negotiation and conflict management research

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Coping with Conflict: Testosterone and Cortisol Changes in Men Dealing with Disagreement about Values versus Resources

Fieke Harinck,[1] Marina Kouzakova,[1] Naomi Ellemers[1,2] and Daan Scheepers[1,2]

1 Department of Social and Organizational Psychology, Institute of Psychology, Leiden University, Leiden, The Netherlands
2 Department of Social, Health, and Organizational Psychology, Utrecht University, The Netherlands

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Correspondence
Fieke Harinck, Institute of Psychology, Department of Social and Organizational Psychology, Wassenaarseweg 52, P.O. Box 9555, 2300 RB Leiden, The Netherlands; e-mail: sharinck@fsw.leidenuniv.nl.

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Abstract

In an experimental design, we manipulated disagreement about values versus resources ($N = 36$). We investigated, using male participants, how the nature of the conflict affects testosterone and cortisol changes. We hypothesized a testosterone increase in response to disagreement about resources, but no increase when values were at stake. Results corroborated this idea. This research illustrates how psychological factors affect neuroendocrine and coping responses to social stressors and conflict.

Empirical studies have documented testosterone increases in response to human competition, for instance in athletic performance (Archer, 2006; Eisenegger, Haushofer, & Fehr, 2011; Fehm-Wolfsdorf, Groth, Kaiser, & Hahlweg, 1999; Heffner et al., 2006). In nonathletic domains, hormone changes in competitive and conflictual situations also depend on individual differences (e.g., in motivation or anxiety) and contextual factors (e.g., the nature of the competition). Yet, much remains to be examined about the precise conditions that elicit testosterone increases and their psychological implications in situations involving competition and conflict (for a recent overview, see Casto & Edwards, 2016). The current study addresses the general observation that people find it more difficult to deal with an interpersonal conflict in which norms and values are at stake compared to a conflict about the distribution of scarce resources (for an overview, see Harinck & Ellemers, 2014). We investigate whether changes in testosterone and cortisol levels can contribute to explaining this effect. We examine whether changes in testosterone and cortisol differ depending on whether a conflict is framed in terms of diverging values or competing claims for resources.

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Conflict

Most people experience stress when engaged in a conflict (De Dreu, Van Dierendonck, & Dijkstra, 2004). Conflict is likely to trigger emotions such as anger and fear, and taxes cognitive resources that are needed to cope with the conflict. The body might adaptively respond to those emotions, fear appraisals, and cognitive demands, indicated by a heightened heart rate, increased muscle tension, and hormonal responses such as higher levels of adrenalin, testosterone and cortisol (Bos, 2012; De Dreu et al., 2004). Over time however, prolonged periods of stress, that trigger hormonal changes, have been found to have detrimental effects, for psychological and physical well-being. In this article, we argue that different types of conflict raise different hormonal reactions, and that, as a result, the implications of some types of conflict for the physical well-being of those engaged in such conflict might be worse than others. More specifically, we argue that conflicts about resources are likely to be characterized by a different hormonal response pattern than conflicts about values; conflicts about resources are more likely to trigger a testosterone response, whereas conflicts about values are more likely to trigger a cortisol response. Below, we will elaborate on the reasoning underlying these expectations.

In general, two types of conflict can be distinguished; conflicts about resources and conflicts about values. Even though many conflicts are mixed—in that both resources and values are involved—it is possible to consider them as separate types of conflict and to identify their specific implications. Often—in real conflict—one of the issues is more important than the other, and as such can be treated as predominantly a value conflict or predominantly a resource conflict. In the current study, we will experimentally tease those two types of conflict apart. Resource conflicts address the division of scarce resources, such as time, money, territory, or natural resources such as water, oil, and gas. Value conflicts imply disagreement about norms and values, debating non-tangible issues such as norms about appropriate behavior, or political ideas (Harinck, 2004; Harinck & De Dreu, 2004; Harinck, De Dreu, & Van Vianen, 2000; Harinck & Ellemers, 2014; Harinck & Van Kleef, 2012; Kouzakova, Ellemers, Harinck, & Scheepers, 2012; Kouzakova, Harinck, Ellemers, & Scheepers, 2014; Stoeckli & Tanner, 2014; Wade-Benzoni et al., 2002).

We decided to focus on the distinction between value-based conflict and resource-based conflict for two reasons. First, this difference captures an essential distinction in the range of conflicts that can occur (e.g., in politics or decision-making situations) which makes it relevant to study whether categorizing conflict as value-based versus resource-based helps to understand how they unfold and how they might be resolved. The second reason that we compare these two types of conflict is that they represent two fundamentally different classes of situations that raise different concerns and responses (a tangible scarce resource on the one hand, and an intangible, subjective value on the other). In sum, we study the current two types of conflict because they are clearly different from each other, capture a large set of different conflicts that are not easy to resolve, and understanding how these conflicts are different and may have to be approached differently is relevant for many people.

Prior research has shown that people react differently to these two types of conflict—behaviorally, perceptually, emotionally, and physically. In general, people engaged in a conflict over resources, for example, when buying or selling an object, reach more win-win agreements, they are more likely to engage in logrolling and consider the conflict more as a challenge. In comparison, people in a value conflict, for example, when discussing whether affirmative action should be introduced at the work floor, are more inclined to force their own point of view and consider the conflict as a threat (for a more elaborate overview of the effects of resource conflict and value conflict, see Harinck & Ellemers, 2014; or for a theoretical overview, see Wade-Benzoni et al., 2002).

What we do not know, however, is first, whether these different types of conflict trigger different endocrine (hormonal) changes such as testosterone and cortisol changes, and second, how these endocrine changes relate to subsequent conflict management processes. Endocrine changes are important indicators of coping strategies that people adopt in order to deal with a given stressor such as a resource or value

conflict (Salvador, 2005). In the current study, we investigate changes in testosterone and cortisol levels as a function of resource versus value conflict and relate this to the preference for different conflict management strategies.

Testosterone and Cortisol Responses

Testosterone plays an important role in the regulation of aggression in social interactions and conflict (Carré et al., 2017; Salvador, 2005). Testosterone is a sex hormone that is produced in the male testes, in the female ovaries and in the adrenal cortex of both genders (Eisenegger et al., 2011). Testosterone increases the motivation to act (Bos, Panksepp, Bluthé, & Van Honk, 2012), and the motivation to maintain or seek social status (for an overview, see Eisenegger et al., 2011). Testosterone also reduces fear responses (Eisenegger et al., 2011; Hermans et al., 2007). Recently, testosterone has been characterized as a "social" hormone that helps regulate stressful social interactions such as competitive situations (contests) or conflict (Bos, dissertation; Eisenegger et al., 2011; Eubank, Collins, Lovell, Dorling, & Talbot, 1997; Salvador, 2005).

We anticipate that different types of conflict give rise to different endocrine responses. In general, testosterone levels vary in reaction to competitive situations. Testosterone responses to competitive situations, however, seem to be moderated by the individual's *interpretation* of the competitive situation (Casto & Edwards, 2016; Eisenegger et al., 2011; Eubank et al., 1997; Salvador, 2005). When someone perceives a competitive situation as important and has the resources or capacities to handle the situation effectively, the level of testosterone should rise (Eubank et al., 1997; Salvador, 2005). For example, Eubank et al. (1997) measured changes in testosterone levels 24 hours prior to an important competition. They found that those who consider their stress and anxiety before the competition as *facilitating* their performance (so-called facilitators) showed increasing levels of testosterone. Those who consider their stress and anxiety before the competition as *inhibiting* their performance (so-called debilitators) showed (somewhat) decreasing levels of testosterone.

Likewise, Carré, Muir, Belanger, and Putnam (2006) found that sportsmen displayed higher levels of pregame testosterone levels when playing at their—supportive and familiar—home facilities compared to playing away in an unfamiliar and less supportive environment. Also, Eisenegger, Kumsta, Naef, Gromoll, and Heinrichs (2017) showed that higher testosterone levels are positively related to decisions to compete, and they are related to more confidence in one's performance. The findings mentioned above all seem to indicate that testosterone increases are related to the perceived ability to cope with a competitive situation, while no such increase is observed for those who feel unable to cope with situational demands implied in the competition.

Here, we connect these insights to our prior observations regarding the differences between responses to conflict framed as disagreement over resources versus values. Our prior research suggests that people find it less difficult to cope with disagreements over resources than with conflicts over values (Kouzakova et al., 2014). Cardiovascular indicators suggest that resource conflicts are more easily experienced as challenging rather than threatening, and framing a disagreement as a conflict over resources (instead of values) increases people's subjective confidence in their ability to find a mutually acceptable solution. By comparison, those in a value conflict show cardiovascular responses indicating they consider the conflict as threatening rather than challenging (Kouzakova et al., 2014) and individuals who find themselves in such a conflict do not see much common ground with their opponent. Extending this prior work, and in line with the results observed by Eubank et al. (1997) and Carré et al. (2006), we expect larger increases in testosterone when a conflict is framed in terms of disagreement about resources—as this seems easier to deal with—compared to a conflict that is framed as indicating disagreement about values (*testosterone hypothesis*).

Cortisol is a hormone that is often studied in the context of (social) stress—and conflict is a source of social stress (Salvador, 2005). Cortisol is released by the adrenal cortex within the adrenal glands, and it

has a diurnal pattern; it peaks after awakening, and then gradually declines during the day and following night (Saxbe, 2008). Cortisol levels can also be affected by situational cues; cortisol increases are associated with stressful situations and negative emotions—as experienced in conflict. They influence, for example, heart contractions, glucose levels, and blood pressure. In short; cortisol increases help the body to prepare for and deal with stressful situations (Saxbe, 2008; Vaernes, Ursin, Darragh, & Lambe, 1982).

For these reasons, we anticipate cortisol to increase more strongly in a value conflict compared to a resource conflict. In both types of conflict, people will experience stress, and cortisol levels are likely to rise. However, value conflicts tend to be taken more personally than resource conflicts. This is the case because values reflect people's moral identity and judgments of fairness and justice (Harinck & Ellemers, 2006; Monin, Sawyer, & Marquez, 2008). Due to greater identity involvement in value conflicts, people in value conflicts are strongly inclined to defend and protect their own position, as this reflects their personal norms and values. Based on this reasoning, we anticipate that cortisol levels are more likely to increase when the conflict is framed as a conflict about values rather than resources (*cortisol Hypothesis*).

Method

Participants and Design

Thirty-nine male students from Leiden University (mean age 21.5) participated for 3 credits or 8 euros in a laboratory experiment with a 2 (conflict type: value vs. resource) by 2 design with the conflict as the between-subjects factor and hormone assessment (baseline, poststressor) as the within-subject factor. The sample size of 16–20 participants in each cell was determined by checking prior research with similar hormone measures and similar experimental designs in several different journals (Bos, Hermans, Montoya, Ramsey, & Van Honk, 2010; Eubank et al., 1997; Hermans et al., 2007; Van Peer et al., 2007).

To reduce natural variance in testosterone levels across participants prior to the experiment, participants had to refrain from consuming alcohol or caffeine as well as from doing any strenuous physical exercise 24 hours preceding the experiment. Participants also refrained from smoking, eating or drinking except for water 2 hours prior to the start of the experiment.

Materials

Cover Story

The participants were informed that the current study was to gain knowledge about the development of concentration levels during the process of joint decision making. As the level of one's concentration is reflected in one's blood sugar level, participants were asked to provide saliva samples during the experiment. Further, participants were told they would discuss the choice either in favor or against subletting an apartment with another participant.

Conflict Manipulation

To manipulate the different types of conflict, we used a similar approach as in earlier research concerning value and resource conflict (Harinck et al., 2000; Kouzakova et al., 2012). The participants took a position concerning subletting an apartment. The *topic* of the conflict and divergence of preferences were the same in both conditions, namely the choice for or against subletting. The *nature* of the conflict, however, differed between experimental conditions. In the value condition, participants chose whether they would accept or decline an offer of subletting an apartment for moral reasons; because they consider subletting fair or unfair. In the resource condition, participants chose whether they would accept or decline an offer of subletting an apartment for financial reasons; because they consider subletting financially profitable or not. So in both conditions, parties were either for or against subletting an apartment, but the underlying reason to be for or against differed between the value and resource condition. To immerse participants

in the conflict experience, participants in both conditions generated and subsequently exchanged their arguments with their interaction partner via webcam.

Interaction Partner

All communications from "another participant" were recorded and thus standardized beforehand. A male confederate prerecorded a two-minute presentation of a pro and con position for both the value and the resource condition. Depending on the condition a participant was put in and the position that he took, he received the prerecorded opposing point of view of the same conflict condition.

Experimental Procedure

Since cortisol levels vary as a function of time (they peak at waking and decline over the day), the experiment was carried out between 1 pm and 5 pm. Upon arrival, participants signed for informed consent and were led into individual cubicles where the experiment took place. First, the first half of the T1 saliva sample was collected. Also, background information and control questions were answered for 8 min to reduce anxiety due to the start of the experimental procedure. The control questions also served as a check for participants' compliance with the experimental requirements. Participants watched their interaction partner introducing himself to them via the webcam, after which participants introduced themselves via webcam. Then, the second half of T1 saliva sample was taken.

Next, the conflict issue was introduced and the participants chose the standpoint they wanted to defend throughout the experimental session. Immediately hereafter, participants received a message that their interaction partner disagreed and would defend the opposing viewpoint. To reinforce the experience of a conflict, the participants were asked to write down at least 5 arguments in defense of their viewpoint which they would share with their interaction partner via the webcam. Next, they watched their interaction partner presenting for two minutes his arguments for the opposing viewpoint via webcam. Then, participants presented their own arguments in favor of their viewpoint for the maximum of 2 min. The participants were told that they would exchange options to resolve the conflict in the final phase of the experiment. The total conflict induction procedure took approximately 10 min.

The participants continued with a number of filler tasks. Among these tasks, we assessed which conflict management behaviors participants intended to adopt in anticipation of conflict resolution and the ratings of the other party. Twenty-five minutes after the stressor (and thus 45 min after the start of the experiment), the T2 sample was collected. A 20–25 time interval allows the testosterone response to be measured in saliva (Saxbe, 2008). After completion of this part, participants received funneled debriefing questions aimed at assessing participants' awareness of the experimental hypothesis. Then, the participants were thanked, paid, and debriefed.

Testosterone and Cortisol Collection

Testosterone and cortisol measures can be taken from saliva samples, provided there is a sufficient amount of saliva ($\pm$1 ml) per sample collected. If a participant was not able to produce 1 ml of saliva in one time, we waited and collected the additional sample a few minutes later. In the current study, there were seven participants for whom one saliva sample consisted of two saliva collections gathered over a short period of time (e.g., within a period of 10 min). In total, two saliva samples were taken from each participant. The first sample T1 (the basal level) was collected before the start of the experiment. The T1 sample was used to assess testosterone and cortisol baselines. As in prior research (Fehm-Wolfsdorf et al., 1999), we took a second saliva sample (T2) 17–25 min after the stressor (the conflict manipulation).

The saliva samples were collected in sterile Eppendorf tubes. Participants could directly expectorate into these tubes, after which the filled tubes were placed in a refrigerator at a -20 °C, in order to keep the concentration of cortisol and testosterone in the saliva samples safe until defrosted for analyses. After thawing, salivettes were centrifuged at 3,000 rpm for 5 min, which resulted in a clear supernatant of low

viscosity. Sampling tubes used for passive drooling were centrifuged at 10,000 rpm for 5 min, resulting in mucous compounds being restricted to the lower part of the tube.

Salivary testosterone and cortisol concentrations were measured using commercially available chemiluminescence-immunoassays with high sensitivity (IBL International, Hamburg, Germany). The standard range of testosterone using this technique is 6.4–760 pg/ml. The testosterone range of our sample was 43.19–274.00 pg/ml, which is within the standard range. The standard range of cortisol using this technique is 0.015–3.20 μg/dl, which is equivalent to 0.41–88.29 nmol/L as reported in our study. The cortisol range of our sample was 1.93–15.42 nmol/L, which is within the standard range. Testosterone is reported in pg/ml, cortisol is reported in nmol/L.

Ratings Other Party

As measures of subjective conflict, we assessed after the discussion how participants felt about the interaction with the other party with 4 items ($\alpha = .77$), such as "to what extent did you like the interaction with the other" and "to what extent did it feel like you and the other person formed a team" (1 = "not at all" to 7 = "a lot"). We also assessed the likeability of the other person with 3 items ($\alpha = .72$), such as "how likeable do you think the other is?" and "to what extent would you like to be friends with the other?" (1 = "not at all" to 7 = "a lot").

Conflict Management Styles

We assessed participants' self-reported conflict handling styles with the DUTCH (De Dreu, Evers, Beersma, Kluwer, & Nauta, 2001). There were 5 subscales; yielding, compromising, forcing, problem solving, and avoiding. Each scale consisted of 4 items, and each item could be answered on a 7-point scale (1 = "not at all" to 7 = "yes, certainly"). The two constructive conflict management styles were compromising and problem solving. Compromising ($\alpha = .84$) had, for example, the item "I aim for a compromise if possible" and problem solving ($\alpha = .62$), for example, had the item "I try to find a solution that serves my own and the other party's interests." There were 3 less constructive conflict management styles: yielding, forcing, and avoiding. Yielding ($\alpha = .72$), for example, had the item "I will yield to the wishes of the other party." Forcing ($\alpha = .75$), for example, had the item "I will fight for a good outcome for myself." Avoiding ($\alpha = .73$), for example, had the item "I try to avoid a confrontation."

Results

Participants and Exclusions

A total of 39 male students participated in the study. Two participants could not produce enough saliva within the designated time frames, and they were not included in the analyses. For one participant, the data storage failed, so we could not use this participant's data for the analyses, which resulted in 36 participants in the final data file ($M_{age} = 21.56$). Before we analyzed the hormone measures we checked for outliers. To simplify the detection of outliers, we first transformed the hormone measurements into *z*-scores. There was one participant whose baseline cortisol measure had a *z*-score of 4.07, and whose poststressor cortisol measure had a *z*-score of 3.24. We excluded the data of this participant from the hormone analysis. This resulted in a database of 35 participants for the hormone analyses; $N = 18$ in the value conflict condition, and $N = 17$ in the resource conflict condition. Statistical analyses were carried out after the data collection was completed, and there was no extra data collection after the analyses.

Hormones

Testosterone levels were analyzed for skewness and kurtosis; baseline skewness was .65 and its kurtosis .59, poststressor testosterone skewness was .47 and kurtosis −.04. We also checked whether the control

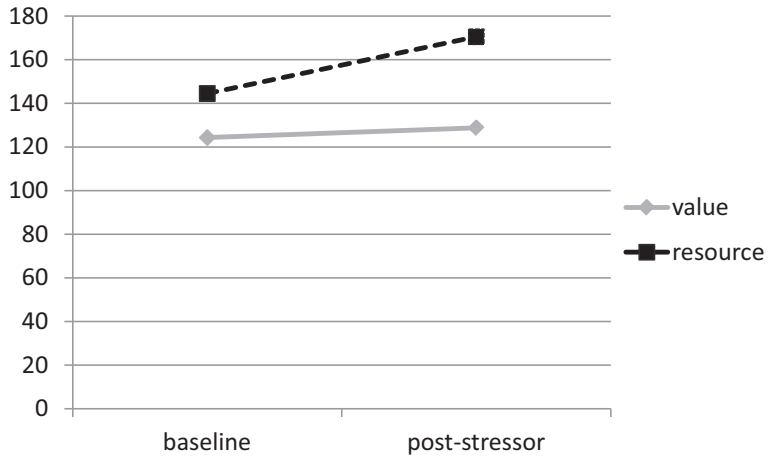

Figure 1. Testosterone levels (pg/ml) for the baseline and poststressor measure, per conflict type.

variables (number of hours of sleep last night, number of hours without drinking, number of hours without eating, whether participants had had examinations in the last two weeks, the average amount of cigarettes they smoked per day for the last two weeks, the average number of joints they smoked per day for the last two weeks, and the number of joints they smoked during the two days prior to the experiment) were correlated with the hormone measurements. Of these measures, the average amount of cigarettes (M = 3.14, SD = 6.45) was significantly correlated with the baseline testosterone measure, r = .49, p = .003. We therefore included this variable as a covariate in the testosterone analyses.

We analyzed testosterone levels by means of a 2 (conflict type: value vs. interests) by 2 (time: baseline vs. poststressor time 2) ANOVA with the conflict type as the between-subjects factor, time as the within-subject factor, and the average number of cigarettes per day in the last two weeks as covariate (see above). This analysis revealed a main effect of time, $F(1,32) = 9.31$, $p = .005$, $\eta^2 = .23$, indicating testosterone levels increased over time. However, this main effect was qualified by an interaction of Conflict × Time, $F(1,32) = 4.27$, $p = .047$, $\eta^2 = .12$ (see Figure 1), showing that the increase was only significant in the resource conflict, $t(16) = 2.40$, $p < .05$, ($M_{baseline}$ = 144.51, SD = 56.27, 95% $CI_{baseline}$ = 117.75–171.25 vs. $M_{poststressor}$ = 170.54, SD = 60.65, 95% $CI_{poststressor}$ = 142.52–198.55), but not in the value conflict, $t(17) = 1.13$, *ns*, ($M_{baseline}$ = 124.31, SD = 48.28 vs. $M_{poststressor}$ = 128.77, SD = 48.53). Without the covariate, the interaction remained marginally significant, $F(1,33) = 3.65$, $p = .065$. This effect supports the testosterone hypothesis.[1]

The cortisol hypothesis argued that in the value conflict condition the cortisol levels might increase more after conflict induction (compared to basal cortisol), compared to the resource conflict condition. We analyzed cortisol levels by means of a 2 (conflict type: value vs. interests) by 2 (time: baseline vs. poststressor time 2) ANOVA with the conflict as the between-subjects factor and time as the within-subject factor. Cortisol showed a main effect of conflict, $F(1,33) = 5.01$,

[1]We also analyzed the basal testosterone and poststressor testosterone in an ANOVA with the baseline testosterone levels as covariate, conflict type as between-subjects factor and the poststressor testosterone levels as the dependent variable. Testosterone showed an effect of the baseline covariate, $F(1,32) = 55.00$, $p < .001$, $\eta^2 = .63$, and more importantly, a (marginal) effect of conflict type, $F(1,33) = 4.19$, $p = .053$, $\eta^2 = .11$. The effect of conflict type showed that the postconflict testosterone levels were higher in the resource conflict (M = 165.39, SD = 62.76) compared to the value conflict (M = 128.77, SD = 48.53). When adding the number of cigarettes as covariate, the effect of conflict type remained the same, $F(1,32) = 4.00$, $p < .054$. The effect of the number of cigarettes as covariate was not significant, $F(1,32) = 0.59$, *ns*.

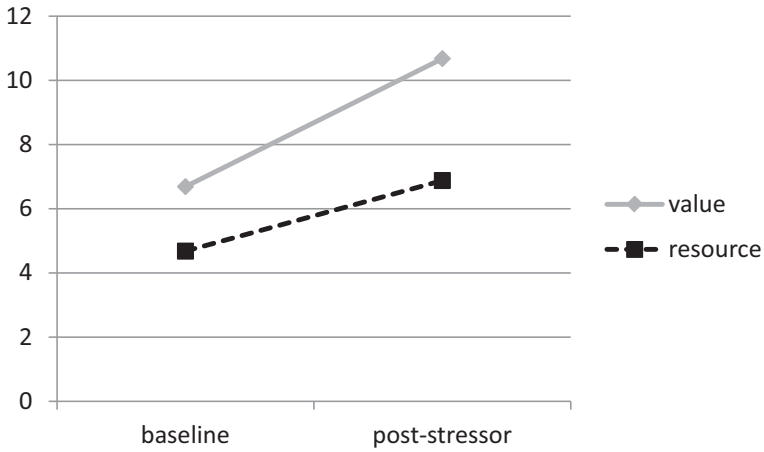

Figure 2. Cortisol levels (nmol/L) for the baseline and poststressor measure, per conflict type.

Table 1
Correlations between the Hormone Measures, Ratings of the Interaction Partner, and Conflict Management Styles

	Interaction	Liking	Yielding	Compromising	Forcing	Problem solving	Avoiding
Difference score testosterone†	.36*	.02	.01	.06	−.46**	.22	.00
Difference score cortisol	−.20	.01	.07	.29^{+}	.05	.26	−.11

Note. †Corrected for number of cigarettes.
*$p < .05$. **$p < .01$. +$p < .10$.

$p = .032$, $\eta^2 = .13$, and a main effect of time, $F(1,33) = 12.45$, $p = .001$, $\eta^2 = .27$. The main effect of conflict showed that people in the value conflict condition generally had higher levels of cortisol ($M = 8.69$, $SD = 4.75$; 95% CI = 6.50–10.88) compared to those in the resource conflict ($M = 5.78$, $SD = 2.55$; 95% CI = 4.56–6.99). The main effect of time showed that people's level of cortisol increased over time ($M_{\text{baseline}} = 5.72$, $SD = 3.54$, 95% CI = 4.55–6.89 vs. $M_{\text{post-stressor}} = 8.83$, $SD = 5.82$, 95% CI = 6.90–10.75). The interaction was not significant, $F(1,33) = 1.05$, *ns*. Thus, we found no support for the cortisol hypothesis; participants in the value and the resource conflict conditions showed similar cortisol increases (Figure 2).

Ratings Other Party

The two ratings of the other party (interaction and liking) were analyzed by a one-way multivariate ANOVA with conflict type (value vs. resource) as between-subjects factor and the ratings as dependent variables. The ratings of the interaction showed an effect of conflict type, $F(1,33) = 5.43$, $p = .026$, $\eta^2 = .14$. Participants in the value conflict condition perceived the interaction to be less pleasant ($M = 3.29$, $SD = 0.95$, 95% CI = 2.85–3.73) compared to those in the resource conflict condition ($M = 4.04$, $SD = 0.96$, 95% CI = 3.58–4.49). Ratings of interpersonal attraction did not show an effect of conflict issue, $F(1,33) = 0.54$, *ns*.

The conflict management styles were analyzed by a one-way multivariate ANOVA with conflict issue (resource vs. value) as between-subjects factor and the conflict management styles (yielding, compromising, forcing, problem solving, and avoiding) as dependent variables. Only forcing revealed an effect of conflict issue, $F(1,33) = 5.22$, $p = .029$, $\eta^2 = .14$, all other Fs < 1.02, ps $> .32$. The main effect of forcing

indicated that people in the value conflict condition showed more forcing behavior ($M = 4.18$, $SD = 0.86$) than people in the resource conflict condition ($M = 3.50$, $SD = 0.90$), which is in line with prior research (Harinck & De Dreu, 2004).

We correlated the hormonal difference scores with the conflict management styles and the ratings of the interaction and the other party (see Table 1). The testosterone difference score and forcing were negatively correlated, $r = -.46$, $p < .01$, indicating that an increase in testosterone was related to a decrease in forcing, or vice versa. This finding is in line with the significant relation between the testosterone increase and the rating of the interaction, $r = .36$, $p < .05$. It seems that a larger increase in testosterone is related to a more positive interaction.

Increases in cortisol were only marginally related to the interpersonal ratings and conflict management styles.

Discussion

We tested testosterone levels before and after the experience of a conflict framed in terms of disagreement about values or resources. In line with our testosterone hypothesis, men in a resource conflict showed an increase in testosterone after the conflict, whereas men in a value conflict did not show an increase in testosterone after the conflict. The increase in testosterone was further related to a more positive rating of the interaction, and to less competitive forcing behavior. Salvador (2005) stated that testosterone does not increase due to winning or losing a conflict, but that the way a person *copes* with a social stressor—such as conflict—determines whether testosterone levels will rise or decline. Those who assess a conflict situation as important to them, *and* think they have the resources to cope effectively with this situation are likely to use an active coping style that is reflected in increased testosterone levels (Eisenegger et al., 2017; Salvador, 2005). Our results suggest that people feel more able to cope effectively with a conflict when it is framed in terms of a disagreement about resources rather than values. This corroborates and extends our earlier work showing that people in a resource conflict are more likely than those in a value conflict to show a cardiovascular challenge response (Kouzakova et al., 2014).

On the other hand, the cortisol hypothesis was not supported; men in both conflict conditions showed an increase in cortisol as the conflict unfolded. Although the increase in the value condition seemed stronger than in the resource condition, this difference was not significant. In theory, this may be due to our small sample offering low statistical power. However, even though we anticipated stronger cortisol responses in the value conflict condition we note that, unlike what we observed for testosterone, cortisol increased in both experimental conditions. This suggests that being in a conflict situation in itself is rather stressful, relatively independently of whether the conflict issue is framed in terms of resources or values.

Our finding that a resource conflict resulted in a strong increase in testosterone and a (more modest) increase in cortisol is in line with research by Eubank et al. (1997), of "facilitators" and "debilitators" during interpersonal conflict. Facilitators are people who view their anxiety prior to an important competitive encounter as positive for their performance while debilitators are people who view their anxiety prior to an important competitive encounter as negative for their performance. In the research by Eubank et al., debilitators showed a similar hormonal pattern as people in the value conflict condition in the current study: a slightly decreased level of testosterone (in our study no decrease) in combination with an increase in cortisol. Moreover, Eubank and colleagues found higher cortisol in the debilitators than in the facilitators condition; again this is similar to our results in the value versus resource conditions, even though we did not find significant differences here. We might speculate that people are generally anxious for an upcoming conflict, but those in a resource conflict may feel more able to do well in the process, and as a result, they may consider their stress or anxiety as a positive means to perform well. We know that those in value conflict generally feel more threatened compared to those in a resource

conflict (Kouzakova et al., 2014), so we could argue that they might view their anxiety as less positive for their performance during the conflict.

Our research underlines the growing notion that psychological factors affect the neuroendocrine response to social stressors and social competition (Casto & Edwards, 2016; Wu, Eisenegger, Zilioli, Watson, & Clark, 2017), and as such, neuroendocrine responses are context-dependent (Bos et al., 2012). In the current study, all participants faced an identical conflict with another party. However, this conflict was framed as referring to the division of a scarce resource (resource conflict) or appeared to represent diverging norms and values (value conflict). This difference in how the conflict is framed has important psychological consequences. Prior research showed that people react differently to these types of conflict; they are more willing to make trade-offs in resource conflict (Harinck & De Dreu, 2004; Harinck et al., 2000), they beat less around the bush in value conflict (Harinck, 2004), they perceive more common ground in resource conflict, they take value conflict more personally (Kouzakova et al., 2012), and finally, they show a cardiovascular challenge reaction in resource conflict and a cardiovascular threat reaction in value conflict (Kouzakova et al., 2014). The current study adds to this knowledge by showing that the testosterone response to these conflicts differs as well, and at the same time, the study shows that a social stressor such as conflict may result in different neuroendocrine reactions depending on how people psychologically react to the stressor.

At the same time, the current research raises interesting avenues for future research, more specifically about the interplay between hormones and emotions. For example, Dickerson, Gruenewald, and Kemeny (2004) showed that cortisol increases are largest when people perform a task that includes a social-evaluative threat (participants' performance could be negatively evaluated). It might be that certain emotions, such as anger, fear, or shame influence, or are influenced by, hormone changes, which might influence the subsequent interaction pattern. Also, research by Bos and colleagues (Bos et al., 2010, 2012) shows that testosterone affects trust and social behavior. For example, trust and cognitive empathy is reduced by higher levels of testosterone (Van Honk et al., 2010) which may affect how well people are able to deal with their counterpart during conflict. Negotiation research including several negotiation rounds might shed light on these types of processes.

We realize that the N in this study is relatively small, which means that we should draw our conclusions cautiously. With a low N, statistical power may decrease and the risk of a false positive result (the risk of finding an effect that actually is not there) might increase. We therefore think that the findings of this study are an interesting first step to further research that could study the effects of hormonal changes in negotiations in larger samples. In that regard, the current results seem promising.

Future research might also study responses of female participants to similar manipulations. Women may react differently to social stressors than men (e.g., because they also command different coping strategies), and their testosterone or cortisol reactions might differ from males (Lash, Gillespie, Eisler, & Southard, 1991; Otte et al., 2005; Salvador, 2005; Taylor et al., 2000, 2002). For instance, among females the inclination to affiliate with others ("tend-and-befriend") might be more prominent, instead of showing the more masculine fight-or-flight response.

Finally, it would be interesting to study whether conflicts about values and resources also give rise to different bargaining zones. In the current paradigm, we manipulated whether different positions are based upon values or resources. This manipulation results in a variety of different reactions on the behavioral, cognitive, emotional, and even endocrine level (for an overview, see Harinck & Ellemers, 2014). The bargaining zone, or perceived bargaining zone, is an important factor when parties decide how they are going to negotiate with each other. The perceived bargaining zone depends on how large parties estimate the distance between them that needs to be overcome. Whether parties will find an agreement depends on their willingness to give in to the other party to overcome this distance. Each of these aspects might be affected differently by the value-based versus resource-based nature of the conflict. As such, it would be interesting to examine in future research whether the underlying conflict characteristics (values vs. resources) would influence these aspects of the negotiation as well.

Conclusion

Different types of conflict give rise to different endocrine responses; men facing a resource conflict show a stronger increase in testosterone than men facing value conflict. This research shows that different types of conflict trigger different types of responses, not only on a behavioral or cognitive level, but also on a less consciously regulated endocrine level. Our results provide additional support for the notion that people feel more capable of handling a conflict about the division of scarce resources (e.g., via negotiation) compared to a value conflict in which personal norms and values are at stake. Thus, changes in hormone levels in reaction to a conflict give us more insight in why it is often harder to solve value conflict compared to resource conflict.

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Fieke Harinck is Assistant Professor at the section of Social and Organizational Psychology of Leiden University. She received her PhD in work and organizational psychology at the University of Amsterdam. She investigates various aspects of conflict and negotiation, including appreciating the other party, compliments, mediation styles and the effect of improvisation training on negotiation processes and outcomes. Besides her academic career in negotiation and conflict management, she applies this knowledge in her work as mediator.

Marina Kouzakova received her PhD at the Radboud University in Nijmegen, for which she investigated the role of mimicry and subtle signs of exclusion. She subsequently worked as a post-doc at the section of Social and Organizational Psychology of Leiden University. In this role she investigated the role of identity threat in value conflict.

Naomi Ellemers is a social- and organizational psychologist and a Distinguished University Professor at Utrecht University. She is an expert on cooperation in groups and organizations, addressing how social identities lead people to transcend their individual interests and invest in collective outcomes. A key contribution of Ellemers to the field relates to the challenges that emerge when people who represent different social groups and communities work together, and how this affects the career prospects of women and ethnic minority members.

Daan Scheepers (Ph.D, 2002, University of Amsterdam) is associate professor of social and organizational psychology at Leiden University and Professor of Psychophysiology of Groups at Utrecht University. His research centers on group processes, inter-group relations, status, power, and threat. In studying these topics he takes a social-psychophysiological approach, combining self-report, cognitive, and psychophysiological measures to better understand social behavior.