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# Physiological and Behavioral Reactivity when One's Self-Worthis Staked on Competence

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**ABSTRACT** - Contingent self-esteem, where one's self-value is staked on success and competence, is a particularly vulnerable disposition with impact on well-being. This study compared physiological and behavioral reactivity between individuals self-rated as high and low in competence based self-esteem ($N$ = 61), in a performance situation. To assess reactivity we used a traditional overt measure of blood pressure and a novel, covert, measure of response force. The results show that high scorers in competence based self-esteem exhibited an overall pattern of stronger reactivity as indicated by higher blood pressure and response force as compared to low scorers.

Self-esteem, a personal judgment of one's worthiness, has been widely studied as a factor linked with human behavior and well-being. To facilitate an understanding of human functioning and adjustment beyond the buffering effects of self-esteem, concepts such as unstable self-esteem and contingent self-esteem have emerged (Crocker & Wolfe, 2001; Deci & Ryan, 1995; Kernis, Granneman, & Barclay, 1989). These two phenomena are thought to be interwoven providing a profound source of vulnerability (Crocker & Park, 2004; Deci & Ryan, 1995; Paradise, & Kernis, 2002). Contingent self-esteem refers to a belief that one's self-value has to be consistently earned by external means, such as outcomes of one's daily undertakings or approval of others. Consequently, the individual's self-esteem fluctuates depending on the outcomes of certain acts and is therefore fragile (Crocker & Wolfe, 2001; Paradise & Kernis, 2002).

Of particular interest for stress and health is contingent self-esteem based on competence and achievements (Crocker & Park, 2004; Paradise & Kernis, 2002). That kind of conditional attitude to one's own value as a person emanates from early experiences of being appreciated only when living up to certain parental standards (Deci & Ryan, 1995). Later in life, the internalized incessant pursuits to validate the self incline the person to maladaptive competition including strong control needs, self-criticism, and frustration (DiPaula & Campbell, 2002; Hallsten, 2005; Smith, Glazer, Riz, & Gallo, 2004). Hence, this kind of stance elicits specific patterns of cognitive-emotional reactivity in situations where one's self-worth is an issue (Crocker & Park, 2004). Though this kind of reactivity is closely linked to physiological mechanisms (Johnson & Forsman, 1995; Rasmussen, Willingham, & Glover, 1996), to date, evidence of the

vulnerability status of self-esteem staked on competence derives merely from subjective behavioral and health reports (Crocker & Park, 2004). Moreover, the core of vulnerability in current conceptualizations of contingent self-esteem is unclear (see Johnson & Blom, 2007). Therefore, the present study set out to examine physiological and behavioral reactivity in people with high self-reported competence based self-esteem (CBSE), as defined by Johnson and Blom (2007), in a performance situation where the outcomes were evaluated.

***Competence Based Self-Esteem***

What distinguishes CBSE (Johnson & Blom, 2007) from other approaches to competence based contingent self-esteem is that the concept is clearly separated from other contingencies such as relationships or others' approval (Johnson & Blom, 2007). Moreover, contrary to other current models, it implies a notion of an impoverished basic self-esteem (Forsman & Johnson, 1996) which constitutes the essence of vulnerability in CBSE as it impels the individual to compensatory pursuits of success and perfection to feel valuable (Deci & Ryan, 1995; Johnson & Blom 2007; Johnson & Forsman, 1995).

The CBSE construct builds theoretically on certain aspects of a dynamic model of basic self-esteem and earning self-esteem (by competence) developed by Forsman and Johnson (1996). In this model, basic self-esteem refers to an affective-experiential aspect of self-esteem, acquired in infancy by parents' unconditional love and a secure attachment pattern (Bowlby, 1980; Deci & Ryan, 1995) whereas earning self-esteem indicates a need to enhance one's self-esteem by competence. Johnson and Forsman (1995) showed clearly that the level of basic self-esteem is decisive for whether competence strivings turn to be adaptive or maladaptive. In their experiment, individuals highly predisposed to earn self-esteem by competence (Forsman & Johnson, 1996) with a concomitant low basic self-esteem, when offered subsequent choices of task difficulty and receiving failure feedback, exhibited unrealistically increased ambition, poor performance, and high physiological reactivity. By way of contrast, individuals with high levels of both basic self-esteem and earning self-esteem (by competence) showed adaptive patterns of behavior by exhibiting realistic ambition, good performance, and lower physiological reactivity.

The CBSE construct and scale of concern in the present study builds theoretically on the maladaptive SE combination i.e., low basic self-esteem accompanied with high earning self-esteem. This self-esteem strategy is considered particularly vulnerable and has been found to be associated with self-esteem instability, "toxic" achievement strivings, performance anxiety, poor health status, and somatic complaints (Johnson, 1998; Johnson, 2010; Johnson, Paananen, Rahinantti, & Hannonen, 1997).

Note that high degree of CBSE does not indicate a high level of self-esteem acquired from competence. Instead, the measure captures attitudes and behaviors of an individual who perceives competence and high standards as important means to compensate a low basic sense of self-esteem (e.g. "I experience other people's success as threatening"). People who have an accentuated CBSE structure are over-critical and controlling with a harsh and unforgiving attitude towards one's own failures and shortcomings (Johnson & Blom, 2007), a pattern likely to entail unhealthy strivings, over-work, and stress-related disease (Dunkley, Zuroff, & Blankstein, 2003; Hallsten, 2005; Johnson, 2010).

CBSE has shown discriminant validity by being unrelated to affiliation needs and dependency (Johnson & Blom, 2007). Moreover, Johnson and Blom (2007) showed that high CBSE appeared an interactive function of low trait self-esteem and high competence related striving for self-esteem, when negative affect was controlled, which indicates the construct's unique status over and above trait self-esteem and negative affect.

***Competence Based Self-Esteem and Cardiac Reactivity***

Physiological reactivity is a known antecedent of stress-related disease (Lovallo, 1997; Smith et al., 2004). In addition, it is widely agreed that psychological stress involves anticipation or confrontation with situations that are perceived as potential threats to self-esteem (Lamb, 1979). In this respect, people whose self-esteem is conditional upon their achievements should perceive performance situations with unpredictable outcomes and personal evaluation as particularly threatening, entailing heightened cardiovascular reactivity (Johnson & Forsman, 1995; Lyness, 1993; Tomaka, Blascovich, Kibler, & Ernst, 1997). Indeed, Johnson and Forsman (1995) found that low trait self-esteem alone did not elicit high physiological reactivity in a performance situation with failure feedback unless this trait was accompanied with high need to earn self-esteem by competence. Moreover, it can be thought that competence based self-esteem triggers highest tension and uneasiness before starting to perform, as the lack of control in this phase is greater than when actually performing when the sense of own control increases (Greco & Roger, 2003; Monat, Averill, & Lazarus, 1972).

On these grounds, it seems reasonable that contingent self-esteem staked on competence plays a crucial role in psychological stress experiences. Therefore, there is a need to examine further the vulnerability status of this predisposition by direct observation of the relation between CBSE and physiological reactivity. Although the empirical frame of research available to support the present thesis concerns self-esteem stability, type A pattern, and ego involvement, providing only indirect links to competence based self-esteem, these approaches were considered relevant background for our conjecture.

Studying the stability of global self-esteem Rasmussen et al. (1996) found that in a performance situation where outcomes were evaluated, self-esteem instability accounted for a significant proportion of variance in cardiovascular reactivity. As self-esteem instability is associated with self-esteem built on outcomes of one's performances (see Johnson, 1998; Kernis et al., 1989), Rasmussen et al. concluded that perceived threat to self-worth is a critical mediator of physiological reactivity eliciting strong negative emotions with physiological consequences (see also Seery, Blascovich, Weisbuch, & Vick, 2004; Tomaka et al., 1997).

From another perspective, Price (1982) proposed that the vulnerable component in the competitive type A behavior pattern is a belief that one must constantly prove oneself through achievements or else risk being judged unworthy. In support of this view, Pittner and Houston (1980) found greater systolic and diastolic blood pressure in type A persons in response to threat to self-esteem than in type B persons (see Lyness, 1993, for a review). However, the general type A concept refers to different cognitive beliefs, both adaptive and maladaptive (Price, 1982), and, therefore, evidence of its vulnerability status is inconsistent, often explained by differences in self-esteem level (Johnson, 2010;

Lyness, 1993). On these grounds, it appears that CBSE which includes concerns of self-worth as a part of the measure provides a more adequate and informative factor to predict and understand people's unhealthy strivings than type A concept (Levenson, 1983; Martin, Kuiper, & Westra, 1989).

### *Effort and Physical Exertion*

Self-esteem implications of task performance may not only be associated with anxiety or fear of failure. The ego-involvement in people who stake their self-esteem on competence is likely to elicit anger and a frustrated effort-mobilisation (Gendolla & Richter, 2005; Kernis et al., 1989). For instance, Gendolla and Richter (2005) found that high ego-involvement (i.e. the self rather than the task is an issue when performing a task) increased participants' momentary exertion, indicated by blood pressure and various skin conductance responses, when they were instructed to "do their best".

In line with narcissistic self-enhancers (Robins & Beer, 2001), persons with CBSE structure tend to increase their effort with unrealistically high expectations of outcomes when facing failure (Di Paula & Campbell, 2002; Johnson & Forsman, 1995; Robins & Beer, 2001). These patterns of behavior indicate that frustrated effort-mobilisation and a state of tension created by ego-involvement and uncertain outcomes are particular implications in competence based self-esteem.

In sum, by embracing concepts like unstable and fragile self-esteem, "toxic" strivings, and ego-involvement, CBSE is considered a key to core psychological stress mechanisms triggered by situational cues involving ego-threat (Tomaka et al., 1997). Therefore, the aim of the present study was to complement previous research (Crocker & Park, 2004; Kernis et al., 1989; Rasmussen et al., 1996) by examining directly, for the first time, physiological and behavioral markers of competence based self-esteem.

### *The Present Study*

The study was designed to examine the differences in patterns of reactivity between high and low CBSE participants (extreme scorers) when performing a computer based test. Their task was to replicate sequences of coloured squares presented on a computer screen and their progress was evaluated throughout. Cardiac reactivity was measured by way of blood pressure. Moreover, as CBSE people are considered likely to persist in compulsive effort to succeed when facing ego-threat (Di Paula & Campbell, 2002; Johnson & Forsman, 1995; Robins & Beer, 2001), a novel covert measure of response force, widely considered to reflect motor preparation and arousal (Jaśkowski, & Włodarczyk, 2006; Ulrich & Wing, 1991), was introduced and implemented in part of the sample to assess the participants' momentary exertion. To capture the emotional tone of the reactivity, each individual's perceived arousal was also measured (see Tomaka et al., 1997). On the basis of previous research (Johnson & Forsman, 1995; Rasmussen et al., 1996) it was hypothesized that individuals with high scores in CBSE would exhibit higher cardiovascular reactivity and response force during the test session than those with low scores particularly in the beginning of the test, as uncertainty in anticipation of the outcomes is thought to trigger competence based self-esteem (Lamb, 1979; Lyness, 1993; Monat et al., 1972).

## Method

### *Participants*

The participants were 61 undergraduate students (age range 19 to 51, $M$ = 27) extracted from a total of 220 students who had responded to a questionnaire with the CBSE Scale (Johnson & Blom, 2007). Individuals whose mean CBSE scores in the questionnaire study deviated by one standard deviation ($SD$ = 0.61) or more from the total mean ($M$ = 2.91) of the scale, positively or negatively, were selected to the experimental sample. The final sample consisted of 32 (10 men and 22 women) participants with high scores on CBSE and 29 (11 men and 18 women) with low scores on CBSE. A $t$-test comparing mean CBSE scores for the two experimental groups confirmed that they were significantly different $t$ (59) = 18.11, $p < 0.001$.

### *Measures*

The Competence based self-esteem (CBSE) Scale (Johnson & Blom, 2007) consists of 12 items which refer to behaviors and attitudes which arise when competence is pursued for self-validation. The factor structure (Johnson & Blom, 2007) comprises two factors; self-value conditional upon competence (e.g. "I feel worthwhile only when I have performed well" or "It is not who I am, but what I can accomplish that matters") and self-criticism/comparison with others (e.g. "No matter how well I have completed a task there is always a nagging feeling that I should have done better" or "Other people's successes make me to push myself even harder"). The scale is based on a clear theoretical and empirical distinction from other contingencies of self-esteem such as relations and social approval and has shown high internal consistency and test-retest reliability in different samples (Johnson & Blom, 2007). It has gained good convergent and discriminant validity by showing positive associations with "toxic" achievement striving and perfectionism while being unrelated to affiliation and dependency needs and by accounting for unique variance over and above trait self-esteem and neuroticism (Johnson & Blom, 2007). Cronbach's alpha of the CBSE scale in the present study was 0.87. Responses to each item were given on a 5-point scale (ranging from 1 = strongly disagree to 5 = strongly agree).

Perceived arousal was measured using a modified form of The Perceived Arousal Scale (PAS; Anderson, Deuser, & DeNeve, 1995). Examples of the 12 perceived states presented for the participants were: strained, tense, irritated, frustrated, relaxed, calm (the scores of the two latter words were reversed). They were instructed to indicate "to what extent you felt this way when you were performing the test?" by using a 5-point rating format (ranging from 1 = very slightly to 5 = extremely). The high scores in the scale indicated a negatively felt arousal. Cronbach's alpha for the scale was 0.79

### *Apparatus*

Cardiovascular reactivity (CVR) was monitored using a cuff positioned on participant's non-dominant arm above the brachial artery. The device used was an automatic digital blood-pressure device (Blood Pressure Monitor, DS-140, A & D Company, Tokyo, Japan) registering systolic (SBP) and diastolic blood pressure (DBP), and heart rate (HR).

Response force (RF) was measured using a single FlexiForce load sensor (Tekscan FlexiForce ELF A201, Tekscan Inc., South Boston, USA) placed inside a wireless computer mouse between the right outer button casing and internal micro-switch. Analog-to-digital conversion and response force was recorded (in Newtons) at an acquisition rate of 8 Hz using an ELF Force Measurement System, interfaced with a standard desktop computer (Dell Precision PWS370). The wires connecting the FlexiForce sensor to the computer appeared to participants as a normal mouse connection, but the mouse actually communicated with the computer by way of radio frequency. The response force device was calibrated by placing a series of known weights on the mouse button and recording the resistance returned by the sensor (for further details see Englund & Patching, 2009).

The study task was written in Matlab (The Mathworks, Inc.) using the Psychophysics Toolbox extensions (Brainard, 1997; Pelli, 1997). The test comprised a 3 by 3 grid of 9 boxes on a black background. Participants were required to replicate a random configuration of coloured boxes, on average 5 boxes per trial, which appeared on the screen for 200 msecs each, one box at a time. So a complete sequence of 5 target boxes, to be replicated by the participants, lasted 1 sec. Participants responded by moving a mouse cursor sequentially to each box and by pressing the mouse button to select the boxes in the order they were highlighted.

***Design and Procedure***

For practical reasons the experiment data were collected in two waves. On average 6 weeks after responding to the questionnaire, the participants were invited to take part individually and voluntarily in the laboratory study. Only very general information about the test situation was provided at that time.

On their arrival at the laboratory, which was a quiet room, the participants received more detailed instructions informing them of the computer task and blood pressure monitoring before they were seated comfortably at the computer. Further instructions concerning the test were given on the computer screen.

Each session of performing the test lasted 30 minutes and consisted altogether of 12 sets of 5 trials. Participants were instructed to perform as accurately as possible. In each block of five trials, the first trial comprised a random sequence of 4 targets, the following two trials random sequences of 5 targets and in the remaining two trials random sequences of 6 targets. After every set of five trials, performance feedback information was presented on the video monitor. Everyone received the same feedback information, irrespective their actual performance. However, to trigger the participants' self-esteem structure, the majority of the feedback was negative. The number of targets presented on each trial and speed of target presentation were adjusted on the basis of the results of a pilot experiment, so that the feedback information was believable. The actual performance, i.e. each participant's accuracy of replicating the configurations, however, was assessed continuously.

Blood pressure was monitored on three separate occasions: T1 (anticipation) just before the first 10 trials, T2 (beginning) direct after the next 50 trials, and T3 (concluding) direct after the last 50 trials (before the participants were informed that the test was over). Unbeknown to participants, response force was recorded continuously

throughout the test session, every time the mouse button was pressed (this was measured only in the first wave of the study, since the same equipment was not available in the second wave). After the test was completed, participants were asked to complete a self-report measure of their perceived state of arousal during the test. They were then told that the test was over but to obtain a baseline measure of response force they were asked to answer a few routine questions presented on the computer screen, concerning different daily habits. (To ensure that they were relaxed each participant was informed clearly that these questions had nothing to do with the actual test but rather concerned interpretation of the results.) Participants answered these questions by clicking boxes labelled as 'yes', 'no', 'never', 'sometimes', during which a baseline response force was recorded. Finally, baseline blood pressure was recorded after a short period of rest. Before leaving each participant was carefully debriefed about the aims and procedures of the study. The experimenter was unaware of participants' CBSE scores. The present study was ethically approved by The Swedish Research Council's Ethics Committee.

## Results

The results were analyzed in four steps: 1) The differences between the high and low CBSE-groups in cardiovascular reactivity [diastolic blood pressure (DBP), systolic blood pressure (SPB), and heart rate (HR)] over the three measurement occasions (T1, T2, T3) were analyzed using a multivariate mixed model analysis of variance (MANOVA) for repeated measures, with CBSE-group as the between-participant factor and measurement occasion as the within-participant factor, followed by three univariate ANOVAs. 2) The differences in response force between the two groups were analyzed using a mixed model ANOVA for repeated measures with CBSE-group as the between-participant factor and three indexed measurement occasions over time as the within-participant factor. 3) The ratings of perceived arousal were compared between the two groups with high and low scores on the CBSE scale. 4) Inter-correlations between the dependent measures (total means) were calculated.

In line with other studies (e.g. McKinley et al., 2003) reactivity was computed as the difference between the baseline physiological/behavioral measures and those measures taken during the task. For ease of exposition, references to the levels of DBP, SBP, HR, and RF denote the change values from the baseline throughout. Two participants' values of cardiovascular reactivity were removed due to equipment failure.

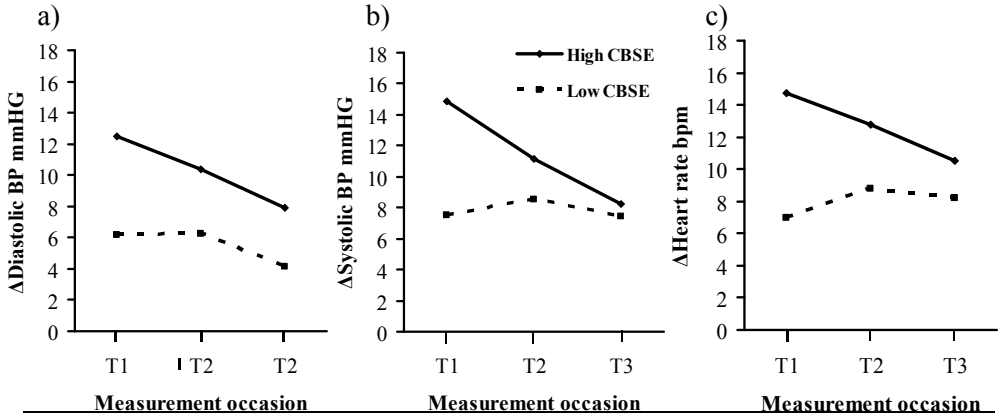
### *Cardiovascular Reactivity (CVR)*

A multivariate mixed model analysis of variance (MANOVA), performed on the three indices of blood pressure, showed a significant main effect of time $F(2,56) = 4.30$, $p < 0.05$, partial $\eta^2 = 0.07$, a significant main effect of SE-group $F(1,57) = 6.47$, $p = 0.01$, partial $\eta^2 = 0.10$ and a significant interaction between time and SE-group $F(2,56) = 3.31$, $p < 0.05$, partial $\eta^2 = 0.06$, indicating that the two groups with high and low CBSE differed in their levels of blood pressure over time.

Figure 1 shows the differences in the three indices of blood pressure between the CBSE-groups over the measurement occasions. In regard to DBP a mixed model univariate ANOVA showed (see Fig. 1a) statistically reliable main effects of time $F(2,114) = 5.34$, $p < 0.01$, partial $\eta^2 = 0.09$ and of SE-group $F(1,58) = 5.63$, $p < 0.01$,

partial $\eta^2$ = 0.10, showing that individuals with high CBSE scores exhibited a higher DBP level over measurement occasions than those with low CBSE scores. The difference between the groups in DBP was largest ($t$ = 2.68, $p$ < 0.01) in the first measurement occasion T1 (anticipation phase). For DBP, no statistically reliable interaction between time and SE-group was found.

**Figure 1**
***Mean Change (Δ) Score in Levels of Diastolic, Systolic Blood Pressure and Heart Rate Between the two CBSE-Groups Over the Three Measurement Occasions.***




Figures 1b and 1c show that SBP and HR followed the same pattern as DBP. Regarding SBP, a univariate ANOVA showed a significant main effect of time $F$(2,114) = 2.81, $p$ = 0.05, partial $\eta^2$ = 0.05, marginal effects of SE-group $F$(1,58) = 3.01, $p$ = 0.06, partial $\eta^2$ = 0.05 and interaction between time and group $F$(2,114) = 2.49, $p$ = 0.07, partial $\eta^2$ = 0.04. HR did not show any significant effects of group or time. However, in line with DBP, the largest difference between the SE groups in SBP ($t$ = 2.36, $p$ < 0.05) and HR ($t$ =2.00, $p$ < 0.05) was, again, exhibited in measurement point T1. Taken altogether, the results indicate that the SE-groups differ in CVR, with the high CBSE-group performing with a higher level of arousal than the low CBSE-group, in particular in measurement occasion T1 (anticipation phase). Diastolic blood pressure was the index which was most affected by the difference in CBSE level. No gender differences were found in CVR.

***Response Force (RF)***

Response force was measured every 125 msec during the 30 min-test. For statistical analyses, all values below 9.81 centi-Newtons (cN) were considered to arise merely as a result of static noise. The data ($N$ = 37) were then reduced to three indexes T1, T2, T3: the mean value of the first 10 trials (anticipation), the mean value of the following 50 trials (beginning), and the mean value of the last 50 trials (concluding).

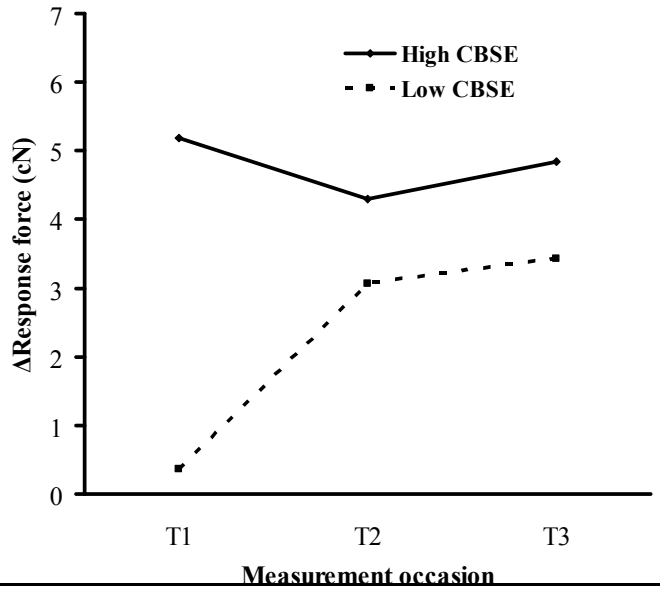
Figure 2 shows the differences in RF between the CBSE groups over the three indexed data points. A mixed model ANOVA revealed a significant interaction effect between CBSE-group and time on the RF measure $F$(2,70) = 5.24, $p$ < 0.01, partial $\eta^2$ =

0.13. This interaction is shown in Figure 2 indicating that, as compared to low scorers in CBSE, the high scorers displayed a substantially higher level of RF in the anticipation phase (T1), which remained high and relatively unchanged toward the end of the session (T2 and T3). By way of contrast, the low scorers in CBSE, who exhibited very low RF in phase T1, approached the medium level in phase T2 and stayed on that level for the rest of the session. A Tukey's HSD test ($p < 0.001$) showed a significant difference between the groups in index T1. RF in this anticipation phase for low scorers in CBSE was significantly lower ($p < 0.05$) than all the other data points for high scorers in CBSE. No gender differences were found in RF.

***Perceived Arousal (PA)***

A one-way analysis of variance showed a significant difference in perceived arousal between individuals with high ($M = 2.70$; $SD = 0.65$) and those with low ($M = 2.28$; $SD = 0.46$) scores in CBSE, $F(1,59) = 8.68$, $p < 0.01$, partial $\eta^2 = 0.14$. This indicates that high scorers in CBSE reported higher experienced tension, irritation, and frustration during the performance test than low scorers, who felt more relaxed and calm. No gender differences were found in PA.

**Figure 2**
***Mean Change (Δ) Score in Levels of Response Force Between the two CBSE-Groups Over the Three Measurement Occasions***




*Note.* 10 gram force is equivalent to 9.81 centi-Newtons (cN)

***Intercorrelations Among the Indicators of Reactivity***

Pearson correlations were calculated among the five different measures of reactivity (total scores). Table 1 shows that the three indices of blood pressure, DBP, SBP and HR correlated significantly or marginally and positively with each other. It shows further that

DBP, and SBP correlated significantly or marginally significantly and positively with response force (RF). In addition, DBP and RF correlated significantly and positively with perceived arousal (PA).

**Table 1**
***The Intercorrelations Between the Total Means of the Different Measures of Reactivity. The Labels for the Physiological Measures Refer to Differences from Baseline.***

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1. DBP | | | | |
| 2. SBP | .18* | | | |
| 3. HR | .24** | .39*** | | |
| 4. RF | .36** | .25* | .21 | |
| 5. PA | .33*** | -.10 | -.04 | .32** |

*Note*. DBP = diastolic blood pressure; SBP = systolic blood pressure; HR = heart rate; RF = response force; PA = perceived arousal. RF: $N = 37$; Other indices: $N = 61$
*$p < .10$ **$p < .05$ ***$p < .01$

***Actual Performance***

Actual performance, i.e. the accuracy of the participants' replications of the random configurations on the computer screen, calculated as percentage correct responses (the data was reduced to three indexes following the T1, T2, T3 procedure), was analyzed. A mixed model ANOVA revealed no main effect of CBSE-group but a significant effect of time $F(2,118) = 20.87$, $p < 0.001$, partial $\eta^2 = 0.26$ and a marginal interaction between group and time $F(2,118) = 3.32$, $p = 0.05$, partial $\eta^2 = 0.04$. High scorers in CBSE, starting with somewhat higher accuracy than low scorers, proceeded with a consistent but small increase toward T3, while the low scorers in CBSE reached the level of high scorers at T2 diminishing slightly their accuracy toward T3. Tukey HSD tests failed to reveal any significant changes over time.

## Discussion

To complement previous research on contingent self-esteem and its vulnerable implications, the present study compared physiological and behavioral reactivity in a performance situation between individuals high and low in competence based self-esteem. The multivariate results indicate that cardiovascular reactivity differed significantly over time as a function of CBSE level. The univariate tests showed that diastolic blood pressure was significantly higher and systolic blood pressure on the border of being significantly higher over the entire test performance in the high as compared to low scorers on CBSE, in accordance with the hypothesis. The differences were largest in the first measurement occasion. Though heart rate did not differ between the SE-groups this index was also significantly higher in high CBSE scorers in the first

measurement occasion, which was in line with the hypothesis of higher reactivity in high CBSE scorers during the anticipation phase.

The results of response force, indicating momentary exertion, were in line with the hypothesis. An interaction overtime showed that the high scorers as compared to the low scorers on CBSE pressed the computer mouse with substantially stronger force in the first phase of the test and continued to use the same level of force toward the end of the test. In contrast, those low in CBSE showed weak exertion in the initial phase, which elevated toward the middle of the test but then remained close the medium level. The continuously high momentary exertion and effort mobilization in high scorers in CBSE indicates the importance of performance outcomes for their self-validation.

The autonomic responses in high CBSE scorers were especially strong in the initial phase of the test which was in line with the hypothesis and conforms to theories of psychological stress (Lamb, 1979; Monat et al., 1972). It suggests that uncertainty in the anticipation phase triggers strongly the cognitive-motivational structure of CBSE, which drives the individual to secure self-esteem by means of good performances (see also Lyness, 1993). More specifically, a particular apprehension arises in people with high CBSE, who by definition (Johnson & Blom, 2007) have strong control needs and low tolerance for failures, in a phase which lacks clear indications of situation contingencies and outcomes. This tension and worry seems to diminish when starting to perform as the sense of own control increases (Greco & Roger, 2003; Lyness, 1993; Monat et al., 1972).

The general decline of blood pressure levels toward the end of the session probably indicates an experimental adaptation. This general trend was less obvious for response force, probably because the measure indicated effort laid down in performance. The high CBSE-group exerted with high response force throughout the session (see Di Paula & Campbell, 2002), but without reaching better actual results than the low CBSE-group. So struggling to balance between a challenge to gain self-esteem and threat of failure, the dilemma for people whose self-value is staked on competence, may entail in contra-productive persistence when performance is not related to effort (Johnson & Forsman, 1995; McFarlin, 1985).

An additional result in the present study, compatible with this struggle, was that the high CBSE-group reported significantly stronger feelings of irritation, frustration, and tension, when performing the computer test. That these scores correlated positively with diastolic blood pressure and response force suggests that high CBSE individuals' autonomic responses reflect a negatively felt state (see also Tomaka et al., 1997), arising from an effortful but frustrated and anxious striving during the performance test (see also Johnson & Forsman, 1995). This emotional stance is supported by results of a previous semantic association test where high scorers in CBSE associated 'work' with frustration, pain, and tension (Johnson & Blom, 2007).

A particular advantage of the present study is that we utilized different objective indicators of reactivity. Indeed, patterns of physiological responses across multiple response systems have been considered useful to ascribe psychological meaning to physiological responses (Tomaka et al., 1997). In this respect, our provisional use of the covert measure of response force, indicating momentary exertion and showing correspondence with the measurement of blood pressure, is particularly innovative. Due to this methodology, a computer based test with performance outcomes was considered

most suitable way to test the present hypotheses, but there are no reasons to think that the results found in the present study should not generalize to other performance tests with failure feedback (see Johnson & Forsman, 1995). Future research in a larger, gender balanced group might usefully evaluate further the potential of response force to indicate behavioral consequences of competence based self-esteem.

Before concluding, the possible confounding influence of broader personality factors, such as negative affect or trait self-esteem, need to be discussed. It is clear that CBSE (in line with other types of contingent self-esteem) is connected to negative affect via low basic/trait self-esteem which is its theoretical underpinning (Johnson & Blom, 2007). However, it is less likely that the higher physiological reactivity found in the present study in the high CBSE-group is explained by negative affect or trait self-esteem. First, CBSE has been shown to be an interactive function of low trait self-esteem and high competence needs for gaining self-esteem, when negative affect was controlled (Johnson & Blom, 2007). Second, Johnson and Forsman (1995) demonstrated that low trait (basic) self-esteem resulted in elevated physiological arousal after negative feedback in a performance situation only in individuals whose need for earning SE by competence also was high. These results indicate that physiological and behavioral implications of CBSE are independent of negative affect and trait self-esteem. Further support for this argument is provided by the research of Wilson, Lindsay, and Schooler (2000) suggesting that emotional tone alone is insufficient to elicit reactivity without some cognitive accompaniments (see also Levenson, 1983). Accordingly, Jorgensen, Johnson, Kolodziej, and Schreer (1996) found in a meta-analysis a weak and inconsistent association between neuroticism and blood pressure. Moreover, as the accuracy scores of replicating the configurations on the computer screen did not differ between the groups the possibility that the actual performance can explain the present results of reactivity is ruled out.

To conclude, the present results complement previous research by utilizing a theoretically sound conceptualization of competence based self-esteem and by, first time, examining directly objective reactivity indicators of this predisposition. A novel contribution is provided by the tentative use of response force which appears to concur with the overt indices of reactivity. As competence based self-esteem structure appears to evoke reactivity in terms of increased effort, anxiety, and strain when performing with uncertain outcomes, its role for work-related stress and wellbeing is important to address in forthcoming studies.

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## References

Anderson, G. A., Deuser, W. E., & DeNeve K. (1995). Hot temperatures, hostile affect, hostile cognition, and arousal: Tests of a general model of affective aggression. *Personality and Social Psychology Bulletin, 21*, 434-448.

Bowlby, J. (1980). *Attachment and loss, Vol. 3. Loss separation and depression.* New York: Basic Books.

Brainard, D. H. (1997). The Psychophysics Toolbox. *Spatial Vision, 10,* 433-436.

Crocker, J., & Park, L. E. (2004). The costly pursuit of self-esteem. *Psychological Bulletin, 130,* 392-414.

Crocker, J., & Wolfe, C. T. (2001). Contingencies of self-worth. *Psychological Review, 108*, 593-623.

Deci, E. L., & Ryan, R. M. (1995). Human autonomy, the basis of true self-esteem. In M. H. Kernis (Ed.*), Efficacy, agency and self-esteem* (pp. 31-71). New York: Plenum Press.

Di Paula, A., & Campbell, J. D. (2002). Self-esteem and persistence in the face of failure. *Journal of Personality and Social Psychology, 83,* 711-724.

Dunkley, D. M., Zuroff, D. C., & Blankstein, K. R. (2003). Self-critical perfectionism and daily affect: Dispositional and situational influences on stress and coping. *Journal of Personality and Social Psychology, 84*, 234-252.

Englund, M., & Patching G. R. (2009). An inexpensive and accurate method of measuring the force of key-presses in reaction time research. *Behavior Research Methods, 41*, 1254-1261.

Forsman, L., & Johnson, M. (1996). Dimensionality and validity of two scales measuring different aspects of self-esteem. *Scandinavian Journal of Psychology, 37*, 1-15.

Gendolla, G. H. E., & Richter, M. (2005). Ego involvement and effort: Cardiovascular, electrodermal, and performance effects. *Psychophysiology, 42,* 595-603.

Greco, V., & Roger, D. (2003). Uncertainty, stress, and health. *Personality and Individual Differences, 34*, 1057-1068.

Hallsten, L. (2005). Burnout and wornout: Concepts and data from a national survey. In A.-S. G. Antoniou & C. L. Cooper, (Eds), *Research companion to organizational health psychology*, (pp. 516-536). Cheltenham: Elgar Publ.

Jaśkowski, P., & Włodarczyk, D. (2006). Task modulation of the effects of brightness on reaction time and response force. *International Journal of Psychophysiology*, *61*, 98-112.

Johnson, M. (1998). Self-esteem stability: The importance of basic self-esteem and competence strivings for the stability of global self-esteem. *European Journal of Personality, 12*, 103-116.

Johnson, M. (2010). Depressive styles, self-esteem structure, and health: A dynamic approach to differential vulnerability in self-criticism and dependency. *Individual Differences Research*, *8*, 45-66.

Johnson, M., & Blom, V. (2007). Development and validation of two measures of contingent self-esteem. *Individual Differences Research, 5,* 300-328.

Johnson, M., & Forsman, L. (1995). Competence strivings and self-esteem: An experimental study. *Personality and Individual Differences, 19,* 417-430.

Johnson, M., Paananen, M. L., Rahinantti, P., & Hannonen, P. (1997). Depressed fibromyalgia patients are equipped with an emphatic competence dependent self-esteem. *Clinical Rheumatology, 16*, 485-491

Jorgensen, R. S., Johnson, B. T., Kolodziej, M. E., & Schreer, G. E. (1996). Elevated blood pressure and personality: A meta-analytic review. *Psychological Bulletin, 120*, 293-320.

Kernis , M. H., Granneman, B. D., & Barclay, L. C. (1989). Stability and level of self-esteem as predictors of anger, arousal, and hostility. *Journal of Personality and Social Psychology, 56,* 1013-1023.

Lamb, D. H. (1979). On the distinction between physical and psychological stressors. *Motivation and Emotion, 3,* 51-60.

Levenson, R. W. (1983). Personality research and psychophysiology: General considerations. *Journal of Research in Personality, 17*, 1-21

Lovallo, W. R. (1997*). Stress and health. Biological and psychological interactions*. Sage: Newbury Park, CA.

Lyness, S. A. (1993). Predictors of differences between type A and B individuals in heart rate and blood pressure reactivity. *Psychological Bulletin, 114,* 266-295.

Martin, R. A., Kuiper, N. A., & Westra, H. A. (1989). Cognitive and affective components of the Type A behavior pattern: Preliminary evidence for a self-worth contingency model. *Personality and Individual Differences, 10*, 771-784.

McFarlin, D. B. (1985). Persistence in face of failure: The impact of self-esteem and contingency information. *Personality and Social Psychology Bulletin*, *11*, 153-163.

McKinley, Shapiro, P. A., Bagiella, E. et al., (2003). Deriving heart period variability from blood pressure waveforms. *Journal of Applied Psychology, 95,* 1431-1438.

Monat, A., Averill, J., & Lazarus, R. (1972). Anticipatory stress and coping reactions under various conditions of uncertainty. *Journal of Personality and Social Psychology, 24*, 237-253.

Paradise, A. W., & Kernis, M. H. (2002). Self-esteem and psychological well-being: Implications of fragile self-esteem. *Journal of Social and Clinical Psychology, 21,* 345-361.

Pelli, D. G. (1997). The Video Toolbox software for visual psychophysics: Transforming numbers into movies. *Spatial Vision, 10*, 433-436.

Pittner, M. S., & Houston, B. K. (1980). Response to stress, cognitive coping strategies, and the type A behavior pattern. *Journal of Personality and Social Psychology, 39,* 147-157.

Price, V. A. (1982). *Type A behavior pattern: A model for research and practice*. New York: Academic Press.

Rasmussen, P. R., Willingham, J. K., & Glover, T. L. (1996). Self-esteem stability, cynical hostility, and cardiovascular reactivity to challenge. *Personality and Individual Differences, 21,* 711-718.

Robins, R. W., & Beer, J. S. (2001). Positive illusions about the self: Short-term benefits and long-term costs. *Journal of Personality and Social Psychology*, *80*, 340-352.

Seery, M. D., Blascovich, J., Weisbuch, M., & Vick, S.B. (2004). The relationship between self-esteem level, self-esteem stability, and cardiovascular reactions to performance feedback. *Journal of Personality and Social Psychology, 87,* 133-145.

Smith, T., W., Glazer, K., Riz, J. M., & Gallo, L. C. (2004). Hostility, anger, aggressiveness, and coronary heart disease: An interpersonal perspective on personality, emotion, and health. *Journal of Personality, 72,* 1217-1270.

Tomaka, J., Blascovich, J., Kibler, J., & Ernst, J. M. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *Journal of Personality and Social Psychology, 73*, 63-72.

Ulrich, R., & Wing, A. M. (1991). A recruitment theory of force-time relations in the production of brief force pulses: The parallel force unit model. *Psychological Review*, *98*, 268-294.

Wilson, T. D., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes, *Psychological Review, 107*, 101-126.