Inter-group Status Differences as Challenge or Threat:

The Role of Legitimacy

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Abstract

Based on social identity theory (Tajfel & Turner, 1979) we examined the motivational consequences of inter-group status differences as a function of the legitimacy of these differences. Motivational responses were conceptualized in terms of challenge and threat and operationalized by their cardiovascular markers, as described by the biopsychosocial model (BPS-CT; Blascovich & Mendes, 2010). Participants (*N*=104) were categorized in minimal groups. Group status and status legitimacy were manipulated in the context of an inter-group competition. High status elicited relatively more challenge (less threat) when status differences were legitimate than when they were illegitimate. Low status elicited relatively less threat (more challenge) when status differences were illegitimate than when they were legitimate. Cardiovascular reactivity in line with challenge mediated performance during the competition. Results are discussed in terms of the relationship between social status and stress, and the BPS-CT as novel and useful motivational framework for studying social identity processes.

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Possessing low status can be an important source of stress (Chen, Cohen, & Miller, 2010; Miller & Kaiser, 2001). This stress can be observed at the physiological level, for example in terms of increased blood pressure and elevated cortisol (Blascovich, Spencer, Quinn, & Steele, 2001; Matheson & Cole, 2004). In turn, these physiological correlates of stress play a key role in the relationship between social status and a variety of health outcomes (Saplosky, 2005). In the current research we examine the circumstances under which inter-group status differences lead to a *maladaptive* cardiovascular stress profile (termed *threat*) or a *benign* cardiovascular stress profile (termed *challenge*; Blascovich & Mendes, 2010). More specifically, we focus on how the legitimacy of inter-group status differences shapes the relationship between group status and cardiovascular responses indicative of challenge and threat motivational states.

Although those low in status do generally show more physiological signs of stress than those high in status, the relationship between status and stress is moderated by the *meaning* of the status differences (Sapolsky, 2005). For example, in his research on primates, Sapolsky demonstrated that although lower-ranked baboons show most hormonal signs of stress when the hierarchy of the group is stable, the higher-ranked baboons show most stress when the group is unstable (Sapolsky, 1983; 2005; see also Scheepers, 2009). In the current research we extend this reasoning to a human population, an inter-group context, and—most importantly—a chief factor shaping the meaning of status differences in human contexts, namely whether these differences are *legitimate* (Jost & Major, 2001). On the basis of social identity theory (Tajfel & Turner, 1979) we predicted that members of the high status group show relatively more challenge (less threat) when status differences are legitimate than when they are illegitimate. By contrast, we predicted that members of the low status group show

relatively less threat (more challenge) when status differences are illegitimate than when they are legitimate.

Social Identity, Group Status, and Status Legitimacy

According to social identity theory (SIT: Tajfel & Turner, 1979; see also Ellemers & Haslam, 2012) people derive part of their identity from the groups to which they belong (i.e., their "social identity"). The motivational part of SIT describes how people strive for positive social identities, a need that is served by inclusion in groups with a relatively high status. When the need for a positive social identity is undermined, for example when being part of a low status group, a state of social identity threat arises (Branscombe, Ellemers, Spears, & Doosje, 1999; Ellemers, Spears, & Doosje, 2002). This aversive state can in turn have a number of important consequences like decreased self-esteem and increased discrimination against out-groups (Branscombe & Wann, 1994).

Much research within the social identity tradition has been devoted to examine how group members cope with low or otherwise threatened group status (Boen & Vanbeselaere, 2000; Ellemers, 1993; Ellemers & Haslam, 2012; Mummendey, Kessler, Klink, & Mielke, 1999). In this work, a distinction has been made between individualistic responses, like individual mobility to another group, and collective responses like increasing effort to improve the status of the group as a whole (Ellemers, 1993; Ouwerkerk, De Gilder, & De Vries, 2000). Which of these options is chosen depends on socio-structural variables like the *permeability* of the group boundaries, and the *stability* and *legitimacy* of the inter-group status differences. When group boundaries are permeable and status differences are perceived to be stable and legitimate, individual mobility becomes more likely. By contrast, when group boundaries are closed and status differences are perceived to be unstable and illegitimate collectivistic responses become more likely (collective action; Ellemers, 1993; Tajfel & Turner, 1979).

To illustrate the social identity rationale regarding the relation between social-structural variables and responses to low status take as an example a soccer team that loses game after game and finds itself at the bottom of the league. One option for the players to deal with the threat stemming from this low status would be to try joining another, more successful, team (i.e., individual mobility). However, in case this not feasible, the stability and legitimacy of the status position determine whether the players are likely to invest additional effort to collectively improve the team's position. More specifically, when the team's position is perceived to be illegitimate (e.g., referees have been systematically biased against the team), or unstable (e.g., the team has recently attracted some good young players), increased team effort to improve the group's position becomes more likely (Ellemers, 1993; Tajfel & Turner, 1979).

Despite the conceptual and practical differences between inter-group status stability and -legitimacy, these two factors do often have similar consequences as they both signal the security of the inter-group status relations (Tajfel & Turner, 1979). That is, both unstable and illegitimate status relations make "cognitive alternatives" for the current state of affairs salient, thereby indicating whether social change is likely to occur (Turner & Brown, 1978). Hence, whether in isolation or in interaction with (in)stability, illegitimate inter-group status differences trigger social change attempts by members of low status groups (Bettencourt, Dorr, Charlton, & Hume, 2001; Ellemers, 1993; Scheepers, Branscombe, Spears, & Doosje, 2002; Turner & Brown, 1978).

Previous research using self-report and behavioral measures has yielded evidence for social identity theory's hypotheses regarding the role of status legitimacy in shaping the cognitive, emotional, and behavioral consequences of inter-group status differences. For example, members of high status groups show more in-group favoritism than members of low status groups when status differences are legitimate, but these differences disappear when

status differences are illegitimate (Turner & Brown, 1978; see Bettencourt et al., 2001, for meta-analytic evidence). Similarly, Scheepers et al. (2002) found that when status differences were legitimate, members of a high status group perceived their group as more cohesive than members of low status groups, but when status differences were illegitimate it was the members of the low status group who perceived their group as more cohesive. This latter response was interpreted in terms of bolstering solidarity and preparing for social change when members of low status groups believe that their group's position is illegitimate (see also Ellemers, 1993, for similar effects on in-group identification). Finally, O'Brien and Major (2005) found that the self-esteem of ethnic minority-group members was lower when they believed that the social system was legitimate than when they believed that the system was illegitimate, while the opposite was true for ethnic majority-group members (see also Jost & Hunyady, 2002).

In summary, previous work has shown that when inter-group status differences are legitimate, members of high status groups show higher in-group favoritism, perceived group cohesion, identification, and self-esteem than members of low status groups. However, when status differences are illegitimate, these differences disappear or even reverse, when members of low status groups prepare for social change. In addition, the depressed self-esteem by members of high status groups when status differences are illegitimate is in keeping with previous research showing that members of high status groups do often feel insecure, or even guilty when it becomes clear that the group's high status has been obtained in an unfair way (Doosje, Branscombe, Spears, & Manstead, 1998).

In the current research we build upon this previous work and address the more basic motivational and physiological processes, in terms of challenge and threat, that may lay at the basis of the different responses by members of low and high status groups as a function of status legitimacy. Addressing these more basic processes is novel and important for at least

two reasons: First, as indicated above, status differences have important *health* implications, and some of the negative health outcomes for members of low status groups are mediated by physiological stress responses (Sapolsky, 2005). However, whereas the CV threat pattern (which will be described in more detail below) represents a maladaptive pattern related to negative health outcomes, the CV challenge pattern represents a benign pattern that may confer long-term health benefits (Blascovich, 2008). Thus, the current research provides insight into the contextual factors through which status may affect long-term health outcomes. Second, the current research is the first to our knowledge that directly examines specific *motivational* processes as a function of (il)legitimate status differences between groups. Understanding these processes is important for predicting when members of low status groups accept their fate or seek social change, and when members of high status groups react most defensively in order to protect the status of their group.

Measuring Challenge and Threat

The biopsychosocial model of challenge and threat (BPS-CT) describes specific cardiovascular (CV) markers of the motivational states of *threat* and *challenge* during so-called *motivated performance situations* (e.g., athletic performance, doing a math test, giving a speech). According to the BPS-CT, threat and challenge result from the appraisal of the motivated performance situation in terms its demands (effort, uncertainty, danger), as well as the person's resources (skills, knowledge, support, dispositions) to deal with these demands. When demands outweigh resources, a threat motivational state arises, whereas when resources approach or exceed demands, a challenge motivational state arises (Blascovich, 2008; Blascovich & Mendes, 2010; Blascovich & Tomaka, 1996). Importantly, however, this appraisal process is not a "cold" and conscious calculation, but is strongly influenced by "affective cues" (Blascovich & Mendes, 2000): While positive affect facilitates challenge, negative affect facilitates threat.

At the CV level, challenge and threat are differentiated by means of specific patterns of cardiac output (CO, the amount of blood pumped out by the heart in a minute) and total peripheral resistance (TPR, a measure of resistance to blood flow). Challenge is marked by increased CO and decreased TPR compared to baseline levels. Threat, by contrast, is marked by increased TPR and stable or even decreased CO (Blascovich & Mendes, 2010). Put differently, a state of challenge is marked by high CO and low TPR, which enables the efficient mobilization and transportation of energy during motivated performance. Threat, by contrast, is marked by relatively high TPR and low CO, which leads to a less efficient mobilization and transportation of energy during motivated performance. Cardiac output and TPR can also be combined in a single threat – challenge index (TCI: Blascovich, Seery, Mugridge, Norris, & Weisbuch, 2004; Kassam, Koslov, & Mendes, 2009; Seery, Weisbuch, Hetenyi, & Blascovich, 2010).

The BPS-CT has been validated in dozens of studies, and has provided a new motivational perspective on a variety of topics, ranging from social facilitation to inter-ethnic interactions (see Blascovich & Mendes, 2010 for an overview). As described above, advantages of applying the physiological response patterns described in the BPS-CT include that they constitute direct markers of specific motivational states, and that they have predictive value for important health and performance outcomes (Blascovich, 2008; Blascovich et al., 2004; Kassam et al., 2009; Seery et al., 2010). In addition, using these measures has important methodological benefits, like that they can tap into the unconscious aspects of challenge and threat motivational states. Moreover, CV measures indicative of challenge and threat can be taken online, continuously, and are less subject to demand concerns than self-report measures.

The Current Research

We performed a minimal group study in which we manipulated group status and status legitimacy similar to the study by Scheepers et al. (2002). After initial categorization, participants performed a group task on which positive or negative feedback was given in comparison to an out-group (status manipulation). Participants were then given an opportunity to communicate with other in-group members via the computer system. During this communication session, participants received a message from another in-group member who either contested or justified the in-group's status. After this, participants performed a second round of the status-defining task, which was the main motivated performance situation we focused on with regard to CV-markers of challenge and threat.

We predicted that members of the high status group show relatively more challenge (less threat) when status differences are legitimate than when they are illegitimate. By contrast, we predicted that members of the low status group show relatively less threat (more challenge) when status differences are illegitimate than when they are legitimate. More specifically, in terms of the appraisal component of the BPS-CT, we reasoned that low group status is likely to function as an affective cue, leading to relative threat. When low status is seen as legitimate, and thus secure, increased effort is required to improve the group's position (higher demands), further increasing the threat. However, the claim by an in-group member that the group's low status is illegitimate will increase feelings of solidarity and support (higher resources), increasing relative challenge. For members of the high status group we reasoned that the group's positive value functions as an affective cue leading to relative challenge, especially when status differences are legitimate and secure (low demands). However, the claim by an in-group member that the high status is illegitimate will induce uncertainty (a demand) and, moreover, will form a direct threat to the positive status of the group (Doosje et al., 1998), increasing relative threat.

We also examined the performance on the second round of the status-defining group task. In keeping with the general findings in research on the BPS-CT (Blascovich et al., 2004; Kassam et al., 2009; Seery et al., 2010), we predict that a tendency towards challenge will go hand in hand with better performance. More specifically, we predict that challenge mediates performance.

Method

Participants and Design

Participants were 104 female[1] undergraduates (age: $M = 21$, range: 17 - 27) at Leiden University, who were paid 5 Euros for their participation, and were randomly assigned to one of the four conditions of the 2(Group Status: Low vs. High) X 2(Status Legitimacy: Illegitimate vs. Legitimate) design. During data collection, one participant fainted, leaving a final sample of 103. However, due to technical problems, signal loss, or motion artifact, there was some missing data for the CV-measures, resulting in lower degrees of freedom for the statistical tests regarding these measures.[2]

Cardiovascular Measures

To assess CV-markers of challenge and threat motivational states, impedance-cardiographic signals (ICG), electrocardiographic signals (EKG), and blood pressure were continuously measured using a Biopac MP150 system (Biopac Systems Inc., Goleta, CA), using the same laboratory and apparatus, and following the same procedures, as described by Scheepers (2009). Physiological data were stored using *Acqknowledge* software (Biopac Systems, Goleta, CA). Acqknowledge was also used to calculate Mean Arterial Pressure (MAP) from the continual blood pressure signal. The ICG complexes were scored using AMS-IMP software (Free University, Amsterdam, the Netherlands), which yielded CO. Total peripheral resistance was in turn calculated from CO and MAP using the following formula: TPR = (MAP/CO) x 80 (Sherwood et al., 1990). In addition to CO and TPR, we also

calculated Heart Rate (HR) and Pre-Ejection Period (PEP), which is a measure of ventricular contractility. A significantly increased HR and decreased PEP (compared to baseline) mark task-engagement, which is a key aspect of motivated performance and a prerequisite of a further interpretation of CO and TPR in terms of challenge and threat (Blascovich et al., 2004; Kassam et al., 2009; Seery et al., 2010).

Procedure

The whole experiment was run on computers, such that all information, tasks, and manipulations were delivered via the computer. Participants arrived individually in a room where multiple cubicles were visible. The participant was directly escorted to one of these cubicles where sensors for physiological recording were applied. Then, five minutes of baseline CV-responses were collected during which the participant sat quietly and relaxed.

After the baseline period, participants received some general information about the study. The research was said to be concerned with "association style and pattern recognition" Participants were told that earlier research had revealed that people can be divided into two categories on the basis of their association style: People with a more "holistic" association style, and people with a more "detailed" association style. The goal of this research was said to be finding out whether the "holistic group" or the "detailed group" performed better in a pattern recognition task. In order to determine their association-style, participants then completed the "mental association test" which consisted of eleven items (see also Scheepers et al., 2002). For some of these items the participant had to indicate which word did not fit into a particular set (e.g., boat, sail, rudder, and deck). Other items involved similar questions about sets of figures. At the end of the task, participants received feedback about their association style. All participants were categorized as belonging to the "holistic" group.

After the categorization procedure, participants performed a "pattern recognition task" consisting of twenty separate trials. At each trial, five squares, labeled "A", "B", "C", "D",

and “E”, appeared at the screen. It was the participant’s task to click, in alphabetical order, on these squares. On each trial, the squares appeared at different spots on the screen (see Aarts, Gollwitzer, & Hassin, 2004, Study 1). Participants were told that performance on this task would be assessed on two dimensions: Accuracy and speed. Accuracy was said to be assessed by means of the length of the route that the mouse pointer took to complete a given trial, as well as by the number of “mis-hits” (i.e., clicking outside a square, or on the wrong square). Speed was said to be assessed by means of the time it took to complete a given trial. In reality, it is not possible to assess accuracy using this task, only speed (Aarts et al., 2004).

After the task we provided group-level feedback about the groups’ relative performance, which was our status manipulation. First, participants received information about how performance was assessed. We explained that in our formula accuracy was weighted three times as much as speed in calculating each group’s performance score. We included this information to give some room for questioning the legitimacy of the group status differential. Participants were then shown a graph ostensibly representing the performance of both groups. In the low status conditions, participants learned that their in-group, the holistic group, had performed worse in comparison to the detailed group. In the high status conditions, participants learned that their in-group had outperformed the other group. Participants did not receive specific information about the number of other people (in-group or out-group members) that were present in their session. The status feedback was said to be based on “the performance of members of the holistic and detailed groups that have participated in this research project so far”.

After the status manipulation, we gave participants a within-group communication opportunity via the computer network. We told them that later on they would be performing a second pattern recognition task so the communication session was an opportunity to exchange “tips and strategies” for performing well on the second task. Participants were first given one

minute to type in their own message, if they wished to do so. Then, a new screen appeared, showing messages from three in-group members. These messages were said to be written by "members of the holistic group that are present in the current session or were present in a previous session". First, there was a person who had not written anything. We included this "silent" person because we were concerned that some participants would not generate a message and might therefore see themselves as "bad" group members if they thought that every other member wrote a message and they did not. The second in-group member sent the same message in all conditions: a general comment about the pattern recognition task. The third person's message communicated our legitimacy manipulation. Two versions of that message were constructed. In the illegitimate conditions the person wrote: "I have checked the equation by which our performance, as well as that of the other group, was assessed. It is quite unfair. At first glance, this task seems to be all about speed. Making accuracy count more than speed in determining performance is therefore unfair. It shows group differences due to chance. Our group is not where it belongs. Our current high [low] position on the ranking is an unfair reflection of what we are as a group." In the legitimate conditions, the person wrote: "I have checked the equation by which our performance, as well as that of the other group, was assessed. It is quite fair. In terms of speed we will probably score all quite similar. Making accuracy count more than speed in determining performance is therefore fair. It shows the true differences between the groups. Our group is where it belongs. Our current high [low] position on the ranking is a fair reflection of what we are as a group." After they saw the messages, a second and similar pattern recognition task followed, consisting of fifteen trials. This time, the task was slightly more difficult as there were more squares per trial, while the squares themselves were somewhat smaller in size. On average, participants took 1 minute and 24 seconds to complete the second round of the task. After the task, participants were debriefed via the computer. The debriefing was concluded with the information that

participants should open the door of the cubicle and call the experimenter. After the experimenter had removed the electrodes, the participant was verbally probed for suspicion and was given the opportunity to ask further questions. Finally, participants were compensated for their participation, and then dismissed.

Checks and Measures

The successfulness of the manipulations was checked using several items. Just after the first pattern recognition task and just before receiving the status feedback it was checked whether the participants were aware of their group membership. Participants responded by clicking on one of two buttons, one of which was labeled "holistic group" and the other "detailed group". Just before the second pattern recognition task a similar procedure was used to check whether the participant was aware of the status differences. The legitimacy of the status differences was checked with the following item: "to what extent do you find the procedure by which the performance-scores were calculated a fair one?" Responses were made by placing crosses on 100-point scales with *not at all* (0) and *very much* (100) as endpoints.

The primary dependent measure was the cardiovascular reactivity during the second pattern recognition task. In addition, we also measured performance during the task, in the form of reaction times on the trials (Aarts et al., 2004).

Results

Checks

Ninety-seven percent of the participants indicated their group membership in accordance with the categorization procedure, and 95% of the participants indicated the status of their group in accordance with the status manipulation. The participants who gave an incorrect response to the group membership or status questions were equally divided across conditions ($\chi^2 = 6.01$, $p = .111$) and were prompted with the correct response before

proceeding with the experiment; therefore, the data of all participants was retained the in main analyses reported below.[3] On the basis of the suspicion check there was no reason to exclude participants. The legitimacy check was analyzed using a 2(Group Status: Low vs. High) X 2(Status Legitimacy: Illegitimate vs. Legitimate) ANOVA. The only effect that emerged from this analysis was a main effect for legitimacy, $F(1, 99) = 9.84$, $p = .002$: Legitimacy was perceived to be greater in the legitimate condition ($M = 60.06$, $SD = 19.15$) than in the illegitimate condition ($M = 49.13$, $SD = 15.76$). In summary, we can conclude that the manipulations were successful.

Cardiovascular Measures

Mean levels of HR (Heart Rate), PEP (Pre-Ejection Period), CO (Cardiac Output), and TPR (Total Peripheral Resistance) were calculated for the last minute of the baseline, and the first minute of the (second) task. We then checked for differences between the conditions on baseline levels of the cardiovascular measures. Although there were no significant effects on HR, PEP, and CO, there was a significant effect of group status on baseline levels of TPR, $F(1, 87) = 5.45$, $p = .022$. Therefore, we included baseline TPR as covariate in the ANOVAs on TPR and TCI (i.e., the Threat Challenge Index, which is partly based on TPR; see below). In line with standard practice, reactivity scores were then created for the four measures by subtracting the baseline scores from the task scores, and univariate outliers (defined as 3.3*SD* above/below the mean) were assigned a value of 1% higher/lower than the adjacent non-extreme value (Blascovich et al., 2004; Mendes, Blascovich, Lickel, & Hunter, 2002; Seery, West, Weisbuch, & Blascovich, 2008). In addition to examining CO and TPR reactivity separately, we also calculated a combined Threat-Challenge Index (TCI) by calculating *Z*-scores of CO and TPR reactivity, then multiplying TPR with -1 and summing the result with the CO *Z*-score (Blascovich et al., 2004; Kassam et al., 2009; Seery et al., 2010). Higher scores on the resulting index—which maximizes the reliability of the cardiovascular measures

(Seery et al., 2010)—indicate a greater challenge motivational state, whereas lower scores indicate a greater threat motivational state.

PEP reactivity scores (M = -8.71, SD = 10.58), were significantly smaller than 0 (i.e., the baseline level), $t(95) = 8.06$, $p < .001$. HR reactivity scores (M = 0.35, SD = 5.61) were not significantly greater than 0, however, $t(99) = 0.63$, $p = .532$.[4] However, the most basic physiological sign of task engagement is sympathetic nervous system and because PEP is the most direct CV index of sympathetic nervous system activation (Brownley, Hurwitz, & Schneiderman, 2000), somewhat more weight should be given to PEP than to the HR (which is under both sympathetic and parasympathetic influence; see also Kelsey, 2012). Hence, we conclude that sufficient signs of task engagement are present to justify a further interpretation of CV indices in terms of challenge and threat motivational states.

The means for CO and TPR as a function of group status and status legitimacy are presented in Table 1. As can be seen in the table, members of the high status group showed relatively more challenge (high CO, low TPR) when status differences were legitimate than when they were illegitimate. By contrast, members of the low status group showed relatively more threat (low CO, high TPR) when status differences were legitimate than when they were illegitimate.

2(Group Status: Low vs. High) X 2(Status Legitimacy: Illegitimate vs. Legitimate) ANOVAs on CO revealed a significant main effect of group status, $F(1, 92) = 4.02$, $p = .048$, which was qualified by a significant interaction between group status and status legitimacy, $F(1, 92) = 8.74$, $p = .004$. Members of the high status group had lower CO when status differences were illegitimate than when they were legitimate, $F(1, 92) = 5.88$, $p = .017$, while members of the low status group had somewhat higher CO when status differences were illegitimate, than when they were legitimate, $F(1, 92) = 3.01$, $p = .086$. Moreover, when status was legitimate, members of the high status group had higher CO than members of the low

status group, $F(1, 92) = 12.10$, $p = .001$; when status was illegitimate, these differences disappeared, $F(1, 92) = 0.43$, $p = .515$.

The ANOVA on TPR revealed a main effect of status, $F(1, 81) = 6.83$, $p = .011$, which was qualified by an interaction between group status and status legitimacy, $F(1, 81) = 11.80$, $p = .001$. Members of the low status group had somewhat lower TPR when status differences were illegitimate than when they were legitimate, $F(1, 81) = 2.95$, $p = .089$. There were no differences on TPR between the legitimate and illegitimate high status condition, $F(1, 81) = 1.42$, $p = .237$. Moreover, when status was legitimate, members of the low status group had higher TPR than members of the high status group, $F(1, 81) = 8.55$, $p = .004$; when status was illegitimate, these differences disappeared, $F(1, 81) = 0.01$, $p = .979$.

The ANOVA on the TCI nicely summarizes the effects reported above. There was a main effect of group status, $F(1, 81) = 5.64$, $p = .020$, which was qualified by a significant interaction between group status and status legitimacy, $F(1, 81) = 10.26$, $p = .002$. Participants in the high status group showed a stronger tendency towards challenge when status was legitimate than when it was illegitimate, $F(1, 81) = 6.52$, $p = .013$. By contrast, participants in the low status group showed a stronger tendency towards challenge when status was illegitimate than when it was legitimate, $F(1, 81) = 3.75$, $p = .056$. Finally, when status was legitimate, participants in the high status condition displayed a significantly stronger tendency towards challenge than participants in the legitimate low status condition, $F(1, 81) = 15.66$, $p < .001$, whereas when status was illegitimate these differences disappeared, $F(1, 81) = 0.37$, $p = .547$.

Performance

A performance index was calculated by averaging the response times for the trials of the second pattern recognition task. Lower scores (i.e., greater speed) on the resulting index indicate a better performance. We applied the same procedure for outlier detection and

treatment as for the CV measures; there was one participant with outlying reaction time values at both rounds of the task. The performance data as a function of group status and status legitimacy is presented in Table 1.

The performance index was analyzed using a 2(Group Status: Low vs. High) X 2(Status Legitimacy: Illegitimate vs. Legitimate) ANCOVA. In order to control for individual differences in task performance, the average reaction times on the first task were included in the ANCOVA as a covariate.[5] The analyses revealed a main effect of group status, $F(1, 98) = 5.72$, $p = .019$, which was qualified by an interaction among group status and status legitimacy, $F(1, 98) = 8.67$, $p = .004$. In line with the results on cardiovascular markers of challenge, participants in the high status condition responded somewhat faster when status was legitimate than when status was illegitimate, $F(1, 98) = 2.91$, $p = .091$. Moreover, participants in the low status condition responded faster when status was illegitimate than when status was legitimate, $F(1, 98) = 6.20$, $p = .014$. Finally, when status was legitimate participants in the high status condition responded significantly faster than participants in the low status condition $F(1, 98) = 13.58$, $p < .001$. When status differences were illegitimate, however, the differences between those in the low and high status condition disappeared, $F(1, 98) = 0.21$, $p = .651$.

There was a modest, but significant, negative correlation between response times during the second pattern recognition task and the threat-challenge index (TCI) (controlling for reaction times at the first task and baseline TPR), $r = -.27$, $p = .012$. This indicates that those who were more challenged during the task, performed better.

We then tested whether cardiovascular responses indicative of challenge and threat mediated performance outcomes, making use of Preacher and Hayes' (2004) SPSS macro for simple mediation with 5000 bootstrap resamples. The performance index was entered as dependent variable, the interaction term between status and legitimacy was entered as

predictor, the TCI was entered as mediator, and reaction times during the first task and was entered as a covariate.[6] The bootstrap results showed that the indirect effect of condition on performance through higher scores on the TCI was significant with a point estimate of -.10 and a 95% BCa CI of -.25 to -.02, indicating full mediation (see Figure 1). We also tested for reversed mediation, i.e., mediation of cardiovascular responses (TCI) through performance, but did not find evidence for significant mediation in this case: 95% BCa CI: -.02; .48.

Discussion

In line with predictions, members of the high status group showed relatively more challenge (less threat) when status differences were legitimate than when they were illegitimate. By contrast, members of the low status group showed relatively less threat (more challenge) when status differences were illegitimate than when they were legitimate. Moreover, those who showed a stronger tendency towards challenge performed better during a new round of the task on which the inter-group status difference was based. Finally, there was evidence that performance was mediated by CV responses indicative of relative challenge.

The current results extend previous research on physiological responses to differences in social status. Although being low in rank has often been associated with more maladaptive physiological stress responses (Akinola & Mendes, 2013; Chen et al., 2010; Scheepers, De Wit, Ellemers, & Sassenberg, 2012) there are important moderators of this relationship (Sapolsky, 2005). That is, it is not so much status *per se* but what status *means* that determines which status position is more threatening. In his work on primates, Sapolsky has shown how the *stability* of a group determines whether those low or high in rank display the most maladaptive physiological stress profile (see also Scheepers, 2009). The current research examined an important factor shaping the meaning of status differences within and between human social groups, namely the *legitimacy* of these differences. Like stability, legitimacy is

an important indicator of the security of the status hierarchy (Tajfel & Turner, 1979; see also Ellemers, 1993; Lammers, Galinsky, Gordijn, & Otten, 2008). Thus, in keeping with previous work we showed that the physiological benefits of being high in rank do only appear when the status hierarchy is legitimate (i.e., secure). However, when status differences are illegitimate, members of high status groups show a more maladaptive cardiovascular pattern (threat). As a consequence, the current results provide insight into the contextual factors through which status may affect long-term health outcomes: Maladaptive stress profiles are more likely to emerge for members of low status groups when status is legitimate and more likely for members of high status groups when status differences are illegitimate.

The current results are in line with the propositions of social identity theory, but also extend social identity research. Social identity theory describes how the reactions to inter-group status differences are shaped by socio-structural variables like the stability and legitimacy of these differences. The cognitive, affective, and behavioral responses to (il)legitimate inter-group status differences have been extensively documented in the literature (Bettencourt et al., 2001; Boen & Vanbeselaere, 2000; Ellemers, 1993; Ellemers & Haslam, 2012; Jost & Hunyady, 2002; Mummendey et al., 1999; O'Brien & Major, 2005; Turner & Brown, 1978). However, despite this rich literature there has been limited research on the precise motivational basis of these responses. The current research provides the most direct evidence so far for specific motivational processes resulting from socio-structural differences between groups. These motivational responses may in turn lay at the basis of important behavioral reactions, such as efforts to improve or preserve the status of the group. As such, the current research provides insight into the circumstances under which members of low status groups are most likely to work for social change, and members of high status groups react most defensively in order to protect the status of their group.

In a more concrete sense, there are two aspects to the greater motivational specificity that BPS-CT principles can offer social identity research: A methodological aspect and a conceptual aspect (Scheepers, 2013). The methodological aspect concerns the measurement of threat in relation to social identity. Although threat has been proposed as driving principle behind a host of important outcome variables in social identity research (e.g., in-group bias, self-esteem, identification; Branscombe et al., 1999; Ellemers et al., 2002), more direct measurements of the state of threat in relation to social identity have been scarce. This seems at least partly due to that it is difficult to measure threat by means of self-report measures because research participants may respond defensively to threat (Bettencourt, Miller, & Hume, 1999) or may not even be aware of the threat in the first place (Blascovich & Mendes, 2000). By means of the cardiovascular profiles described in the BPS-CT, threats that emerge as a function of social identity can be measured in an online, direct, unobtrusive, and unambiguous way.

The second, more conceptual, aspect of the enrichment of social identity research by integration of BPS-CT principles concerns the introduction of challenge as a motivational concept within social identity research. Threat has always had a central place on the research agenda of social identity theorists (see Branscombe et al., 1999; Ellemers et al., 2002 for overviews). However, the stress that has been put on threat as a core motivational principle may have gone somewhat at the expense of examining other motivational processes, such as challenge. This is unfortunate because while threat can be related to more dysfunctional responses to inter-group status differences (e.g., lowered self-esteem, diminished performance), challenge can be related to more constructive responses, such as the willingness to work for social change. The relationship between challenge and performance in the current study provides just one illustration of this. Thus, the combination of principles

from SIT and the BPS-CT provides a fruitful basis for new research and new insights in the psychology of social identity and inter-group relations (Scheepers, 2013).

It should be noted, however, that the current results did not show a full cross-over interaction between status and legitimacy. This is mainly due to that when status was illegitimate, members of the low status groups did not show a "full blown" challenge response. This may seem to be at odds with our previous work on status stability (Scheepers, 2009), which showed that when status differences were unstable, members of the low status group were more challenged than members of the high status group. There is, however, an important difference between status stability, which explicitly indicates the possibility of change, and status legitimacy, which indicates unfairness but not directly the possibility for change. That is, status differences can be illegitimate and stable at the same time. Thus, although illegitimate status differences should make "cognitive alternatives" for the current state of affairs salient (Turner & Brown, 1978), the uncertainty of whether this will actually happen is likely to temper challenge in members of the low status group.

This is not to suggest that members of low status groups will never be challenged by unfair status differences. However, this will be particularly likely in situations where there is a clear channel to guide protest and collective action. In the current paradigm, where directly after receiving information about status legitimacy participants had to perform on a second round of task, such a channel was absent. However, it is possible that participants in the illegitimate low status condition would have shown challenge during a speech where they could give their opinion about the task procedure.

Another issue that should be discussed is that, in retrospect, the current performance measure seems to be suboptimal. That is, the information that for determining performance "accuracy would weight more than speed" might have influenced the strategy that participants used during the second round of the task. In terms of a "speed-accuracy tradeoff" a plausible

strategy might have been to focus somewhat more on accuracy at the expense of speed, making speed a suboptimal performance measure. Importantly, however, it was explicitly mentioned that *both* speed and accuracy would count in calculating performance, so completely switching to accuracy and no longer caring about speed would not have been a good strategy to follow. Indeed, when taking this reasoning one step further you might actually argue that the speed index provides a more conservative test of the role of motivation in the current effects. Still, however, it is well possible that especially "challenged" participants changed their task strategy, making speed a less ideal measure for measuring the behavioral manifestations of this challenge response.

In the current research we operationalized legitimacy as a contextual variable and not as a relatively stable personal belief (cf. Lerner, 1980; Pratto, Sidanius, Stallworth, & Malle, 1994; Townsend, Major, Sawyer, & Mendes, 2010). Based on a previously developed paradigm (Scheepers et al., 2002) we manipulated legitimacy by means of claims by in-group members about the fairness of the inter-group status differences. The manipulation check indicated that these claims did indeed influence, in the intended way, the participant's perception of legitimacy. The current manipulation has also substantial external validity as social change often starts with claims by prominent members of low status groups (e.g., Gandhi, Mandela, King) that the position of the group is illegitimate. Thus, although we should be somewhat cautious to generalize the current effects to other forms and measures of legitimacy, the current operationalization of legitimacy is meaningful and important.

To conclude, the current research shows that being a member of a low status group is not always threatening while being a member of a high status group does not always mean that things are "hunky dory". Rather, whether low or high status poses a threat or a challenge depends on what status means, for example in terms of its legitimacy. It is precisely because the relation between status and "stress" is complex that it is necessary to move beyond

traditional methodology (like self-report measures) and to examine a broader spectrum of stress responses (also “positive stress” in the form of challenge, in addition to “negative stress” in the form of threat). These two innovations formed the basis of the current research. By making a distinction between more benign and maladaptive responses to demanding inter-group situations, and by measuring these responses in a direct, continuous, and unobtrusive way, the current research may draw a more complex, but also more precise picture of motivational responses to inter-group status differences (Scheepers, 2013). Future research might extend the current contribution to other outcome variables in inter-group relations, such as different forms of in-group bias.

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Endnotes

[1]The reason for only recruiting female participants was a quite practical one. At the moment of data collection we had as a general rule in our lab protocol that female research assistants apply electrodes and sensors for physiological recording to female participants only (and male assistants apply electrodes and sensors to male participants only). In this particular study a female assistant collected the data, and thus she only recruited and tested female participants.

[2]At baseline, the ECG data of 3 persons and the ICG data of an additional 2 participants were missing, due to movement artifact or otherwise unscorable waveforms. This resulted in a sample of 100 participants in the analyses testing for possible differences in baseline HR (96 df in the error term of the ANOVA), and 98 participants in the analyses testing for possible differences in baseline PEP and CO (94 df in the error term of the ANOVAs). In addition, baseline blood pressure (BP) scores were missing for an additional 7 participants. As the calculation of TPR relies on both ICG and BP data, we had a sample of 91 participants for the analysis of baseline differences in TPR (87 df in the error term).

Regarding the task period we had missing ICG data for an additional 2 participants and missing BP data for an additional 3 participants. Therefore, for the analyses of the reactivity scores (which rely on both baseline and task readings) we had a sample of 100 participants for HR (99 df in the *t*-test testing HR reactivity against zero) and a sample of 96 participants for PEP and CO (95 df in the *t*-test testing PEP reactivity against zero and 92 df in the error term of the ANOVA on CO reactivity). Finally, we had a sample of 86 participants for the analysis of TPR reactivity and analyses of the TCI (81 df in the error term of the ANCOVA in which we included baseline TPR as covariate).

[3]When excluding the data of the participants who failed the manipulation checks from the analyses the results are virtually identical to the ones that are reported in the main text, in

the sense that all effects that were significant remain significant (and all the effects that were not significant are still not significant), and the patterns of means are similar. This is also the case when conducting all analyses for only the participants who have complete data for all variables (n = 86).

[4]An explanation for the absence of an effect on HR can be found in the type of task we used to create a motivated performance situation. Although HR seems to rise more consistently during more metabolically demanding tasks (e.g., a speech task), this might be less the case for less metabolically demanding tasks, such as the current reaction time task. Some evidence for this comes from the work by Allen, Boquet, and Shelley (1991) who compared CV response patterns for three different tasks, including a reaction time task. One of the clusters of activation for the reaction time task involved "…large magnitude effects for PEP decreases and moderate effects for heart rate […] increase" (p. 278).

[5]Without controlling for performance during the first pattern recognition task, the interaction effect between status and legitimacy on performance during the second task remained significant, $F(1, 99) = 13.52$, $p < .001$. However, another reason to include performance during the first task as a covariate in the analysis of performance during the second task was that, unexpectedly, we found an interaction between group status and status legitimacy on performance during the first task, $F(1, 99) = 5.49$, $p = .021$.

[6]Initially we also entered baseline TPR as a covariate in the model. However, because this covariate was not significant ($p = .887$), we excluded it from the final mediation model which is shown in Figure 1. Baseline TPR was a significant covariate in the reversed mediation model, $p < .001$.

Table 1.

Cardiovascular Reactivity and Performance data as a Function of Group Status and Status Legitimacy

		Low Status		High Status	
		Illegitimate	Legitimate	Illegitimate	Legitimate
Cardiac Output (CO)	*M*	-0.14	-1.30	-0.61	1.15
	SEM	0.48	0.51	0.49	0.49
Total Peripheral Resistance (TPR)	*M*	-97.61	127.74	-33.55	-326.51
	SEM	77.20	73.36	74.34	75.91
Threat – Challenge Index (TCI)	*M*	0.04	-0.72	-0.20	0.82
	SEM	0.28	0.27	0.27	0.28
Performance task 2	*M*	5.56	5.82	5.60	5.42
	SEM	.071	.077	.072	.074

Note. The means for TPR and TCI are predicted means, controlled for baseline TPR. Means on performance during task 2 are predicted means, controlled for performance during task 1; lower numbers on the performance index indicate a better performance.

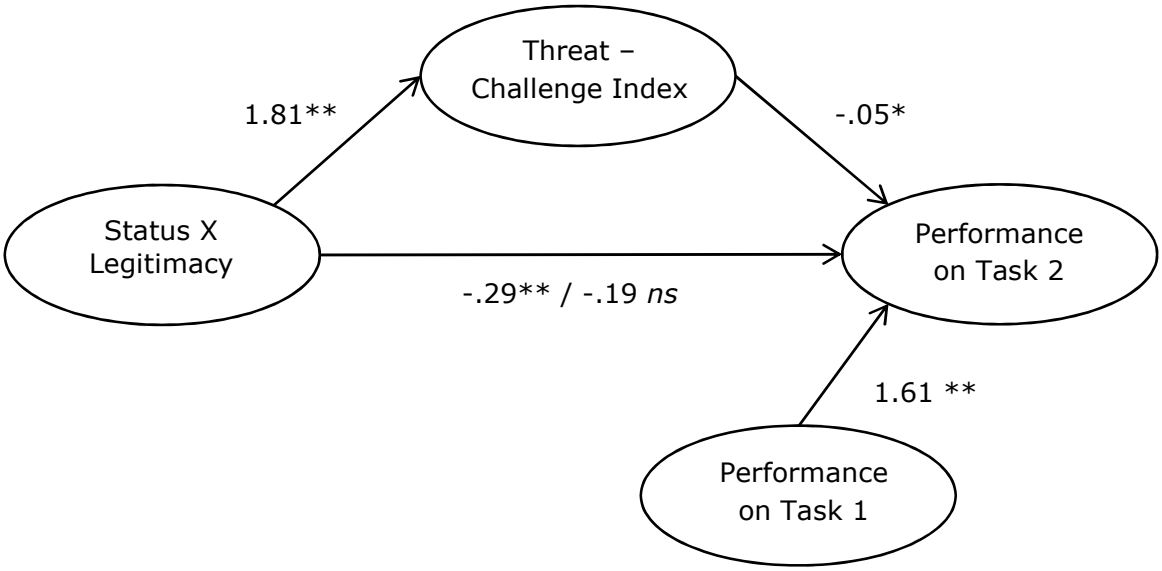

Figure 1. Mediation model.