JOURNAL OF SPORT & EXERCISE PSYCHOLOGY, 2004, **26**, 338-351

Motivated Engagement to Appetitive and Aversive Fanship Cues: Psychophysiological Responses of Rival Sport Fans

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Psychophysiological responses of two rival sport fan groups were assessed within the context of Lang's biphasic theory of emotion. Twenty-four participants, placed in two groups based on their identification with local sport teams, viewed 6 pictures from 6 categories: team-relevant pleasant sport, team-irrelevant sport, team-relevant unpleasant sport, erotica, household objects, and mutilation. Fans rated appetitive sport pictures higher in pleasure and arousal compared to aversive sport pictures. Physiological measures (startle probe-P3, the startle eye-blink reflex, slow cortical potentials to picture onset, and skin conductance) differentiated both appetitive and aversive team-relevant categories from team-irrelevant pictures, and increased orbicularis oculi EMG was found only for team-relevant appetitive pictures. These results suggest there are differences between rival sport fans in response to the same pictorial stimuli, and further suggest that fans provide an ideal population in which to measure motivation toward appetitive stimuli.

Key Words: startle reflex, sport spectators, event-related potentials, P3

The affective, cognitive, and behavioral reactions of high-identified fans tend to be quite extreme due to the increased importance placed on their team's performance (Wann, Melnick, Russell, & Pease, 2001). The motivations for this increased importance have been related to social (group affiliation, family), personal (self-esteem, escapism), and entertainment factors (Wann et al., 2001), suggesting that the fundamental causes of fanship are multifaceted. In addition, the concomitant behavioral responses are equally as diverse and include attempts to influence the outcome of the game, wearing face paint and peculiar costumes in the team's colors, and in more serious instances, violent or aggressive actions. Instances of this behavior have become increasingly commonplace, and one report has even suggested that defeat may prompt symptoms of posttraumatic stress (Banyard & Shevlin, 2001). Thus, sport fans may provide a model for highly motivated behavior and how it is socialized.

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Previous research by Hillman and colleagues (Hillman, Cuthbert, Cauraugh, et al., 2000) found palpable psychophysiological responses associated with varying degrees of identified sport fanship and framed these affective responses within the biphasic theory of emotion (Lang, 1985; Lang, Bradley, & Cuthbert, 1997). This theory organizes emotion along two motivational systems, appetitive and defensive (i.e., hedonic valence), which are founded on primitive neural circuits and have evolved to mediate environmental interactions that either promote or threaten survival (Bradley, Codispoti, Cuthbert, & Lang, 2001; Lang, 2000).

The direction of one's response to these interactions results from the motivational significance of the stimulus and has been measured through three response systems indicative of valence and arousal: expressive and evaluative language, physiological changes mediated by the somatic and autonomic nervous systems, and behavioral sequelae (Lang, 1968, 2000). With regard to physiological changes, several measures have been found to be consistent with the valence or arousal dimensions of emotion. Specifically, the startle eye-blink reflex has been shown to covary with rated emotional valence, while cortical slow potentials, the P3 component of a startle-induced event related potential (ERP), skin conductance, and baseline electromyography (EMG) of the orbicularis oculi are indices of a dimension of arousal associated with emotional responding (Lang et al., 1997). In the context of the picture-viewing paradigm, these arousal measures have been taken to reflect the degree of "motivational engagement" with the stimulus. That is, arousal in this context involves to a great extent the intrinsic allocation of attentional resources needed to process incoming stimuli with high motivational significance (Lang, 2000).

In the framework of biphasic theory, previous psychophysiological research on sport fans compared the responses of low-, moderate-, and high-identified fans to pictures depicting their identified team and team-irrelevant sport cues (Hillman et al., 2000). Results showed that high-identified fans responded to team-relevant cues (i.e., pictures depicting their identified team in action) compared to team-irrelevant pictures (no overt fanship cues), with smaller startle probe-elicited P3 amplitude, more heart rate deceleration, and greater cortical positivity relative to lower identified fan groups. These findings were interpreted to reflect increased motivational engagement with the team-relevant pictures for high-identified fans. Further, no group differences were observed for team-irrelevant sport pictures, suggesting that the motivation of high-identified sport fans is team-specific. This indicates that varying levels of engagement are observable for the same appetitive stimuli based on motivational intensity.

Replicating and extending the research by Hillman et al. (2000), the current study examined two rival groups of high-identified sport fans in response to three categories of sport pictures: team-relevant pleasant pictures (scenes of participants' identified team defeating their rival team); team-relevant unpleasant pictures (scenes of participants' identified team being defeated by their rival team); and team-irrelevant sports cues (scenes with no overt fanship cues) using cortical and autonomic psychophysiological measures. Due to the inclusion of the two fan groups, each picture served as its own control for the pleasant/ unpleasant contrast. For the sake of brevity, we will refer to team-relevant pleasant pictures as winning pictures and team-relevant unpleasant pictures as losing pictures.

The three sport picture categories were used to exemplify appetitive and aversive aspects related to motivated sport fanship. However, it should be noted that in the greater context of emotion, scenes depicting sport are generally considered to be highly appetitive, but less arousing than other appetitive stimuli such as erotica, since sport is less relevant to species survival (Bradley et al., 2001). Accordingly, three other categories of pictures (erotica, household objects, and mutilation) were included for use as emotional controls to examine whether differences in affective responses of rival fan groups were content-specific.

It was hypothesized that winning scenes would elicit significant differences compared to losing scenes on measures of affective valence—smaller startle eye-blink responses and increased SAM (Self-Assessment Manikin) pleasure ratings for winning relative to losing pictures. Note that this involves a within-subjects analysis in which "winning" and "losing" contents include different actual slides for members of the two fan groups (e.g., slides of Florida winning for Florida fans, and Florida State winning for FSU fans). Both winning and losing scenes were also hypothesized to differ from team-irrelevant sports pictures on measures of arousal: SAM arousal ratings, startle probe-P3, cortical slow potentials, skin conductance, and orbicularis oculi EMG. However, winning and losing scenes were not expected to differ on these arousal measures, since previous research has indicated that both appetitive and aversive pictures elicit increased intensity when compared with affectively neutral scenes (e.g., Bradley et al., 2001; Lang et al., 1997).

It was further hypothesized that the two rival groups of fans would exhibit opposite responses for measures of hedonic valence to a given set of team-relevant pictures (e.g., those of FSU winning), but similar responses to team-irrelevant pictures. Specifically, this would be observed for measures of the startle eye-blink reflex and SAM pleasure ratings. In contrast, measures of the arousal dimension were predicted to display similar responses to each set of pictures for both groups of rival fans, since both were anticipated to be comparable in arousal value. Responses to the three emotional control categories were not expected to differ based on team identification.

Method

Participants

Twenty-four (14 M, 10 F) volunteers from the Gainesville, Florida, area were paid $15 for participating in the experiment. Their mean age was 24 years. Participants were selected based on their extreme identification with either the University of Florida Gator or the Florida State Seminole football teams and were recruited through ads. All participants averaged 6.5 or higher (on an 8-point Likert scale) on the Sport Spectator Identification Scale (SSIS; Wann & Branscombe, 1993) to qualify for this experiment. This valid and reliable scale has been used previously to measure affiliation with various sport teams (Wann et al., 2001).

Apparatus and Response Measures

The electroencephalogram (EEG) was recorded using a Nihon-Kohden amplifier and LabView software on a Macintosh computer. The International 10-20 system (Jasper, 1958) was followed for 7 electrode sites: F3, Fz, F4, Cz, P3, Pz, and P4, and Sensormedics silver/silver chloride miniature electrodes were placed on the mastoids (A1, A2). All channels were referenced to Cz and digitally re-referenced off-line to linked mastoids. Vertical and horizontal eye movements were recorded using Sensormedics silver/silver chloride miniature electrodes to account for ocular artifacts. A 35-Hz high-frequency cutoff and a 10-s time constant (.016-Hz low-frequency cutoff) were used to record all cortical and ocular channels. To shorten the time slew between EEG channels, we used a data sampling rate of 1250 Hz/channel and then converted off-line to 125 Hz/channel (Miller, 1990) by discarding 9 of every 10 samples. Ocular artifacts were corrected off-line using an eye movement artifact correction procedure, which corrected for vertical eye movements followed by horizontal eye movements (Gratton, Coles, & Donchin, 1983; Miller, Gratton, & Yee, 1988). EEG was recorded from 3 s prior to slide onset until 1 s after slide offset (i.e., 10 s). Any individual trial that contained an off-scale channel was excluded from the analysis.

Stimulus presentation, stimulus timing, and data collection were controlled by a Northgate 486 microcomputer using VPM software (Cook, 1994). Skin conductance was collected from adjacent sites with standard Sensormedics silver/silver chloride electrodes placed on the hypothenar eminence of the left palm. The electrodes were filled with 0.05 Molar Unibase cream electrolyte (Fowles, 1981). A Coulbourn S71-22 skin conductance coupler administered a constant 0.5 volts across sensors. The skin conductance coupler was calibrated to record a range of 0–40 µSiemens before each recording session.

The eye-blink response to the startle probe was assessed by recording EMG activity from the orbicularis oculi muscle beneath the left eye. Two adjacent Sensormedics silver/silver chloride miniature electrodes filled with electrolyte paste were used. The raw EMG signal was amplified and routed through a Coulbourn S75-01 bioamplifier. The signal was bandpass filtered from 90 to 250 Hz. It was then rectified and integrated using a Coulbourn S76-01 contour with a time constant of 125 ms. The blink response was sampled at 1,000 Hz from 50 ms before until 250 ms after the acoustic startle-probe onset.

Finally, we used a computerized version of the Self-Assessment Manikin (Lang, 1980) to gather subjective ratings on the dimensions of pleasure and arousal. The SAM is an interactive computer display that was animated on a 0- to 20-point scale and controlled by an IBM-XT computer. The SAM was displayed on a 12-in. computer monitor approximately 2.0 m from the participant directly below the slide projection screen. Participants used a joystick that manipulated the SAM to make their ratings.

Stimulus Materials and Design

Participants viewed 30 color slides from the International Affective Picture System[1] (IAPS; Center for the Study of Emotion and Attention, 1997), depicting 5 scenes from each of the 6 affective categories: winning football scenes (identified team beating rival team on a particular play); losing football scenes (identified team losing to rival team on a particular play); team-irrelevant sports (no overt fanship cues, e.g., individual or other team sports); erotica (couples engaged in sexual activity); benign household objects; and pictures of mutilated victims. The football

[1] IAPS: University of Florida dominating Florida State University – 8107, 8112, 8126, 8129, 8133; Florida State University Seminoles dominating University of Florida – 8108, 8128, 8131, 8132, 8134; Team-irrelevant sports – 8034, 8116, 8117, 8130, 8311; Erotica – 4659, 4664, 4680, 4800, 4810; Household objects – 7000, 7030, 7080, 7090, 7170; Mutilation – 3000, 3071, 3102, 3130, 3150

pictures depicted the University of Florida and the Florida State University teams competing against each other with specific pictures including scenes of players catching passes, blocking punts, and celebrating after touchdowns.

Slide viewing took place in a private room where the participants were free from experimenter interaction during the course of the experiment. Pictures were presented on a white matte approximately 2.0 m from a reclining chair where participants sat. The visual angle of the slides was approximately 24 deg. Slides were presented using a Kodak Ektagraphic III slide projector and controlled by a Northgate computer. The order of slide presentation was balanced across participants.

During each of the 30 trials, an acoustic startle probe was administered after slide onset. The startle probe consisted of a 50-ms burst of 95-dB white noise with instantaneous rise time. This stimulus was generated by a Coulbourn S81-02 white noise generator and an S82-24 amplifier. A Quest model 1700 precision impulse sound level meter was used to calibrate the white noise burst. The probe was delivered at either 2.5 or 4.5 s into the 6-second slide-viewing period. Startle probes were presented binaurally using calibrated telephonic TDH-49 headphones. Across participants, the noise burst was counterbalanced to ensure that slides were probed during both times with equal frequency in each condition. Finally, five startle probes were delivered during the intertrial interval to assess the effects of the startle probe in the absence of an affective foreground stimulus. This also minimized the predictability of the times in which the startle probe would be administered.

Procedure

Upon arriving at the laboratory, participants were told that the purpose of the experiment was to examine emotional responses related to sport. They completed the informed consent form and were invited to ask questions; then physiological sensors were attached. For the cortical measures, Elefix EEG paste was applied to each site and the sensor was attached. A ground sensor was placed on the left forearm and skin conductance sensors were placed on the left palm. Startle blink reflex, vertical and horizontal eye movement, and mastoid sensors were then attached to the corresponding regions of the face. When the participants were seated comfortably, they were fitted with headphones, the lights were dimmed, and they were given a few minutes to acclimate to the room.

Participants were instructed that slides would appear on the screen in front of them and that the pictures were to be viewed the entire time they were being presented. In addition, participants were familiarized with the use of the SAM and instructed to ignore any brief, occasional noises heard through the headphones. Then two practice trials were presented. When all questions were answered, slides were presented for 6 s each with a randomly determined intertrial interval of 6 to 18 s. Following each slide, participants rated the picture using the SAM along the dimensions of pleasure, arousal, and dominance. After the ratings for the final slide were completed, the physiological sensors were removed. Finally, participants filled out the SSIS and the postexperimental questionnaires and were debriefed as to the purpose of the experiment.

Physiological Data Reduction and Analysis

Each peak of the ERP (i.e., N1, P2, N2, P3) to the acoustic startle probe was scored by a computer algorithm which determined the base-to-peak amplitude on averaged waveforms for each participant, affective category, and electrode site. The P3 component window was from the N2 latency until 504 ms. Peaks for N1, P2, and N2 were also scored, but no significant findings occurred and the results are not reported here.

Similar to the probe-ERP reduction, cortical slow-wave potentials to picture onset were scored for specific time intervals in the 1st through 4th second of the picture period: 300–400 ms, 400–700 ms, 700–1000 ms, 1000–2000 ms, and 3000–4000 ms. The 2000–3000-ms and 4000–5000-ms time periods were excluded from slow potential analyses as they contained the startle probes. For each individual time period, base-to-peak amplitude was calculated for each participant, affective category, and electrode site (Cuthbert, Schupp, Bradley, Birbaumer, & Lang, 1996).

Averaged EMG activity was reduced in half-second intervals and calculated in change scores by subtracting the mean activity during the 1 second preceding picture onset from the average response during the picture viewing period (6 s). In addition, an average for the entire slide viewing period was calculated in each participant for all pictures in an affective category. Similarly, skin conductance response magnitude was scored as the largest value, in μSiemens, from 0.9 s to 4.0 s after picture onset. Change scores from baseline activity for skin conductance response were also calculated.

Startle responses were scored off-line for baseline orbicularis activity, startle magnitude, peak latency, onset latency, and peak amplitude. Startle magnitudes were converted for each participant to a standardized T-score, with a mean of 50 and a standard deviation of 10, using all trials with valid data for that participant as the reference distribution.

Two separate analyses were conducted for each measure to examine affective responses of sport fans. The first analysis combined the two groups of sport fans (University of Florida Gator fans and Florida State Seminole fans) to study overall affective responses to varying sport pictures. A one-way ANOVA was conducted on the three sport categories: winning, team-irrelevant, and losing pictures. Second, response differences between the two rival groups of football fans (UF Gator and FSU Seminole) were analyzed using a 2 × 2 (between: Spectator Group × within: Team-Relevant Picture Categories) mixed-design ANOVA.

In accord with the hypotheses about expected patterns of results along the valence and arousal dimensions, five planned comparisons (each with a Bonferroni-corrected *p*-value of .01) were used to test differences between the emotional control pictures and the sports pictures: winning vs. unpleasant (mutilation) pictures; winning vs. pleasant (erotica) pictures; losing vs. unpleasant pictures; losing vs. pleasant pictures; and team-irrelevant vs. neutral pictures. Only the first and fourth contrasts were expected to differ for measures of valence. The comparisons for arousal measures were expected to reveal whether, in these groups of highly motivated fans, the team-relevant pictures would be comparable to the emotion control (erotica, mutilation) categories.

Analyses of probe-P3 ERPs were confined to the parietal leads. This decision was based on a preliminary omnibus analysis that comprised three within-subjects factors—a valence factor that included all 6 content categories, 3 sport and 3 non-sport; a topography factor that included two regions, the frontal (F3, Fz, and F4) and parietal (P3, Pz, and P4) rows; and an electrode site factor that included the left (F3, P3), central (Fz, Pz), and right (P3, P4) leads. The results showed an overall significant effect for valence, $F(5, 19) = 3.1$, $p < .05$. Although this main effect interacted with topography, Content × Region $F(5, 19) = 3.2$, $p < .05$, follow-up tests indicated that while the means were in the same directions at both frontal and parietal sites, only the latter showed a significant condition effect when tested separately, $F(5, 19) = 5.2$, $p < .005$. Thus, analyses are reported for parietal leads only.

Preliminary analyses of the slow waves showed comparably strong valence effects at both frontal and parietal regions. Accordingly, slow wave data are also presented only for parietal sites to maintain consistency with the ERP analyses. Electrode site did not vary systematically with Content, and so this variable is not considered further in any electrocortical analyses.

For all analyses, tests with three or more within-subject levels were conducted using the multivariate Wilks' Lambda test to control for possible nonhomogeneity of the variance/ covariance matrix. Follow-up univariate ANOVAs and *t*-tests were used to break down all significant interactions.

Results

Results will be discussed in five sections. The first section compares the sport categories with the emotional control categories. The other four sections focus solely on differential sport fans' responses to the sport picture categories and include subjective report data, affective responses to the startle probe, cortical slow potentials to picture-viewing, and electromyographic and peripheral response during picture-viewing.

Sport and Emotional Control Pictures

Overall, rival fan group responses did not differ for the standard affective picture categories (erotica, household objects, and mutilation); accordingly, fan group is not considered further in these analyses. Data for all conditions and measures are shown in Table 1.

As shown in the left three columns of Table 1, responses to standard affective pictures were generally in accord with prior studies using these pictures. Valence and arousal ratings were highly significant in the expected directions. Startle blinks exhibited the typical relationship to affective valence. Skin conductance and orbicularis oculi EMG mirrored arousal ratings, with greatly increased responding for the two high-arousal categories compared to neutral. Similar to skin conductance, both P3 and slow waves covaried as anticipated with arousal ratings: Higher-arousing pictures resulted in more initial positivity of slow waves, and smaller P3 responses to the startle probes. Thus, overall the results were highly consistent with prior studies of pleasant, neutral, and unpleasant picture categories with respect to measures typically covarying with both valence and arousal (Bradley et al., 2001).

In general, the planned comparisons of sports pictures with standard pictures revealed comparable reactivity. Winning pictures prompted the most positive valence ratings of any picture category for this ardent fan group; in contrast, the blink responses yielded the opposite effect, with the overall smallest blinks elicited during erotic slides. Team-irrelevant sports pictures were rated as more pleasant and more arousing than the neutral household objects, while eye blinks elicited during the latter were smaller than during the former. Both winning and losing pictures did not differ in arousal ratings from either erotica or mutilation, nor did skin con-

Table 1 Mean (*SE*) Values for All Measures to Each Picture Category

Measure	Pleasant	Neutral	Unpleasant		Winning	Irrelevant	Losing
			Picture Category				
Valence ratings	14.9	10.1	3.8	***	17.3+ –	12.3 n	5.4+
(0–20 scale)	(0.7)	(0.2)	(0.6)		(0.5)	(0.4)	(0.6)
Arousal ratings	14.7	3.9	13.7	***	15.9	10.0	13.0
(0-20 scale)	(0.8)	(0.6)	(0.8)		(0.6)	(0.7)	(0.6)
Eye-blink startle	45.4	47.2	50.2	**	49.4+	52.0 n	48.8
(T-score)	(0.5)	(0.6)	(1.0)		(1.1)	(0.7)	(0.9)
P3 startle	10.6	15.8	14.0	*	12.0	17.1	14.1
(P3, Pz, P4)	(1.3)	(1.9)	(1.3)		(2.0)	(1.8)	(1.4)
Slow wave (P3, Pz, P4)	15.2	9.3	13.4	**	16.1	8.2	13.6
(700–1000 ms)	(1.5)	(1.0)	(1.6)		(1.4)	(1.2)	(1.8)
Orbicularis EMG	0.34	0.01	0.29	*	1.23+ –	0.31 n	0.20
(µV)	(0.11)	(0.05)	(0.11)		(0.29)	(0.09)	(0.13)
Skin conductance	0.11	0.02	0.09	***	0.09	0.01	0.07
µSiemens	(0.02)	(0.01)	(0.02)		(0.02)	(0.01)	(0.02)

Note: Asterisks denote differences among the three emotion control categories (left three columns): *$p < .05$; **$p < .01$; ***$p < .001$. Significant planned comparisons at $p < .01$ for sports pictures (see text) are denoted by '+', '–', and 'n' for contrasts with pleasant, unpleasant, and neutral pictures, respectively.

ductance, slow waves to picture onset, or P3 responses to the startle probes. For orbicularis EMG, pictures depicting winning situations evoked by far the largest responses, differing considerably from erotica or mutilation pictures.

Subjective Report

For valence ratings, fans reported significantly more pleasure to winning pictures compared to team-irrelevant sports scenes. Conversely, losing pictures elicited significantly less pleasure relative to team-irrelevant sports pictures. This resulted in a significant picture category effect, $F(2, 22) = 114.0$, $p < .0001$. When fan group was included as a factor, a significant interaction with picture category occurred, $F(2, 21) = 163.8$, $p < .0001$, as both groups reported increased pleasure to scenes in which their own team was beating their rival team compared to losing to their rival team (see Table 2). Follow-up univariate ANOVAs on each picture category confirmed this finding since significant group differences were found for both winning and losing picture categories, $F(1, 22) < 72.12$, p's $< .0001$. No differences were observed for team-irrelevant pictures.

Subjective arousal judgments revealed increased arousal for both winning and losing picture categories compared to team-irrelevant sport pictures, $F(2, 22) = 59.16$, $p < .0001$, and winning pictures evoked greater responses relative to losing pictures, $F(1, 23) = 13.51$, $p < .01$. Fan group also interacted with picture category,

Table 2 Mean (*SE*) Valence and Arousal Ratings for Each Picture Category by Rival Fan Group

	Valence			Arousal		
Fan group	U. FL winning	Team-irrelevant	FL State winning	U. FL winning	Team-irrelevant	FL State winning
U. FL Gator	17.0 (.8)	12.2 (.5)	3.4 (.7)	14.8 (.8)	9.7 (1.0)	14.7 (.8)
FSU Seminole	7.4 (.8)	12.4 (.5)	17.7 (.7)	11.4 (.8)	10.4 (1.0)	17.0 (.8)

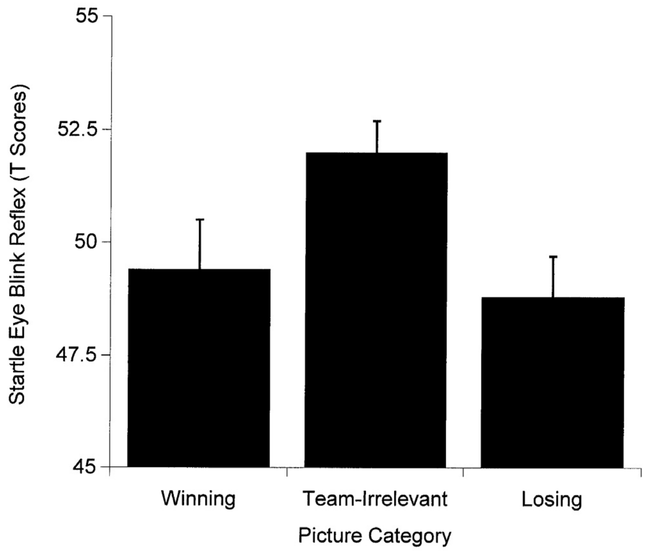

Figure 1 — Startle-blink reflex for the three picture categories regardless of fan affiliation.

$F(2, 21) = 49.0$, $p < .0001$, as Seminole fans rated winning pictures with increased arousal compared to losing pictures. This effect was not observed for the Gator fans (see Table 2).

Acoustic Startle Probe

Two physiological measures to the acoustic startle probe were collected: the eye-blink response and the P3 component of the ERP.

Eye-Blink Response. Smaller eye-blink responses were observed for both winning and losing categories compared to team-irrelevant sports pictures, resulting in a marginal picture category effect, $F(2, 21) = 3.06$, $p < .07$ (see Figure 1). This picture category effect did not interact with fan group.

Probe-P3. As mentioned above, these analyses employed the parietal electrode row. Both winning and losing categories elicited smaller P3 peaks compared to team-irrelevant sport pictures, $F(2, 22) = 9.4$, $p < .002$ (see Figures 2 and 3). Winning and losing pictures did not differ. In addition, no significant interaction with fan group was found, $F < 1$.

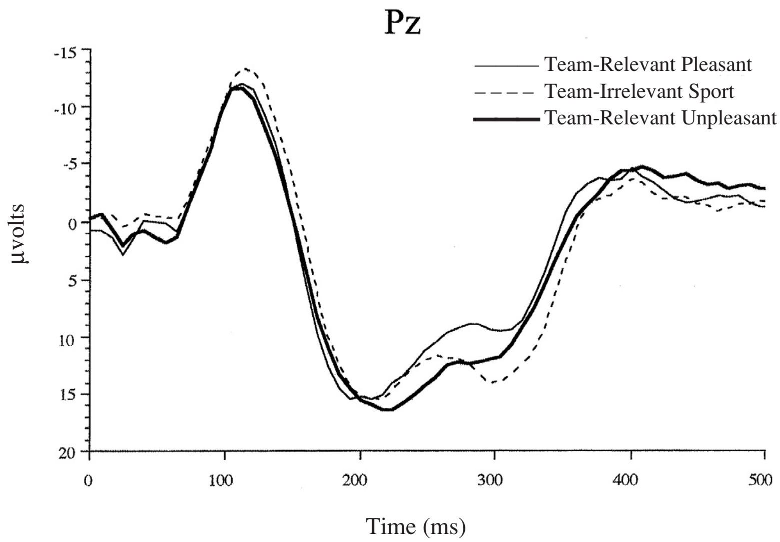

Figure 2 — Startle-probe ERP waveform for the 3 picture categories regardless of fan affiliation.

Cortical Slow Potentials

Slow potentials to picture-viewing were characterized by an initial negativity following picture onset that gave way to a sustained positive-going waveform. This waveform gradually returned to prestimulus baseline after approximately 5000 ms. For these analyses, the 700–1000-ms time period was used to study cortical effects during the first second of picture viewing. All other time periods (300–400 ms, 400–700 ms, 1000–2000 ms, and 3000–4000 ms) yielded highly similar results and thus will not be discussed further in order to simplify presentation.

As predicted, results showed strongly increased positivity for winning and losing pictures versus team-irrelevant sport pictures, $F(2, 22) = 15.6$, $p < .001$ (see Figure 3). In contrast, winning and losing pictures did not differ in slow wave magnitude. Furthermore, fan group did not interact significantly with picture category.

Electromyographic and Peripheral Responses

Skin Conductance Response. The natural log score for peak skin conductance revealed that winning and losing pictures elicited increased activity compared to team-irrelevant material, $F(2, 22) = 5.36$, $p < .02$ (see Table 1). No significant differences based on fan group were found.

Orbicularis Oculi EMG. The EMG from the orbicularis oculi muscle revealed that fans showed increased activity to winning pictures compared to losing and team-irrelevant sports scenes, $F(2, 21) = 7.53$, $p < .005$ (see Table 1). Further, fan group interacted with picture category, $F(1, 22) = 9.29$, $p < .01$, as both groups showed greater EMG activity to pictures of their team winning compared to losing and team-irrelevant pictures. Follow-up univariate ANOVAs revealed that this effect was significant for Gator fans, $F(2, 10) = 4.78$, $p < .05$, but only marginally significant for Seminole fans, $F(2, 10) = 3.59$, $p < .07$.

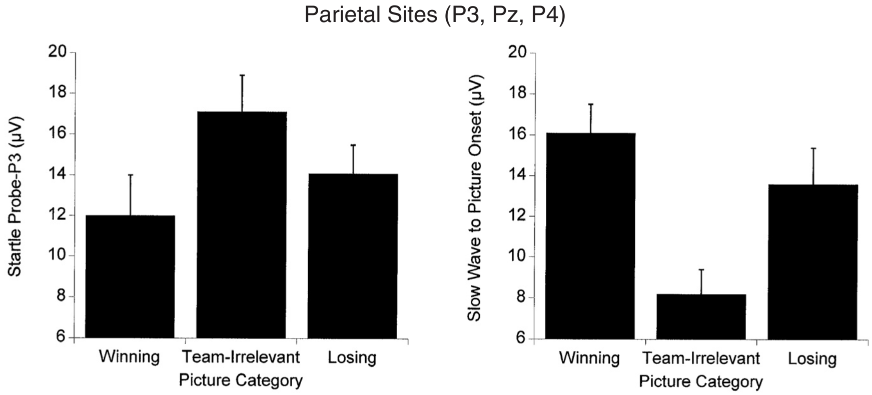

Figure 3 — Means (*SE*) for probe-P3 (left) and cortical slow wave to picture onset (right). Both panels represent parietal sites for the 3 picture categories regardless of fan affiliation.

Discussion

Framed by the biphasic theory of emotion (Lang, 1985, 2000), the purpose of this study was threefold. First, affective responses of sport fans were assessed to sport-relevant stimuli that varied along the hedonic valence dimension. That is, emotional sport pictures were selected to represent appetitive and aversive fanship stimuli. Previous works included solely pleasant sport pictures (as determined by subjective ratings; Hillman et al., 2000; Lang, Greenwald, Bradley, & Hamm, 1993). Second, this study determined whether rival fan groups differed in their physiological responses to the same eliciting stimuli. Third, the current study extended the database determining the role of sport in the larger spectrum of emotion.

In sum, the results of this study were consistent with the hypothesis that there would be increased affective engagement for motivated sport fans viewing their identified team compared to team-irrelevant sport stimuli. For subjective appraisals, valence ratings reflected the fans' pleasure to pictures of their team in winning circumstances and displeasure to seeing their team in losing situations, with team-irrelevant pictures falling between the two team-relevant categories. Arousal ratings revealed that both winning and losing pictures were appraised as more arousing compared to team-irrelevant sport stimuli, regardless of fan affiliation. Smaller startle probe-P3 and startle-blink reflex, increased positive slow cortical potentials to picture onset, and greater skin conductance response also differentiated winning and losing pictures from team-irrelevant sport scenes. Finally, increased orbicularis oculi EMG activity was evident only for winning scenes compared to the other two sport categories.

Generally, subjective measures of valence and arousal related fairly consistently to physiological responses to picture-viewing. As hypothesized, differences in startle probe-P3 amplitude were elicited using team-relevant and team-irrelevant pictures. Specifically, both winning and losing categories elicited attenuated probe P3 peaks compared to team-irrelevant sport pictures. P3 differences are interpreted using a dual task model of attention (Donchin & Coles, 1988; Picton, 1992). As such, engagement for the primary stimulus (i.e., affective pictures) uses an increased finite attentional store; therefore fewer attentional resources may be allotted for secondary stimulus (i.e., startle probe) processing (Schupp, Cuthbert, Bradley, et al., in press). In accordance with Hillman et al. (2000), and confirming our expectations, no differences were observed between winning and losing pictures, since both categories contained identified fanship cues, which are judged with increased arousal compared to team-irrelevant sport pictures. Hence, picture category differences based on specific fan group identification were also not expected.

Startle-blink responses to picture-viewing also appeared to be modulated by stimulus engagement, which on the surface may appear contradictory to previous affective startle data (e.g., Lang et al., 1990) since winning and losing pictures elicited inhibition of the eye-blink response compared to team-irrelevant cues. However, recent developments in affective startle research have shown that pleasant and unpleasant pictures of low or moderate arousal elicit less affective modulation of the eye-blink reflex. That is, only high arousing content has demonstrated the affect-startle effect, with unpleasant pictures eliciting potentiation and pleasant pictures evoking increased inhibition compared to neutral stimuli (Cuthbert, Bradley, & Lang, 1996). As such, compared to scenes of erotica and harm or threat—contents judged highest in arousal—other semantic picture categories (e.g., sport) that are judged equally pleasant or unpleasant, but less arousing, may not exhibit the same startle-blink modulation (Bradley et al., 2001). This finding has been theorized to reflect humans' motivational hierarchy (the need to procreate, avoid harm, etc.; Bradley et al., 2001).

Furthermore, pleasant, team-irrelevant, and unpleasant sport scenes only differed slightly along the spectrum of emotion since all contain similar content. Therefore the observed inhibition for both winning and losing categories compared to team-irrelevant pictures may reflect increased motivational engagement for identified sport cues, and not the designation of a priori valence assignments. Additional research is needed to help us understand the affect-startle effect as it relates to sport fans and sport cues. Examining sport fans' gaze behavior using visual search technology may shed light on this finding through the systematic observation of which regions of the pictorial stimuli individuals fixate upon, as it may be that motivated fans spend considerable time looking at a specific component of the scene depicting their team regardless of whether the overall scene shows their team winning or losing.

Replicating previous research on sport fans (Hillman et al., 2000), slow cortical potentials to picture-viewing differentiated team-relevant from team-irrelevant pictures, as increased positivity was apparent in the former compared to the latter. This effect is believed to occur because EEG positivity indexes the processing of emotional stimuli, as is suggested by the strong correlation between EEG positivity and subjective arousal appraisals (Cuthbert, Schupp, et al., 1996). Increases in EEG positivity did not differ based on fan group, further suggesting that slow potentials to picture-viewing are modulated by stimulus arousal.

Additional evidence of arousal modulation differences in identified fans' responses to varying picture categories comes from changes in skin conductance. Notably, this measure reflects changes in the sympathetic nervous system, rather than the central nervous system responses discussed above. Similar to both startle probe measures and slow cortical potentials, skin conductance differentiated both team-relevant categories from team-irrelevant pictures, with increased activity in the former. This finding corroborates earlier picture-viewing research (Bradley et al., 2001; Cuthbert, Schupp, et al., 1996; Lang et al., 1993) in which skin conductance increased with arousal judgments, implying increased attentional engagement for the pictorial stimulus.

Facial expressions have often been measured in response to affective pictorial stimuli (Ekman, Friesen, & Ellsworth, 1972; Lang et al., 1993). Sport fans respond to identified sport cues with overt affective engagement. Therefore, facial activity should be a measurable part of their affective responses to identified sport cues. Interestingly, increased orbicularis oculi EMG resulted only for winning pictures compared to team-irrelevant and losing cues. Previous research has generally shown that increased muscle activity in this region varies with picture arousal (Lang et al., 1993). The fact that EMG activity was increased solely for winning pictures may reflect changes associated with pleasant facial expressions (i.e., the Duchenne smile). Future research should include measurement of facial muscle activity, such as the zygomatic major, to test this relationship. Finallly, when fan group was included as a factor, an interaction with picture category occurred since both groups only showed increased activity to their identified team in dominant situations, further supporting this effect.

In conclusion, these results suggest that identified fanship cues can accurately differentiate physiological responses in sport fans, extending earlier work in this area (Hillman et al., 2000). Furthermore, rival fan groups displayed differential physiological responses to the same pictorial stimuli, suggesting that motivation for specific stimuli is measurable in an identified population. As a whole, this study supports the use of sport fans as a population in which to better understand physiological concomitants of personally relevant motivated engagement for appetitive stimuli.

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Acknowledgment

This work was supported in part by National Institute of Mental Health grants MH37757, MH43975, and MH52384, and National Institute of Aging grant AG09779 to Peter J. Lang.

These data were presented to the North American Society for the Psychology of Sport and Physical Activity in Chicago in 1998 (Hillman, Cuthbert, Bradley, & Lang).

Manuscript submitted: November 2002
Revision accepted: October 11, 2003