THE INFLUENCE OF A MOTIVATIONAL CLIMATE INTERVENTION ON PARTICIPANT SALIVARY CORTISOL AND MOTIVATIONAL RESPONSES

by

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Abstract

The purpose of this study was to examine college students' stress responses, as measured by salivary cortisol, in a caring/task-involving climate compared to an ego-involving climate. In addition, the association between motivational climate and motivational responses (i.e., self-reported enjoyment, effort, anxiety, self-confidence, stress, shame, self-consciousness, and intent and excitement to continue juggling) were examined. Participants (n = 107; M_{age} =19.89 years) were separated by sex (i.e., male and female) and randomly assigned to either a caring/task- or an ego-involving motivational climate where they spent 30 minutes learning how to juggle. Seven salivary cortisol samples were collected over a 2-hour period. Results indicated that participating in the ego-involving climate elicited a significant salivary cortisol spike, while participating in the caring/task-involving climate led to a significant decrease in salivary cortisol levels. In addition, the ego-involving climate participants reported significantly higher levels of cognitive anxiety, somatic anxiety, stress, shame, and self-consciousness, whereas the caring/task-involving climate participants reported significantly higher levels of effort, enjoyment, self-confidence, and interest and excitement in juggling in the future. The present study builds on goal perspective research by providing physiological evidence that participating in an ego-involving motivational climate can not only result in maladaptive motivational responses but may also elicit a significant cortisol spike.

Keywords: stress, achievement goal theory, cortisol, sport performance, motivational climate

The Influence of a Motivational Climate Intervention on Participant Salivary Cortisol and Motivational Responses

Research in Goal Perspective Theory (Nicholls, 1984, 1989) has provided practitioners and researchers alike with insight into how motivational climates (i.e., caring, task- and ego-involving) are associated with cognitive, affective, and behavioral responses (Fry & Newton, 2003; Smith, Smoll, & Cumming, 2007). The response variation associated with these markedly different motivational climates has resulted in a better understanding of the controllable factors that predict more advantageous motivational responses in achievement-based settings (Gano-Overway et al., 2009; Ntoumanis & Biddle, 1999). Specifically, the intentional creation of caring and task-involving climates that focus on personal effort, improvement, and belonging, yield more positive, adaptive responses (Balaguer, Duda, & Crespo, 1999; Newton et al., 2007). In contrast, perceptions of an ego-involving climate in achievement-based settings, where success is defined by outperforming others, are more frequently associated with maladaptive motivational and behavioral outcomes (Quested & Duda, 2009; Solmon, 1996). While there is an extensive body of research supporting the benefits of creating a caring and task- as opposed to an ego-involving climate, researchers have not yet explored the potential physiological stress responses participants experience in these climates. Consequently, the purpose of this study was to examine college students' stress responses, as measured by salivary cortisol, in a caring/task-involving motivational climate relative to an ego-involving motivational climate.

Nicholls' Goal Perspective Theory is a prominent theory of motivation in sport (Ntoumanis, 2001). The broad spectrum of research employing this theory strongly suggests that the motivational climate created by leaders in each unique setting has a major impact on the

participants' responses (Balaguer, et al., 1999). According to Nicholls (1984, 1989), the motivational climate can be either task- (i.e., mastery) or ego-involving (i.e., performance).

The motivational climate is determined by the factors that are perceived to be emphasized in a particular setting (i.e., features that are valued and recognized the most). For example, in a task-involving climate, individuals perceive the focus is on skill mastery, individual effort, and cooperation with others. In contrast, in an ego-involving climate, individuals perceive the focus is on ability, and attention and recognition are given to those who outperform others. Further, individuals perceive that mistakes are punished, social rankings are valued, and within-group competition is encouraged. In essence, individuals perceive performance-based rewards and social evaluations as important determinants of success in ego-involving climates, whereas mastery-based rewards, such as individual effort and improvement, represent success in task-involving climates.

While research in goal perspective theory has traditionally focused on task- and ego-involving climates, a growing emphasis is now also being placed on the influence of creating a caring climate in achievement-based settings (Newton, et al., 2007). Newton et al. (2007) operationally define a caring climate as "the extent to which individuals perceive a particular setting to be interpersonally inviting, safe, supportive, and able to provide the experience of being valued and respected".

The psychological benefits and positive motivational responses of creating caring, task-involving climates in achievement-based settings are well documented (Fry & Gano-Overway, 2010; Ntoumanis & Biddle, 1999; Pensgaard & Roberts, 2002), while perceptions of an ego-involving climate continues to reveal maladaptive motivational responses (Ntoumanis & Biddle, 1999). In fact, research on caring climates has generated compelling evidence that caring

climates not only positively impact participant motivation in achievement-based settings but are also beneficial for the overall well-being of participants (Reinboth & Duda, 2006). Similarly, research in Goal Perspective Theory has also shown that task-involving climates are associated with participants reporting higher levels of perceived competence (Barkoukis, Tsorbatzoudis, & Grouios, 2008); increased intrinsic motivation, regardless of ability level (Duda, Chi, Newton, Walling, & Catley, 1995); decreased anxiety (Smith, et al., 2007); as well as a greater likelihood to both persist in the face of failure and to select more challenging activities (Solmon, 1996), relative to participants in ego-involving climates.

To date, research in sport psychology has mainly considered the psychological and social influence of the climate and its affect on participants. Another way to monitor the influence the climate has on participants would be to examine physiological stress responses. One precise means of examining stress is to monitor cortisol levels. When a psychological stressor is perceived, the hypothalamic-pituitary-adrenal axis (HPA axis) is activated, resulting in cortisol release into the bloodstream by the adrenal glands (Fry & Hoffman, 2008). Consequently, salivary cortisol is often used as a simple, economical means of assessing the human stress response, as it is a reliable physiological indicator of stress (Kalman & Grahn, 2004). This allows for an easily administered examination of cortisol levels, and thus, the stress response to each respective climate.

Heightened cortisol levels clearly have physiological and psychological consequences that directly pertain to athletic performance. For instance, higher levels of cortisol have been found to coincide with a decrease in vigor, an increase in tension and depression, and a decrease in athletic performance (Filaire, Bernain, Sagnol, & Lac, 2001). High levels of cortisol have also been found to impede immune function and hinder protein synthesis (Harbuz, Chover-Gonzalez,

& Jessop, 2003; Kraemer et al., 2009), which is essential for muscle development. Likewise, with heightened cortisol levels the human body will utilize a higher percent of protein as a metabolic substrate, instead of glycogen. As a result, the body's ability to repair and recover from athletic activity is hindered (Kraemer et al., 2004) and could negatively affect performance. Moreover, chronic exposure to an environment that elicits a stress response, such as cortisol, has been shown to precipitate disease and impair both immune and cardiovascular functioning (McEwen & Stellar, 1993), both of which are necessary for superior performance.

Psychological stress research conducted in achievement-based settings strongly suggests that perceptions of an ego-involving climate will likely elicit a cortisol response, (i.e., a physiological stress response). In a meta-analysis of acute psychological stressors invoking a cortisol response, Dickerson & Kemeny (2004) found that achievement-based settings that are perceived to be uncontrollable or socially-evaluative result in a cortisol spike. Further, these cortisol responses were additive (Cook, Ng, Read, Harris, & Riad-Fahmy, 1987), resulting in the greatest cortisol increase when both uncontrollable and socially-evaluative features were present (Dickerson & Kemeny, 2004). By definition, ego-involving climates are both socially-evaluative and exhibit uncontrollable elements. For example, hardworking, but low performing athletes will never be deemed successful in ego-involving climates, as success is defined by outperforming others. Therefore, athletes have less control over their success. Given that social comparisons and rivalry are the norm, the very nature of an ego-involving climate is socially-evaluative. Thus, it is reasonable to infer that an ego-involving motivational climate would likely yield a greater cortisol response, as the very factors found to elicit a cortisol spike in achievement-based settings actually define an ego-involving motivational climate.

Additional support that the perception of an ego-involving climate will likely result in a significantly greater cortisol spike is the unexamined link between the stress buffering hypothesis (Cassel, 1976; Cobb, 1976) and a caring climate. The stress buffering hypothesis suggests that the impact of stressors is alleviated when participants partake in open, equitable relations (Cassel, 1976), where each person believes "that he [she] is cared for and loved, esteemed, and a member of a network of mutual obligations" (Cobb, 1976, p. 1). Likewise, leading stress researchers suggest that feeling valued and having a sense of belonging (i.e., characteristics that define a caring climate) are also likely to buffer the stress response (Cohen & Pressman, 2004). It follows that the lack of triggers that elicit a cortisol spike in a task-involving climate as well as the stress buffering features characteristic of a caring climate would result in participants displaying significantly lower cortisol levels relative to participants in ego-involving climates.

Understanding how to optimize participants' performance and experience through the creation of a particular climate assists sport practitioners in more readily developing quality training programs for athletes. The purpose of this study was to examine college students' stress responses, as measured by salivary cortisol while learning to juggle, in a caring/task-involving climate compared to an ego-involving climate. As a secondary assessment, motivational responses as measured by self-reported enjoyment, effort, anxiety, self-confidence, stress, shame, self-consciousness, and intent and excitement to continue juggling were examined in relation to motivational climate. It was hypothesized that the ego-involving climate relative to the caring/task-involving climate would result in significantly greater cortisol responses and less advantageous motivational responses (e.g., decreased effort and enjoyment).

Method

Sample and Participant Selection

University students (n = 107, age range: 18-28 years, M_{age} =19.89, SD = 1.80) from a Division I, Midwestern University were randomly assigned to one of four experimental groups: (1) females in a caring, task-involving climate (n = 28), (2) females in an ego-involving climate (n = 33), (3) males in a caring, task-involving climate (n = 23), and (4) males in an ego-involving climate (n = 23). Prior to inclusion in the study, participants were screened by means of a health history questionnaire. Exclusion criteria included acute or chronic psychiatric and affective disorders or disease, medication intake, smoking more than 5 cigarettes a day and for women, current pregnancy, and breastfeeding. Participants were Caucasian (78.5%), Asian/Pacific Islander (10.3%), Hispanic (3.7%), African American (1.9 %), Native American (1.9%), and Other (3.7%). Further, participants were mostly non-smokers (97.2%), who consume less than 6 alcoholic drinks per week (84.1%). All participants gave written consent and, after completion of the experiment, were debriefed as to the true purpose of the study. The study was approved by the researchers' university Internal Review Board.

Additionally, participants were required to follow pre-experiment instructions to help prevent confounds to the cortisol measurement: no eating 2 hours before the experiment, no consuming caffeine or smoking for 1 hour prior to participation, no cardiovascular or resistance training for 48 hours prior to participation, and no alcohol consumption greater than 2 drinks for the 24 hours prior to the experiment. A total of 17 participants were removed from the cortisol analysis for either failing to adhere to the pre-experiment instructions or for reporting a current illness.

Assessments and Measures

Physiological assessment.

Cortisol samples. Cotton dental rolls in the form of salivettes were used for salivary cortisol collection. Salivettes are a quick and reliable means of collecting saliva samples for cortisol analysis (Hellhammer, Kirschbaum, & Belkien, 1987). Participants were trained on proper sampling techniques, and each sample was visually inspected for blood contamination and then stored at room temperature for no longer than 20 minutes. Once all saliva samples had been collected, they were frozen at -80˚ C until assayed.

The sample collected during the Salivette training was considered the first of 2 baseline measures (t = -20 and t = 0), at time -20 min from juggling session onset. In sum, a total of seven samples were collected per participant: the 2 baseline and 5 post-manipulation response measures (t = +30, +45, +60, +75, and +90 min post-baseline). Time (0) marks the onset of the 30 minute juggling training session (see Figure 1 for salivary cortisol sampling timeline).

To help control for the diurnal pattern of cortisol (Pruessner et al., 1997), experimental sessions were run from 4:00 PM to 6:00 PM. Salivary cortisol collection conducted between 3:00 and 6:00 PM more easily distinguishes the variability in daily cortisol levels (Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004), resulting in more sensitive salivary cortisol response to acute stressors.

Biochemical analysis. Immediately prior to the biochemical analysis, all specimens were thawed to room temperature (~25˚C), and then spun at 3000 rpm for 15 minutes, a process which allows for analysis of clear saliva by helping separate out any sediment. Each sample was thawed only once to avoid freeze-thaw artifact and were assayed in duplicate. All salivary samples from a particular individual were analyzed in the same assay to help prevent systematic

variation due to technical errors. Intra- and inter-assay precision were 5.3% and 9.3%, respectively. Salivary free-cortisol concentration was determined using a commercially available Enzymatic Immunoassay (EIA) technique (Salimetrics, State College, PA, USA).

Psychological assessments. A 7-point Likert-type response format was used for all items across scales: 1 (*strongly disagree*) to 7 (*strongly agree*). Mean scores on each component were computed (range 1-7), with a higher score reflecting a stronger level of that particular measure.

Pre- and post-session questionnaires.

Cognitive anxiety, somatic anxiety, and self-confidence. Competitive state anxiety was examined using the Competitive State Anxiety Inventory-2 (CSAI-2: Martens, Burton, Vealey, Bump, & Smith, 1990) both prior to and immediately following the experimentally manipulated juggling session. This 27-item inventory with three equal item scales: Somatic state anxiety (e.g., "I feel/felt nervous."), cognitive anxiety (e.g., "I am/was concerned about performing poorly."), and self-confidence (e.g., "I am/was confident about performing well."). For the purpose of this study, four items were not relevant and were omitted. The CSAI-2 has demonstrated reliability and validity as a self-report competitive state anxiety scale assessing somatic and cognitive state anxiety levels, as well as self-confidence (Martens, et al., 1990). The Cronbach's reliability coefficients for this study were .83, .84, and .90 for pre-session and .80, .88, .94 for post-session, respectively.

Enjoyment. Enjoyment was measured using Duda and Nicholls' (1992) five-item scale. This allowed for examination of the participants' experience of fun while learning new skills (pre) and during the juggling training session (post). A sample enjoyment item is, "Learning to

juggle at the training session was fun." Both pre- and post-session Cronbach's reliability coefficients were .96.

Effort. The participants' effort levels were measured using the five-item Effort subscale of the Intrinsic Motivation Inventory (IMI: McAuley, Duncan, & Tammen, 1989) both before (e.g., "I try hard while learning new physical activities" and following the juggling session (e.g., "I tried hard while at the juggling training session"). This scale resulted in a Cronbach's reliability coefficient of .88 for both pre- and post-session.

Post-session only questionnaires.

Perceived motivational climate. The 21-item Perceived Motivational Climate in Sport Questionnaire (PMCSQ: Seifriz, Duda, & Chi, 1992) was used to assess participants' perceptions of the dominating motivational climate in their instructional juggling session. A sample item for each scale is, "During the juggling session, trying hard was rewarded" (task-involving) and "only athletic students were noticed" (ego-involving). The PMCSQ has demonstrated adequate psychometric properties including factorial validity and internal reliability (Seifriz, et al., 1992; Walling, Duda, & Chi, 1993). The internal reliability of this scale was .94 for ego and .89 for task.

Caring climate. The 13-item Caring Climate Scale (CCS: Newton, et al., 2007) was used to assess the participants' perceptions of multiple caring elements, including support, concern, and acceptance. A sample item is, "During the juggling session, the participants felt that they were treated fairly." The internal reliability of this scale was .99.

Additional items. Five additional items were created for the purpose of this study in an effort to examine feelings of stress, shame, self-consciousness, intention to continue juggling and

excitement to continue juggling. A sample item is, "At times, I felt shame during the juggling session."

Procedure

Upon arrival, groups were split in half and assigned two jugging teachers per group. Similar to the Solmon juggling study (1996), each teacher lead an average of seven participants per session. Also, in an effort to help ensure the creation of each respective climate, two confederates were assigned to each group, operating as if they were participants in the study. Each participant was given a number to place on the front of their shirt and a bag containing seven 2 mL Cryovial plastic containers, each with a cotton dental role inside. Immediately following the initial saliva sample collection, participants were asked to complete all pre-psychological assays as well as an activity log examining participant adherence to the pre-experiment instructions. Participants were then given 20 minutes to complete the pre-session questionnaires. At this time, participants were taken to a gym located inside the building where the juggling training session began. Immediately prior to the start of the 30 minute juggling session, the second saliva sample was collected. After the juggling session was completed, the third saliva sample was collected. Teachers then exited the room and participants were escorted back to the original classroom by the primary investigators. Participants were given 15 minutes to complete the post-session questionnaires. During the time remaining, participants were placed in a neutral environment where they were permitted to read neutral magazines, work on homework, and were allowed to do other activities unlikely to induce a cortisol response (e.g., no social media or conversations).

Personnel Training

Teachers and confederates were graduate and undergraduate students who attended a 2 ½ hour training session. During the training session, all personnel were educated on the theoretical framework of the study and were trained on how to create a caring and task- or ego-involving climate. Contact the first author for a detailed description of the experimental manipulation and personnel training session.

Results

The means and standard deviations for all scales are presented in Table 1 by Climate (i.e., caring/task and ego) and by Sex within each climate, along with difference scores between climate groups and between males and females within each climate. Correlations among all variables and perceived motivational climate are reported in Table 2. Alpha levels were set to 0.05 and were adjusted with a Bonferroni correction when appropriate.

Background characteristics

Potential group differences in background characteristics (i.e., age, total sleep time, menstruation cycle for females) and baseline levels of variables examined (i.e., cortisol, enjoyment, effort, cognitive anxiety, somatic anxiety, self-confidence) were evaluated using a 2 (Climate: caring/task vs. ego) x 2 (Sex: men vs. women) Multivariate Analysis of Variance (MANOVA). There was no main effect for Climate or Sex and no interaction effect for Climate x Sex for any of the background characteristics examined, suggesting that the random assignment was successful. However, in regard to the variables examined, there was a significant Sex difference in baseline cognitive anxiety levels, $F(1, 103) = 6.24$, $p < .05$, $\eta^2 = .06$, with females reporting significantly higher levels of cognitive anxiety prior to the juggling session. The

246 remaining baseline levels revealed no significant differences for Climate or Sex, and no Climate
247 x Sex interaction.

248 **Motivational climate perceptions**

249 To verify that the climate manipulation was successful, group differences in the
250 perception of motivational climate were examined using a 3 (Climate: caring vs. task vs. ego) x
251 2 (Sex: men vs. women) MANOVA. Analysis of the perceived motivational climate indicates
252 that the intended climates were effectively created. Participants in the caring/task group
253 perceived a significantly higher caring and task-involving climate than did the ego group, $F(1,$
254 $103) = 385.00$, $p < .001$, $\eta^2 = .79$, $F(1, 103) = 113.62$, $p < .001$, $\eta^2 = .53$, respectively. Neither
255 the perception of a caring or a task-involving climate differed as a function of Sex, nor was there
256 a significant Climate x Sex interaction for either of these variables. Furthermore, participants in
257 the ego group perceived a significantly higher ego-involving climate than did the caring/task
258 group, $F(1, 103) = 8.47$, $p < .005$, $\eta^2 = .74$. While there was not a significant Sex effect, there
259 was a significant Climate x Sex interaction for the perception of an ego-involving climate, $F(1,$
260 $103) = 288.47$, $p < .001$, $\eta^2 = .08$ with females ($M = 5.82 \pm 0.84$) in the ego group perceiving
261 higher levels of an ego-involving motivational climate than males ($M = 5.23 \pm 0.91$).

262 **Cortisol responses**

263 Salivary cortisol was assessed using a 2 (Climate: caring/task vs. ego) x 2 (Sex: men vs.
264 women) x 7 (Time: *t* -20 vs. *t* 0 vs. *t* +30 vs. *t* +45 vs. *t* +60 vs. *t* +75 vs. *t* +90) mixed design,
265 repeated-measures ANCOVA. Climate and Sex were treated as between-subjects variables,
266 Time was treated as the within-subjects variable, and participant wake time and birth control use
267 were treated as covariates in the cortisol analyses.

Figure 2 displays salivary cortisol levels by Climate and Time. The 2 (Climate) x 2 (Sex) x 7 (Time) repeated measures ANCOVA resulted in a non-significant 3-way interaction, Wilks' $\lambda = .93$, $F(6, 79) = 0.99$, $p = .432$, $\eta^2 = .07$, and a non-significant Time x Sex interaction, Wilks' $\lambda = .96$, $F(6, 79) = .60$, $p = .730$, $\eta^2 = .044$. As hypothesized, the Time x Climate interaction was significant, Wilks' $\lambda = .814$, $F(6, 79) = 3.07$, $p < .05$, $\eta^2 = .186$, suggesting that group differences in salivary cortisol response were influenced by the motivational climate. More specifically, the only significant differences between participants in the two climates occurred at the 3 samples collected immediately following the exposure to the experimentally manipulated motivational climates (+ 30, + 45, and + 60 min), with the ego group responding with a significantly greater salivary cortisol response relative to the caring/task group.

Pre- and Post-Juggling Session Variables

Group differences in variables measured both pre- and post-juggling session (i.e., enjoyment, effort, cognitive anxiety, somatic anxiety, and self-confidence) were assessed using a 2 (Climate: caring/task vs. ego) x 2 (Sex: men vs. women) x 2 (Time: pre-juggling session vs. post-juggling session) factorial MANOVA. Climate and Sex were treated as between-subjects factors, while Time was treated as the within-subjects factor. Effort and enjoyment were the dependent variables in one MANOVA, while cognitive anxiety, somatic anxiety, and self-confidence were the dependent variables in a separate MANOVA.

Enjoyment and effort.

Examination of group differences in effort and enjoyment during the juggling session relative to learning a new skill in general, revealed a significant main effect for Climate, Wilks' $\lambda = .69$, $F(2, 102) = 23.24$, $p < .001$, $\eta^2 = .31$, but no significant main effect for Sex, Wilks' $\lambda = .99$, $F(2, 102) = .73$, $p = .482$, $\eta^2 = .01$, nor the Climate x Sex interaction, Wilks' $\lambda = .99$, $F(2,$

102) = .69, p = .504, η^2 = .01. There was a significant main effect for Time, Wilks' λ = .67, F(2, 102) = 24.94, p < .001, η^2 = .33 as well as a significant interaction for Time x Climate, Wilks' λ = .63, F(2, 102) = 29.98, p < .001, η^2 = .37. There was, however, no Time x Sex interaction, Wilks' λ = 1.00, F(2, 102) = .07, p = .935, η^2 = .00, or Time x Climate x Sex interaction, Wilks' λ = .99, F(2, 102) = .57, p = .569, η^2 = .01. In sum, results revealed that the ego group reported putting forth significantly less effort and experiencing significantly less enjoyment than the caring/task group.

Cognitive anxiety, somatic anxiety, and self-confidence.

Examination of group differences in the CSAI-2 variables (i.e., cognitive anxiety, somatic anxiety, and self-confidence) during the juggling session relative to just before the juggling session, revealed a significant multivariate main effect for Climate, Wilks' λ = .85, F(3, 101) = 5.83, p < .001, η^2 = .15, and for Sex, Wilks' Lambda = .89, F(3, 101) = 3.98, p < .010, η^2 = .11. There was no significant Climate x Sex interaction, Wilks' λ = .95, F(3, 101) = .1.67, p = .177, η^2 = .05. As expected, there was a significant main effect for Time, Wilks' λ = .64, F(3, 101) = 19.31, p < .001, η^2 = .36, as well as a significant interaction for Time x Climate, Wilks' λ = .66, F(3, 101) = 17.66, p < .001, η^2 = .34. There was no Time x Sex interaction, Wilks' λ = .98, F(3, 101) = .71, p = .548, η^2 = .02, nor was there a significant Time x Climate x Sex interaction, Wilks' λ = .97, F(3, 101) = .972, p = .415, η^2 = .03. Results revealed that the ego climate resulted in a significant increase in cognitive and somatic anxiety and decrease in self-confidence relative to baseline, while the caring/task- climate resulted in a non-significant increase in cognitive and somatic anxiety coupled with a significant increase in self-confidence.

Post-Session Only Variables

Group differences in the independent variables measured post-session only (i.e., stress, shame, self-consciousness, intent to continue juggling and excitement to continue juggling) were examined using a 2 (Climate: caring/task vs. ego) x 2 (Sex: men vs. women) MANOVA. The stress, shame, and self-consciousness items were included as dependent variables in one MANOVA, while intent and excitement to continue juggling were treated as the dependent variables in a separate MANOVA.

Stress, shame, and self-consciousness. Examination of the effect of motivational climate on self-reported feelings of stress, shame, and self-consciousness during the juggling session resulted in a significant main effect of Climate, Wilks' $\lambda = 8.26$, $F(3, 101) = 8.26$, $p < .001$, $\eta^2 = .20$, such that the means of the ego group (*M* Stress = 4.34, *M* Shame = 3.84, and *M* Self-Consciousness = 4.39) were significantly greater than the caring/task group (*M* Stress = 2.51, *M* Shame = 2.51, and *M* Self-Consciousness = 2.92). The Climate η^2 of stress, shame, and self-consciousness were .19, .09, and .10, respectively. The main effect of Sex was not significant, Wilks' $\lambda = .35$, $F(3, 101) = .35$, $p = .792$, $\eta^2 = .01$, nor was the Climate x Sex interaction, Wilks' $\lambda = .96$, $F(3, 101) = 1.25$, $p = .295$, with an η^2 of .04. In summary, the ego group reported experiencing significantly more stress, shame, and self-consciousness than the caring, task-involving group during the juggling session.

Future intent and excitement to continue juggling. Examination of the effect of motivational climate on intent and excitement to continue juggling in the future resulted in a significant main effect of Climate, Wilks' $\lambda = .90$, $F(2, 102) = 6.00$, $p < .005$, $\eta^2 = .11$, such that the means of the ego group (*M* Intent = 3.98 and *M* Excitement = 3.64) were significantly lower than the caring/task group (*M* Intent = 4.88 and *M* Excitement = 4.88). The Climate η^2 of intent and excitement to continue were .19 and .10, respectively. The main effect of Sex was not

significant, Wilks' $\lambda = .99$, $F(2, 102) = .62$, $p = .539$, $\eta^2 = .01$, nor was the interaction of Climate x Sex, Wilks' $\lambda = 1.00$, $F(2, 102) = .01$, $p = .990$, with an η^2 of .00. In brief, the participants in the caring/task group indicated greater intent and excitement to continue juggling.

Discussion

The purpose of this study was to examine college students' stress responses, as measured by salivary cortisol, in a caring/task-involving climate compared to an ego-involving climate. The present study builds on Achievement Goal Perspective research by providing physiological evidence that perceptions of an ego-involving motivational climate not only result in maladaptive motivational responses, as previous research suggests, but may in fact elicit a significant cortisol spike in participants. Also in line with previous research, the present investigation provides evidence that participating in a caring/task-involving climate, even for a short 30 minute session, may result in advantageous motivational responses and may also lead to significantly reduced cortisol levels. It should, however, be noted that the diurnal pattern of cortisol (Pruessner, et al., 1997) may have lead to the significant cortisol decrease in the caring/task group.

The success of the intervention depended on the leaders and confederates being able to create the two distinct climates. Participants in the ego climate rated the environment as nearly 3 points more ego-involving on a 7-point scale, while participants in the caring/task climate perceived the environment to be significantly more caring by over 4 points, and task-involving by over 2 points. The independent t-tests revealed that the manipulation of the climates was a success.

As hypothesized, participation in an ego-involving climate resulted in significantly heightened cortisol responses relative to the caring/task group. The caring/task participants' cortisol levels were not only significantly lower than the ego group, as expected, but surprisingly

359 decreased relative to their baseline levels. This was unexpected as it was hypothesized that the
360 caring/task group would respond with a slight, yet non-significant rise in salivary cortisol due to
361 the novelty and unfamiliarity of the experiment. It was also hypothesized that the ego group
362 would result in a significantly greater cortisol response relative to the caring/task group. Not
363 only was the cortisol response significantly greater for the ego group relative to the caring/task
364 group, but when examining the pre- to post-juggling session cortisol levels, the ego group
365 responded with a significant cortisol increase relative to their baseline levels.

366 The results of the present study align with the findings of Dickerson & Kemeny's (2004)
367 meta-analysis of acute psychological stressors in achievement settings and suggest that the
368 social-evaluative and uncontrollable features that characterize an ego-involving climate are akin
369 to the conditions that trigger a cortisol response in achievement-based settings. The notion that
370 participants in ego-involving climates do not feel as though they have control over the outcome
371 is supported, as well as the idea that social comparison and intra-team rivalry does likely lead to
372 feelings of social evaluation.

373 Not only does it appear that the lack of these features in a task-involving climate does not
374 trigger a cortisol spike, it may be that the social buffering characteristics that define a caring
375 climate (i.e. feeling valued and having a sense of belonging) actually facilitated the decrease in
376 cortisol levels for the caring/task group. Cohen & Pressman (2004) suggest that simply
377 believing that one has social support may both dampen the physiological response and prevent
378 maladaptive behavioral responses. Additionally, the stress buffering hypothesis suggests that
379 coping and adaptation when under stress is facilitated by social support, including feeling cared
380 for (Cobb, 1976). By its very definition a caring climate is a safe and supportive environment
381 where leaders display a genuine concern for their participants. Regardless of the underlying

cause(s), this is compelling in that it provides evidence that a link between the stress buffering hypothesis and the perception of a caring climate may exist.

While the motivational and physiological repercussions of creating a caring/task-involving climate are advantageous, the elevated cortisol response of the ego-involving climate is of concern for a number of reasons. To begin, dysregulation of the HPA system overtime, a condition that can be caused by consistently elevated cortisol levels, is linked to outcomes that are undoubtedly damaging to athletes including hypertension, diabetes, obesity (Epel, Lapidus, McEwen, & Brownell, 2001), and atrophy of nerve cells in the brain (Lupien et al., 1997). When the HPA axis is not turned off, the target organs and tissues can be damaged, lending to further deleterious effects. For instance, elevated cortisol impairs the body's ability to repair damaged muscle (Gore, Jahoor, Wolfe, & Herndon, 1993); increases adipose tissue levels (Purnell et al., 2009); and lessens immune functioning (Dhabhar & Mcewen, 1997), cognitive ability, and memory (Egeland et al., 2005). Furthermore, Abad and colleagues (2001) also found that consistently elevated cortisol during adolescence leads to declines in bone mass. Research even suggests that elevated cortisol levels contribute to physiological changes resultant in mood disorders including depression and anxiety (McEwen, 2003) and is linked to psychological burnout (Grossi et al., 2005). These findings indicate that participation in a motivational climate that elicits a cortisol response could likely hinder athletic performance.

In contrast, the current study adds to the body of literature that suggests participating in a caring/task-involving climate yields adaptive motivational patterns that likely enhance sport performance. For example, results of this study indicated that, relative to the ego group, participants in the caring/task group reported enjoying the activity more, putting forth more effort, and having more self-confidence in their abilities. Additionally, the caring/task

participants reported a greater level of intent and excitement to continue to juggle in the future. On the contrary, the participants in the ego group reported feeling significantly greater levels of cognitive and somatic anxiety, as well as feelings of stress, shame, and self-consciousness while participating in the juggling session. These findings suggest that participants are much more likely to have an optimal experience in physical activity settings if they experience a caring/task-involving climate, as they are more likely to enjoy themselves, try hard, and have a heightened interest in continuing their involvement in the activity.

Several limitations of the current study should be noted. First, this study included a laboratory like setting that is different than what participants experience in real-life physical activity settings. While participants likely volunteered to participate in this research study because they were interested in learning to juggle, it is possible that their level of investment was quite different than if they were athletes in a team setting. It is possible that cortisol responses would be much greater had they been measured with athletes who participate in ego-involving climates and who are highly invested in their sport. Also of important note is the fact that, in the current study, the ego-involving climate was much milder than the climates experience by many athletes in the real world. It is not uncommon, unfortunately, to see coaches yelling, criticizing, and belittling athletes in public. Coaching behaviors such as these could elicit very strong cortisol responses. Another limitation of the current study is that the intervention period was very brief (i.e., 30 minute juggling session) and only a single session. Results could vary tremendously if a longer session was included (e.g., 2 hours) or if cortisol were examined in the long term (i.e., over days or weeks).

These limitations pave the way for future inquiry. First, it will be interesting in future research to include students and athletes who are in real-world situations, where their investment

and commitment to the activity is greater, than would be in a laboratory-based study. Second, it will important in future research to examine the long-term effects of the climate on cortisol responses. For example, in the current study it would have been interesting to have the participants come back for a second session and examine their cortisol levels upon arrival to see if the participants in the ego-involving groups arrived with heightened baseline levels in comparison to the participants in the caring/task-involving groups. In addition, it would be worthwhile to examine the physiological and psychological effects of participating in climates that elicit long-term cortisol responses, as it may be that athletes who regularly participate in highly ego-involving climates may experience greater levels of burnout, overtraining, fatigue, and other detrimental effects hindering athletic performance. Similarly, future research should also examine whether or not participation in an ego-involving climate over time would lead to dysregulation the HPA system. The magnitude of cortisol secretion when experiencing stressful daily events depends on whether the event is ongoing and on how frequently a similar kind of event had occurred previously (van Eck, Berkhof, Nicolson, & Sulon, 1996). If athletes do experience a cortisol spike when coaches create an ego-involving climate, theoretically, their cortisol response will either habituate or become exaggerated in the long-term. Research suggests that habituation of the cortisol response to psychological stressors does not occur for men experiencing stressors that are of an uncontrollable or socially-evaluative nature (Kirschbaum et al., 1995). Therefore, it would not be unfound to speculate that athletes experiencing long-term stressors that are uncontrollable and/or socially-evaluative may also react with an exaggerated stress response.

In a similar vein, it will be important in future research to consider how athletes participating in a caring/task-involving climate might benefit from lower levels of salivary

cortisol. For example, it may be that athletes in such environments experience greater psychological well being (Reinboth & Duda, 2006) than participants in ego-involving climates due to factors influenced by cortisol, or that task climates are associated with greater advances in motor skill development (Theeboom, De Knop, & Weiss, 1995) in part because cortisol is acting as a mechanism helping to explain this outcome.

There are a multitude of coaches that believe that focusing on winning and outperforming others is key to a "successful" team. As a result, an unfortunate reality of sport is that many athletes are regularly participating in ego-involving climates. It will be interesting, as research in this area develops, to discover the extent to which ego-involving climates may actually be detrimental to the very outcome to which it is so focused: winning.

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Table 1

Means and Standard Deviations of Pre- and Post-Juggling-Session Enjoyment, Effort, and Anxiety Scores by Motivational Climate and Sex Within Each Motivational Climate

Variable	Total Caring/ Task	Total Ego	Difference Score	Caring/Task		Difference Score	Ego		Difference Score
				Male	Female		Male	Female	
Enjoyment pre	5.95 (0.71)	5.96 (0.71)	0.01	5.87 (0.77)	6.01 (0.67)	-0.14	5.86 (0.66)	6.04 (0.75)	-0.18
Enjoyment post	5.07 (1.13)	3.61 (1.87)	1.46[b]	5.87 (1.25)	6.24 (1.02)	-0.37	3.54 (1.78)	3.65 (1.96)	-0.11
Effort pre	5.63 (0.96)	5.74 (1.06)	-0.11	5.75 (0.91)	5.53 (1.01)	0.22	5.50 (1.11)	5.90 (1.01)	-0.40
Effort post	5.88 (1.00)	5.00 (1.34)	0.88[b]	5.78 (1.00)	5.96 (1.01)	-0.18	4.88 (1.17)	5.08 (1.46)	-0.20
Cognitive anxiety pre	2.54 (1.25)	2.21 (1.02)	0.33	2.16[c] (0.96)	2.85[c] (1.39)	-0.69	1.98[c] (0.72)	2.37[c] (1.16)	-0.39
Cognitive anxiety post	2.64 (1.32)	3.43 (1.50)	-0.79[b]	2.35 (1.15)	2.88 (1.42)	-0.53	3.09 (1.40)	3.66 (1.54)	-0.57
Somatic anxiety pre	1.94 (0.75)	1.86 (0.78)	0.08	2.04 (0.87)	1.86 (0.65)	0.18	1.85 (0.70)	1.87 (0.84)	0.00
Somatic anxiety post	2.27 (0.89)	2.82 (1.10)	-0.55[b]	2.26 (0.82)	2.28 (0.96)	-0.02	2.67 (0.94)	2.92 (1.20)	-0.25
Self-confidence pre	4.86 (1.10)	4.87 (1.16)	0.01	4.96 (0.96)	4.77 (1.21)	0.19	5.13 (1.03)	4.68 (1.23)	0.45
Self-confidence post	4.98 (1.06)	3.27 (1.54)	1.71[b]	4.97 (1.11)	5.00 (1.04)	-0.03	3.82 (1.42)	2.88 (1.52)	0.94*

Note. Standard deviations are in parentheses.
[a]$p < .05$, between caring/task and ego. [b] $p < .01$, between caring/task and ego. [c]$p < .05$, between males and females. [d]$p < .01$, between males and females.

Table 2

Correlation Table Among the Perceived Motivational Climates and All Post-Juggling Session Variables

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Task	1												
2. Ego	-.70**	1											
3. Caring	.82**	-.84**	1										
4.Enjoy-ment	.67**	-.63**	.72**	1									
5. Effort	.52**	-.27**	.46**	.44**	1								
6. Cognitive Anxiety	-.25**	.48**	-.33**	-.29**	.06	1							
7. Somatic Anxiety	-.21*	.41**	-.37**	-.34**	.07	.76**	1						
8. Self-Confidence	.60**	-.65**	.65**	.58**	.38**	-.59**	-.54**	1					
9. Stress	-.43**	.49**	-.47**	-.50**	-.27**	.41**	.40**	-.65**	1				
10. Shame	-.23**	.48**	-.31**	-.41**	-.17	.61**	.55**	-.64**	.71**	1			
11. Self-Conscious	-.26**	.45**	-.35**	-.30**	-.20*	.52**	.47**	-.56**	.68**	.76**	1		
12. Excitement	.29**	-.36**	.32**	.54**	.20*	-.24*	-.18	.36**	-.50**	-.40**	-.31**	1	
13. Future Intent	.22*	-.30**	.67**	.42**	.21*	-.16	-.10	.23*	-.35**	-.33**	-.21*	.92**	1

*$p < .05$. **$p < .01$.

Figure 1. Salivary Cortisol Sample Timeline

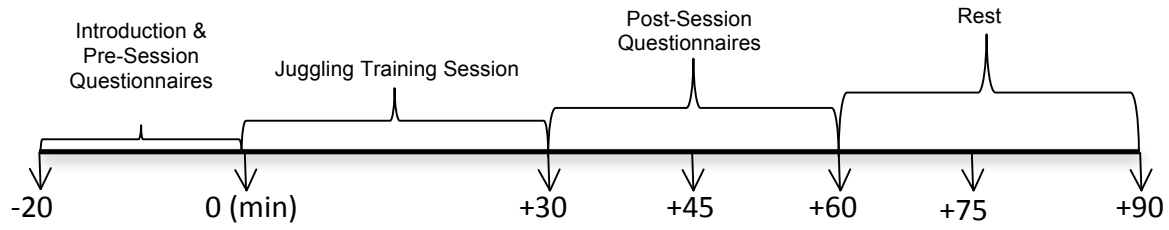

Figure 1. Timeline of session activities (above) and salivary sample collection (below) relative to the beginning of the experimentally manipulated juggling session, $t = 0$ min.

Figure 2. Salivary Cortisol Responses by Motivational Climate

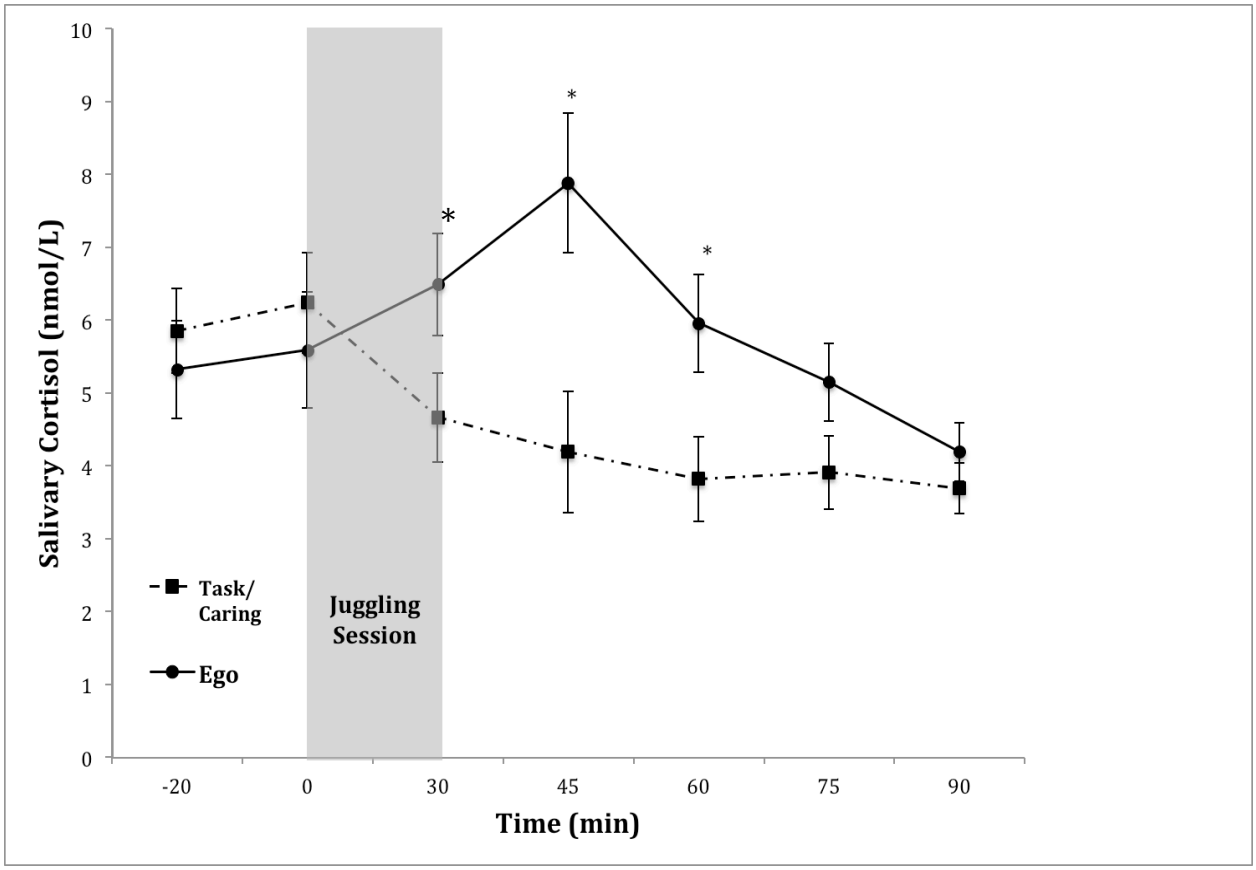

Figure 2. Mean salivary cortisol in nmol/l in response to the experimentally manipulated motivational climate. Vertical line with cross bars represent ±1 standard error. *Indicates significant ($p < .05$) effect such that participants in the ego-involving group demonstrated a significantly greater level of salivary cortisol relative to the caring/task-involving group.