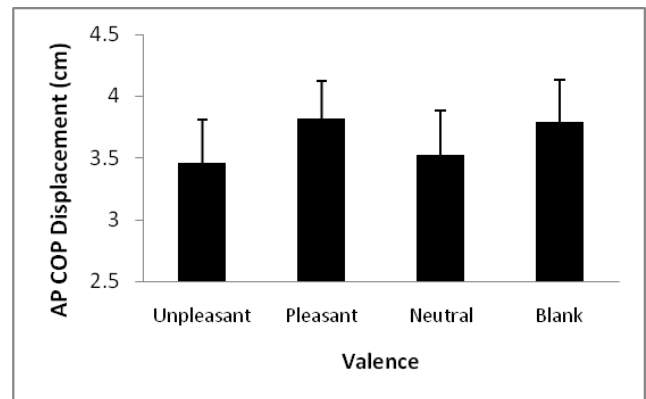
As hypothesized, exposure to unpleasant emotional pictures impeded participants' initiation of gait. Backward movement of the COP trace (i.e., anteroposterior direction) during S1 produces the forward momentum required to initiate gait. As such, these data provided seminal evidence that the induction of unpleasant emotion both diminishes and slows the backward COP movement needed for efficient gait initiation. Contrary to prediction, the exposure to pleasant pictures did not facilitate gait initiation relative to the neutral pictures and control condition.

## CONCLUSION

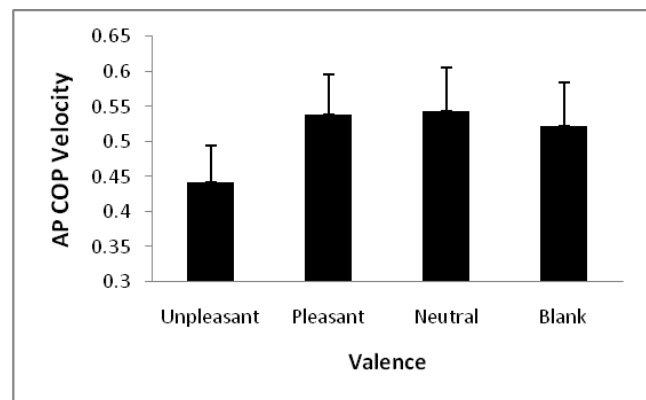
In conclusion, our findings permit strong inference that emotional state systematically modulates whole body movements, such as gait initiation. Additionally, the data indicate that unpleasant affective states (i.e., threat) can interfere with efficient gait initiation, having important implications for populations with postural and gait difficulties. Implications and future directions are discussed.

## REFERENCES

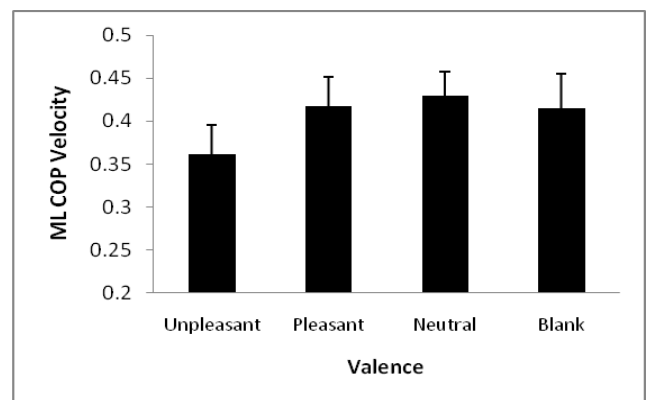
- 1.Chen M and Bargh JA. *Personality and Social Psychology Bulletin* **25**, 215-224, 1999.
- 2.Coombes SA, et al. *Emotion* **7**, 275-284, 2007.



**Figure 2:** AP COP displacement during the S1 phase of gait initiation



**Figure 3:** AP COP velocity during the S1 phase of gait initiation



**Figure 4:** ML COP velocity during the S1 phase of gait initiation

- 3.Coombes SA, et al. *Emotion* **8**, 104-113, 2008.
- 4.Lang PJ, et al. *International affective picture system (IAPS): Instruction manual and affective ratings* (Tech. Rep. No. A-6). University of Florida, Gainesville, FL.