Creativity under the gun

*How threat features and personal characteristics motivate creative responding*

Cheng, Y.

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CHAPTER 3

Creative Defense Ideation Under Threat:
The Role of Threat Features and Threat Sensitivity
It has long been thought that threats undermine the human ability to be creative – to generate ideas, insights, or solutions that are both novel and appropriate (Amabile, 1983; Runco, 2004). This is because threats lead to reduced working memory capacity, fixated attention, and inflexible and rigid thinking (Derryberry & Reed, 1998; Keinan, 1987; Schmader & Johns, 2003; Staw, Sandelands, & Dutton, 1981). Recent work, however, casts doubt on this general "threat-rigidity principle." According to the motivated focus account of creativity by De Dreu and Nijstad (2008), threatened individuals are motivated to mobilize and focus their cognitive resources on coping with the threat at hand, and this threat-induced motivated focus should make them relatively creative within threat-related domains of thought. Indeed, people anticipating a hostile negotiation were quite capable of generating creative competitive negotiation tactics (De Dreu & Nijstad, 2008) and others were remarkably creative if their creativity helped them to avert daunting consequences (Roskes, De Dreu, & Nijstad, 2012).

Although the motivated focus account of creativity has provided an initial framework for understanding the impact of threat exposure on creative thinking, several questions remain unanswered. First, creative threat responding may be more specific and contextual than was previously assumed in initial research supporting the motivated focus account. Indeed, studies on ecological threat responding in animals and humans show that threat responses strongly depend on the nature and features of the threat as well as the context in which the threat is encountered (Gawronski & Cesario, 2013). For instance, whereas people are more likely to adopt active defense tactics, including fight and flight behaviors, when the threat is imminent and self-directed, they are more likely to engage in risk assessment when the threat is not imminent or directed at others (D. C. Blanchard, Griebel, Pobbe, & Blanchard, 2011; Fanselow & Lester, 1988). Moreover, encounters with aggressive humans will elicit other responses than confrontations with attacking animals (Neuberg, Kenrick, & Schaller, 2011). Combined with the motivated focus account of creativity, these findings suggest that threat exposure and important threat features, such as the direction of the threat and the nature of the threat, may interact to influence the creativity of specific threat responses. Accordingly, we predicted that threatened individuals may selectively put more effort on (creative) thinking about certain types of defense tactics that are more adaptive and more often selected given the specific features of the threatening situation that people are exposed to. Second, not everyone is equally sensitive and responsive to threats (Carver & White, 1994). It is thus reasonable to assume that threat exposure (and specific threat features) will stimulate the creative generation of
particular defense tactics especially for individuals high in threat sensitivity.

Taking the motivated focus account of threat-related creativity as a starting point, the main goal of the current study was to examine whether, when, and for whom threat exposure would influence on the generation of different types of creative defense tactics. More specifically, we examined the influence of threat on the generation of specific creative defensive tactics as a function of whether people are exposed to (a) threatening or neutral stimuli (Study 3.1-3.3), (b) self-directed or other-directed threats (Study 3.1-3.2), (c) animal or human threats (Study 3.2), and (d) whether threatened people score high or low on threat sensitivity (Study 3.3). In three studies, participants generated tactics to deal with possible threatening situations, while pictures were displayed depicting self-directed threats (Study 3.1-3.3), other-directed threats (Study 3.1-3.2), or matching neutral stimuli (Study 3.1-3.3). In Study 3.2, we varied the nature of the threat (either animal or human threats) and in Study 3.3 we measured people's self-esteem as an indicator of their threat sensitivity. These three studies and a meta-analysis of findings across these studies allowed us to test the core prediction that threats may differentially influence the generation of specific creative defense tactics, such that threats do not influence the overall number of (original) defense tactics, but selectively promote certain types of tactics that fit the features of the threatening situation.

The Threat-Creativity Link

Threats refer to environmental events that signal a loss of resources (e.g., life, property, relationship, prestige) and have impending negative consequences (Marks & Nesse, 1994; Staw et al., 1981). In the face of threats, a suit of general affective and cognitive processes is triggered geared at facilitating threat-responding (Neuberg et al., 2011): Fearful and anxious feelings are aroused, avoidance motivation is triggered, the conceptual scope narrows and focuses on threat-relevant cues and information, physical and cognitive resources are recruited to vigilantly scrutinize the environment, and the body is mobilized to escape or neutralize the threat (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007; De Dreu & Nijstad, 2008; Dixon, 1998; Elliot, 2008; Ioannou, Mogg, & Bradley, 2004; Robinson, Letkiewicz, Overstreet, Ernst, & Grillon, 2011; Woody & Szechtman, 2011).

A common assumption in research on the link between threat and creativity is that threats and the aversive affective states that are induced by threats narrow the attentional scope (Derryberry & Reed, 1998; Easterbrook, 1959) and limit resources for complex
cognitive functions (Lindström & Bohlin, 2012; Shackman et al., 2006), leading to rigid thinking (Staw et al., 1981) and reduced creativity (Byron & Khazanchi, 2011; Mehta & Zhu, 2009). Nevertheless, creativity can be useful and sometimes crucial to avoid and escape threatening situations. Compared to habitual threat responses, original responses decrease the predictability of behavior, thereby increasing the likelihood of escaping or mitigating the threat at hand (Humphries & Driver, 1967).

To better understand the paradox that creativity is hindered by threats yet often needed to successfully deal with threats, De Dreu and Nijstad (2008) advanced the motivated focus account of creativity. This account suggests that threats may actually improve creative responding, only as long as creativity enables people to effectively deal with the threat they are facing. When exposed to a threat, people are highly motivated to mobilize and focus their cognitive resources to manage the threat at hand (Elliot, 2008; Lang, Davis, & Öhman, 2000; Woody & Szechtman, 2011). This heightened motivation and selective focus of cognitive resources increases the accessibility of threat-relevant knowledge from memory (Eysenck, Derakshan, Santos, & Calvo, 2007), facilitates extensive processing of threat-relevant information (Reinecke, Becker, & Rinck, 2009), and promotes a systematic and effortful way of thinking (Baas, De Dreu, & Nijstad, 2012; Roskes et al., 2012). Through focused effort within threat-relevant domains, threatened individuals will ultimately come up with original solutions that enable them to deal with the threats (cf. De Dreu & Nijstad, 2008).

Crucially, threat-induced creativity will only occur if creative thinking enables people to effectively deal with the threat they are exposed to. Indeed, findings that show a negative effect of threat on creativity are mainly observed in studies where creative task performance was not related to the threat participants were exposed to (e.g., participants that were threatened to lose their jobs were asked to identify a creative solution to fix and light a candle on a wall such that the candle wax would not drip on the floor; Probst, Stewart, Gruys, & Tierney, 2007). However, support for the motivated focus account comes from studies using tasks that allow the measurement of threat-relevant creativity. For example, recent work has shown that people that ran the risk of losing monetary resources achieved high creativity levels when their creative performance was functional to avoid losing monetary resources (Roskes et al., 2012). In addition, De Dreu and Nijstad (2008) reported that anticipating a conflictive rather than cooperative negotiation stimulated more original competitive tactics to deal with the conflict. Here, we take the
threat-relevance of the creativity task one step further and directly ask participants to generate alternative defensive tactics to cope with possible threats.

Although the motivated focus account proposes that threat-induced motivated focus should lead to enhanced creative performance in threat-related domains (De Dreu & Nijstad, 2008), threat-related creative responding may be highly specific. For example, when primed with threats of infectious diseases, individuals showed relatively more inclusive processing of specific disease-related information (e.g., sources of infection), but this effect did not generalize to broader health threat-related issues (e.g., mental health) or threatening confrontations with hostile others (Cheng, Baas, & De Dreu, 2016a). Because more inclusive thinking facilitates the generation of more original ideas (Amabile, 1983; Murray, Sujan, Hirt, & Sujan, 1990), it follows that people that are confronted with a certain threat may likewise be more creative in dealing with the specific threat rather than other types of threat. We will elaborate on this idea below.

**Threat Features and Specific Defensive Behaviors**

Adaptive threat-responding ultimately requires the preparation and execution of calibrated behaviors that meet situational demands and available resources (Gawronski & Cesario, 2013). Ecology research has identified five general defensive behaviors that animals have at their disposal to effectively cope with the possible threats they are facing: freezing, flight, defensive threat (e.g., vocalization, dominant body posture), defensive attack (e.g., fight), and risk assessment (D. C. Blanchard, 1997). The specific defensive behavior chosen depends on the features of the threat, such as the intensity, ambiguity, and the direction of the threat, as well as the context of the threat, such as the (in)escapability of the situation and the distance between the threat and the threatened subject (D. C. Blanchard, Hynd, Minke, Minemoto, & Blanchard, 2001; Gawronski & Cesario, 2013). For example, the presence of a discrete and intense threat most likely elicits flight responses when there is an escape route or a freezing-like response when there is not; when the threat approaches and room for escape decreases, threatened animals tend to display defensive threatening behavior and may ultimately engage in a defensive attack at close distance (R. J. Blanchard, Flannelly, & Blanchard, 1986). Alternatively, a distant or ambiguous threat is more likely to stimulate risk assessment, which consists of orienting towards, and the gathering of information about, a potential threat in order to choose the optimal threat-response (D. C. Blanchard et al., 2011).
Although the human capacity for language use and perspective taking allows for some uniquely human threat responses (e.g., apology, negotiation, or showing empathy; Perkins & Corr, 2006), most human defensive responses parallel those of animals (D. C. Blanchard et al., 2001; Perkins & Corr, 2006; Shuhama, Del-Ben, Loureiro, & Graeff, 2008). This cross-species repertoire of defensive behaviors can be explained by an important dimension of their shared environment – predatory imminence. According to the predatory imminence continuum model (Fanselow, 1994; Fanselow & Lester, 1988), threat states develop along an imminence continuum depending on whether the threat is merely present (but undetected), detected, or attacking. Defenders’ responses vary systematically as threat imminence increases, changing from risk assessment and preparing for defensive actions when the threat is potentially, but not detectably, present, through freezing when the threat is detected but not attacking, to active defense actions, such as fight and flight, when confrontation is inevitable (Mobbs, Hagan, Dalgleish, Silston, & Prévost, 2015).

One feature that influences the perception of threat imminence, and that may thus modulate defensive responses, is the direction of threat – whether the threat is directed towards, or away from, the observer. For example, threatening pictures (snakes or guns) or angry faces directed towards participants led to more resistant psychophysiological responses as compared to directed-away stimuli (Dimberg & Öhman, 1983, Hugdahl & Johnsen, 1989). This, in turn, enhanced the perception of imminence (Flykt, Esteves, & Öhman, 2007). Moreover, Fernandes et al. (2013) presented self- or other-directed threats as distractors during a task in which participants determined whether the orientation of two peripheral bars was the same. They discovered that self-directed threats were perceived as more imminent and facilitated the reaction time for judging the orientation of peripheral bars, whereas other-directed threats slowed down the reaction time in the bar-orientation task as compared to neutral distractors. This evidence is taken to suggest that self-directed threats prompted active motor preparation and other-directed threats prompted immobility responses.

Another threat feature that may induce different types of defensive tactics is the nature of the threat. Throughout our evolutionary past, humans had to respond to encounters with threatening animals as well as aggressive conspecifics. From a functional-evolutionary perspective, animal fear originates from an evolved predatory defense system that functions to avoid and escape predators, and the most adaptive defense strategies are immobility and vigorous escape (Öhman, 1986). Alternatively,
encounters with aggressive humans elicit social fear, which originates from an evolved dominance/submissiveness system (Öhman, 1986; Trower & Gilbert, 1989). The function of submissiveness is to deter attack from dominant individuals, and accordingly, the most adaptive threat responses are submissive tactics, including cooperative and appeasing behaviors. Furthermore, concerning human’s capacity to express oneself with language, some tactics that involve verbal communication, for example, negotiating and apologizing, are more likely to be used when facing human rather than animal threats (D. C. Blanchard et al., 2001; Perkins & Corr, 2006).

In summary, threat responding is highly specific and varies as the imminence of the threat changes. Imminent threats elicit active defenses, such as flight (when escape options are available) and fight (when escape is not possible), less imminent threats evoke freezing, and potential and ambiguous threats are cautiously explored. The direction of threat influences the perceived imminence of the threat, with self-directed threats being perceived as more imminent than other-directed threats. Based on these assumptions, we propose that the direction of threat may differentially influence the generation of creative defensive tactics: exposure to self-directed threats would lead to more original active defense tactics, such as fight and flight, than exposure to other-directed threats (Hypothesis 1a), exposure to other-directed threats would lead to more original passive freezing tactics than exposure to self-directed threats (Hypothesis 1b), and that compared to the exposure to neutral stimuli, exposure to self-directed and other-directed threats would lead to less original risk assessment tactics (Hypothesis 1c). In addition, immediate non-escapable human threats prompt responses involving verbal communication, while animal threats prompt freezing and flight. Therefore, we predicted that the nature of threat would qualify the effects of threat direction on the generation of specific creative defensive tactics, such that people would generate more original cooperative approach tactics when exposed to human rather than animal threats (Hypothesis 2a), and more original freezing and flight tactics when exposed to animal rather than human threats (Hypothesis 2b), and these effects would only occur when people are exposed to threats rather than neutral stimuli (i.e. when the situation is perceived as threatening and arousing; Hypothesis 2c).

Threat Sensitivity

Not everyone is equally sensitive to cues signaling threat and individual differences in threat sensitivity influence the extent to which people adopt avoidance goals (Carver, Sutton, & Scheier, 2000; Elliot & Thrash, 2002). It is thus reasonable to assume that threats
will promote creative defense tactics in certain defense categories especially in people that score high in threat sensitivity. Self-esteem is an important personality characteristic that determines threat sensitivity. Research on the relation between individual differences in self-esteem differences and motivational tendencies suggests that low (as compared to high) self-esteem individuals have stronger self-protective motives that prompt them to focus on avoiding negative outcomes and experiences (Baumeister, Tice, & Hutton, 1989; Heimpel, Elliot, & Wood, 2006). Other work has revealed that higher self-esteem protects individuals from anxiety and anxiety-related behaviors (Greenberg et al., 1992; Solomon, Greenberg, & Pyszczynski, 1991), and provides a buffer against fear of death (Greenberg, Pyszczynski, & Solomon, 1986). This indicates that in threatening situations, individuals with lower self-esteem experience stronger threat, vigilance, and anxiety levels than people with higher self-esteem. Consequently, this anxious arousal and heightened vigilance may motivate low self-esteem individuals to invest more cognitive resources on, and become more creative in, generating specific adaptive defense tactics. Accordingly, we predicted that exposure to threat rather than neutral stimuli would facilitate the generation of certain types of defensive tactics for those who have low rather than high self-esteem (Hypothesis 3).

The Current Research

The present study focuses on the impact of threat exposure, threat features (direction and nature of threats), and individual differences in threat sensitivity on the generation of specific creative defensive tactics. Integrating the motivated focus account of creativity (De Dreu & Nijstad, 2008) with literature on ecological threat responses (D. C. Blanchard et al., 2001; Gawronski & Cesario, 2013), we propose that threats may differentially influence the generation of specific defensive tactics depending on the direction and nature of the threat, and threat sensitivity of the subject. Accordingly, we predict that threats do not have a generalized impact on the generation of creative defense tactics, but selectively promote certain tactics that fit the features of the threatening situation.

This basic prediction was tested in three studies. In Study 3.1, we tested the effect of threat exposure and the direction of threat on the generation of creative defensive tactics. Participants were asked to generate tactics to deal with possible threats while pictures emerged on the screen depicting self-directed threats, other-directed threats, or matching neutral stimuli (depending on condition). In Study 3.2, we set out to replicate the findings of Study 3.1 using the same paradigm except that we additionally varied the nature of
threats participants were exposed to (human vs. animal threats). This enabled us to examine whether the nature of the threat would qualify the effects of threat exposure and direction on the generation of specific creative defensive tactics. Finally, individuals differ in the extent to which they are sensitive to cues signaling threat (e.g., fearful/angry faces, a pointed gun) and therefore the extent to which they tend to adopt avoidance goals (Carver, Sutton, & Scheier, 2000; Elliot & Thrash, 2002). Because motivation determines the level of threat-relevant creativity, we predicted that effects of threat exposure on creative defensive ideation would be moderated by individual differences in threat sensitivity (as indicated by people's self-reported self-esteem). We return to this issue in the Introduction of Study 3.3.

In all three studies, the tactics generated by participants were coded into seven broad defense categories: flight tactics (e.g., “run away”, “walk backwards”), fight tactics (e.g., “strike back”, “find weapons”), freeze tactics (e.g., “stand still”, “make no sound”), risk assessment tactics (e.g., “be vigilant”, “check out the situation”), cooperative approach tactics (e.g., “convince the attacker that it is meaningless to hurt you”, “act friendly”), non-functional avoidance tactics (e.g., “ignore the threat”, “act as if nothing is wrong”), and unspecified tactics that contained ideas that could not be coded into the former six (e.g., “take precautions”, “seek help”, “stay calm”). These seven categories were derived from D. C. Blanchard’s (1997) work and the results of a pre-test. Three changes were made to Blanchard’s original list of five defensive behaviors that were derived from the animal literature, mostly to accommodate uniquely human responses. First, we put defensive threat and defensive attack together under the category “fight” because they both represent approach-oriented active defense tactics that are usually displayed when threats are imminent. Second, we separated non-functional avoidance from freeze tactics, because non-functional avoidance includes deliberately denying the existence of the threat, which is different from freezing – the absence of all overt behaviors induced by overwhelming threats (Bolles & Collier, 1976). Third, because humans have highly developed language skills and a strong ability for perspective taking, cooperative approach was included as a separate category.

From the generated ideas, we could extract the number of non-redundant ideas within different defense categories (fluency) and the number of infrequently mentioned ideas within different defense categories (originality). Because we were primarily interested in creative threat-related ideation, we focus our study findings on originality within different
defense categories. However, we will also provide results for fluency within different defense categories in a meta-analysis of findings across studies that we will report following the empirical studies.

**Study 3.1**

Study 3.1 was designed to examine whether and how threat exposure and the direction of threat would influence the generation of creative defensive tactics. Representing different positions along the threat imminence continuum, we compared self-directed threat (high threat imminence), other-directed threat (moderate threat imminence), and a neutral condition (low threat imminence). We used an idea generation task in which participants generated alternative defensive tactics to cope with threats. This allowed us to test whether exposure to self-directed threats would lead to more original active defense tactics, such as fight and flight, than exposure to other-directed threats (Hypothesis 1a), exposure to other-directed threats would lead to more original passive freezing tactics than exposure to self-directed threats (Hypothesis 1b), and that compared to the exposure to neutral stimuli, exposure to self-directed and other-directed threats would lead to less original risk assessment tactics (Hypothesis 1c).

**Method**

*Design and participants.* Undergraduate students (*N* = 116, 80 females, *M*<sub>age</sub> = 22.01, *SD* = 3.56) were randomly assigned to one of three conditions (self-directed threat, other-directed threat, and a neutral condition). The dependent variables were manipulation checks and originality within each defense category.

*Procedure and manipulation.* Participants were seated in individual cubicles equipped with a computer that displayed all instructions and registered all responses. Participants were asked to generate tactics to deal with threatening situations while the type of threat was left unspecific. During idea generation, pictures emerged on the screen that people were instructed to remember for follow-up questions later in the experimental session. In each condition, there were 14 pictures that were displayed twice in random order. Each picture was shown for 5 s, followed by 3 s of blank screen before the next picture appeared. The pictures were matched on content. They displayed, depending on condition, threats directed at the viewer (self-directed threat; e.g., a man points a gun in the direction of the participant), threats not directed at the viewer (other-directed threat; e.g., a man points a
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gun, but not in the direction of the participant), or matching stimuli in a neutral setting (neutral condition; e.g., a salesman holding a gun in a gun store). The stimulus pictures were selected from a stimulus set by Kveraga et al. (2015) and supplemented with stimuli from the Internet that have been pilot-tested. Sample pictures from all the conditions are presented in Appendix 3.1.

The idea generation task lasted 4 minutes. Following this task, we assessed the extent to which participants perceived the pictures as threatening (“I found the pictures threatening”, “I found the pictures negative”, and “I found the pictures unpleasant”, Cronbach’s $\alpha = .85$) and arousing (“I felt vigilant while looking at the pictures”, and “I felt alert while looking at the pictures”, Cronbach’s $\alpha = .88$), and on four single items whether pictures were self-relevant, directed at themselves, and specifically threatening to themselves or others on a 7-point scale (1 = strongly disagree, to 7 = strongly agree). Finally, to check whether participants in different conditions had different types of threats in mind while generating defensive tactics, with an open question we asked participants to describe what threats they had in mind during the task. We then coded whether or not the described threats were about human threats or animal threats (as in the pictures), or yet other threats (e.g., natural threat, fire, explosion, war, other people in danger, traffic accident, and performance stress).

**Dependent variables.** The tactics generated by participants were coded into seven broad defense categories: flight tactics, fight tactics, freeze tactics, risk assessment tactics, cooperative approach tactics, non-functional avoidance tactics, and unspecified tactics that contained ideas that could not be coded into the former six. Two trained, and independent raters coded all tactics. Interrater reliability was excellent, Cohen’s K = .96, $p < .001$, and differences were solved through discussion.

To get a score for originality, we first assessed how often each tactic was mentioned by all the participants in this study and assigned a percentage score to each tactic (e.g., if an idea was mentioned by 2% of the participants, it received a percentage score 2; if it was mentioned by 39%, it received a score of 39). Ideas were considered original and received a score of 1 if they were mentioned by less than 5 percent of the participants in the current sample (Baas, De Dreu, & Nijstad, 2011; Torrance, 1966). We then summed the number of original tactics per participant within each category as an index of originality within different defense categories (e.g., originality of fight-related ideation, originality of flight-related ideation, etcetera).
Results

Screening of participants. Two participants who generated zero ideas and one participant with fixed response patterns were excluded from analyses, leaving a sample of 113 participants (78 females, $M_{age} = 21.96$, $SD = 3.57$).

Data-analytic strategy. We first verified the effectiveness of our manipulation and whether participants differed in the type of threats they had in mind while generating tactics. Because earlier work has shown that direction of threat influences perception of imminence and modulates defensive behaviors (Fernandes et al., 2013; Flykt et al., 2007), we then examined whether self-directed threat and other-directed threat influenced originality within different defense categories. Finally, we combined the self-directed and other-directed threat conditions and compared them with the neutral condition to examine the effect of threat exposure on originality within different defense categories.

Manipulation check. To verify the effectiveness of our manipulation, we submitted ratings for the level of threat, arousal, self-relevance, the extent to which the focal objects in the pictures were perceived as being directed to themselves, and the level of threat to themselves or others to separate ANOVAs with condition as between-subjects variable. For threat-ratings, we obtained a main effect of condition, $F(2, 110) = 21.21, p < .001, \eta^2_p = .28$.

Post-hoc Tukey tests showed that threat ratings of the pictures in the self-directed and other-directed threat conditions did not differ ($M_{self-directed} = 5.10$, $SD_{self-directed} = 1.21$; $M_{other-directed} = 5.14$, $SD_{other-directed} = 1.30; p = .99$), but were higher than those in the neutral condition ($M = 3.42$, $SD = 1.41; ps < .001$). The same pattern was observed for the perceived arousal level, $F(2, 110) = 8.12, p = .001, \eta^2_p = .13$, with post-hoc Tukey tests showing that arousal ratings made by participants in the self-directed and other-directed threat conditions did not differ ($M_{self-directed} = 4.41$, $SD_{self-directed} = 1.35$; $M_{other-directed} = 4.30$, $SD_{other-directed} = 1.56; p = .95$), but were higher than those reported by participants in the neutral condition ($M = 3.16$ $SD = 1.56; p_{self-directed} = .001, p_{other-directed} = .004$). Likewise, there was a main effect of condition on self-relevance of the threat, $F(2, 110) = 9.24, p < .001, \eta^2_p = .14$, with post-hoc Tukey tests showed that self-relevance ratings of the pictures by participants in the self-directed and other-directed threat conditions did not differ ($M_{self-directed} = 3.18$, $SD_{self-directed} = 1.63$; $M_{other-directed} = 3.05$, $SD_{other-directed} = 1.60; p = .92$), but were higher than those made by participants in the neutral condition ($M = 1.89$, $SD = 1.01; p_{self-directed} < .001, p_{other-directed} = .002$).
Moreover, for the extent to which focal objects in the pictures were perceived as being directed to themselves, we found a main effect of condition, $F(2, 110) = 89.71, p < .001$, $\eta_p^2 = .62$. Post-hoc Tukey tests showed that participants in the self-directed threat condition reported the objects in the pictures were more directed at themselves ($M = 5.97, SD = 0.82$) than those in the other-directed threat ($M = 2.24, SD = 1.19; p < .001$) and neutral conditions ($M = 3.82, SD = 1.52; p < .001$), and participants in the other-directed threat condition reported that the objects in the pictures were less directed at themselves than those in the other two conditions, $p_s < .001$. Finally, the main effect of condition was also found for the extent to which participants believed the pictures were especially threatening to themselves, $F(2, 110) = 22.65, p < .001$, $\eta_p^2 = .29$, or to others, $F(2, 110) = 28.86, p < .001$, $\eta_p^2 = .34$. Post-hoc Tukey tests showed that participants in the self-directed threat condition reported the pictures to be more threatening to themselves ($M = 3.68, SD = 1.68$) than those in the other-directed threat condition ($M = 2.00, SD = 1.27; p < .001$) and neutral condition ($M = 1.87, SD = 0.84; p < .001$), but there was no difference between other-directed threat and neutral conditions, $p = .901$; participants in the other-directed threat condition reported the pictures to be more threatening to others ($M = 5.70, SD = 1.22$) than those in the self-directed threat condition ($M = 3.55, SD = 1.61; p < .001$) and neutral condition ($M = 3.45, SD = 1.48; p < .001$), but there was no difference between self-directed threat and neutral conditions, $p = .946$. In sum, pictures in both self-directed and other-directed threat conditions were equally threatening, arousing, and self-relevant, and more so than the pictures in the neutral condition. However, on more specific questions, we observed that, compared to pictures in the neutral and other-directed threat condition, those in the self-directed threat condition were more directed at, and threatening to, viewers themselves.

We also verified whether participants in the self-directed threat, other-directed threat, and neutral conditions differed in the type of threats they had in mind while doing the idea generation task. Chi-square tests revealed that participants in different conditions did not differ in whether they had human threats, $\chi^2(2) = 5.26, p = .072$; animal threats, $\chi^2(2) = 2.68, p = .262$; or other types of threats in mind, $\chi^2(2) = 4.84, p = .089$. This excludes the possibility that our findings are caused by different types of threat the participants had in mind due to the manipulation.
**Threat direction.** We first examined the influence of threat direction on the number of original tactics in different defense categories. The results of a 2 (self-directed vs. other-directed threat) × 7 (defense category: flight, fight, freeze, risk assessment, cooperative approach, non-functional avoidance, and unspecified ideas) repeated measure ANOVA showed no effects involving threat direction (Fs < 1.30, ps > .272), suggesting that direction of threat did not influence originality of defensive tactics in the task. Therefore, Hypothesis 1a and 1b were not supported. Because self-directed and other-directed threat conditions did not significantly differ from one another on the generation of original defensive tactics, and both conditions stimulated equally high levels of threat, arousal, and self-relevance, these two conditions were put together as threat condition in subsequent analyses and compared with the neutral condition to examine the effect of threat exposure on originality within different defense categories.

**Threat exposure.** To test the effect of threat exposure on the number of original tactics in different defense categories, we submitted the number of original tactics generated within each defense category to a 2 (threat exposure: threat vs. neutral) × 7 (defense category: flight, fight, freeze, risk assessment, cooperative approach, non-functional avoidance, and unspecified tactics) repeated measure ANOVA with the second factor within-subjects. Whereas the main effect of threat exposure was not significant, F(1, 111) = 0.54, p = .462, η² = .01; the main effect for defense category, F(6, 106) = 14.38, p < .001, η² = .45, and the interaction between threat exposure and defense category, F(6, 106) = 4.59, p < .001, η² = .21, were significant. As can be seen in Figure 3.1, conditions did not significantly differ in the number of original flight-related (F(1, 111) = 0.83, p = .365, η² = .01), freeze tactics (F(1, 111) = 0.34, p = .564, η² = .003), and non-functional avoidance tactics that were generated (F(1, 111) = 0.32, p = .575, η² = .003). However, there was a significant effect of threat exposure on the number of original fight tactics, F(1, 111) = 7.90, p = .006, η² = .07, with more original fight tactics generated in the threat condition (M = 1.64, SD = 2.62) than in the neutral condition (M = 0.42, SD = .72). Moreover, an effect of threat exposure on the number of original cooperative approach tactics, F(1, 111) = 8.01, p = .006, η² = .07, showed more original cooperative approach tactics were generated in the threat condition (M = 0.79, SD = 0.93) than in the neutral condition (M = 0.29, SD = 0.77). Furthermore, an effect of threat exposure was found on original unspecified tactics, F(1,
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\(111) = 6.35, p = .013, \eta_p^2 = .05, \) with more original unspecified tactics generated in the neutral condition \((M = 2.55, SD = 2.44)\) than in the threat condition \((M = 1.52, SD = 1.84)\). Finally, although not significant, \(F(1, 111) = 2.81, p = .096, \eta_p^2 = .03, \) participants tended to generate less original risk assessment tactics in the threat condition \((M = 0.27, SD = .58)\) than in the neutral condition \((M = 0.50, SD = .89)\).

**Figure 3.1.** Number of original tactics in different defense categories as a function of threat exposure (displayed are means ± SE).

**Discussion of Study 3.1**

Study 3.1 examined whether threats would differentially influence the generation of original defensive tactics. Although participants in the self-directed threat condition perceived the pictures to be more directed and threatening to themselves than participants in the other-directed threat condition, threat direction did not influence overall threat, arousal and relevance levels and did not differentially influence the generation of original defensive tactics (disconfirming Hypothesis 1a and 1b). This suggests that both threat conditions may have led to equally high levels of perceived threat imminence. And indeed, when threat conditions were combined and compared to a neutral condition, we observed that (a) threat exposure did not influence the overall number of original defensive tactics, (b) but differentially impacted the originality of certain types of tactics: Compared to the
neutral condition, threats led to more original fight and cooperative approach tactics, but less original exploration tactics. We cautiously interpret these results as being consistent with our main prediction, indicating that people confronted with threats selectively generate more original tactics within categories that are usually favored in such circumstances, but less original tactics within categories that are less likely to be selected in the face of imminent threat.

**Study 3.2**

The first goal of Study 3.2 was to replicate the pattern of findings obtained in Study 3.1 with the same manipulation and idea generation task. We tested for threat direction again, to verify whether the null-finding in Study 3.1 was robust rather than a false negative. More importantly, we set out to further understand the circumstances under which threat facilitates creative defensive ideation. We separated the nature of threat (animal vs. human) in Study 3.2 and predicted that the nature of threat would qualify the effect of threat exposure on creative tactics in different defense categories. Confrontation with aggressive animals usually elicits freezing or flight responses, while human threats may elicit submissive behaviors, appeasement, or communication (Öhman, 1986; Perkins & Corr, 2006). Therefore, we predicted that people would generate more original cooperative approach tactics when exposed to human rather than animal threats (Hypothesis 2a), and more original freezing and flight tactics when exposed to animal rather than human threats (Hypothesis 2b), and that these effects would only occur when people are exposed to threats rather than neutral stimuli (i.e. when the situation is perceived as threatening and arousing; Hypothesis 2c).

**Method**

*Design and participants.* Undergraduate students (N = 192, 139 females, $M_{age}$ = 21.64, $SD$ = 3.74) were randomly assigned to one of three conditions (self-directed threat, other-directed threat, and neutral condition). The dependent variables were manipulation checks and originality within each defense category.

*Procedure, manipulations and dependent variables.* The procedure and the manipulation of threat were the same as in Study 3.1, except that we separated the content of threat in the idea generation task. Specifically, participants completed two idea generation tasks, one after the other, with each task lasting 2 minutes. In both tasks, they
were asked to generate ideas about how to deal with threatening situations while pictures emerged on the screen displaying self-directed threats, other-directed threats or matching neutral stimuli (See Study 3.1). However, in one task, the main subjects in the pictures were animals (e.g., dog, shark, or leopard); in the other task, the main subjects in the pictures were humans with weapons (e.g., human with gun, stick, or knife). The nature of threat was manipulated as a within-subjects factor with order counterbalanced.

Then, as before, we assessed the extent to which participants perceived the pictures as threatening (Cronbach’s α = .86), arousing (Cronbach’s α = .90), and on four single items whether pictures were self-relevant, directed at themselves, and specifically threatening to themselves or others on a 7-point scale (1 = strongly disagree, to 7 = strongly agree). Finally, we asked participants to describe the threats they had in mind during the idea generation task and coded whether or not participants mentioned human threat, animal threat, and/or other types of threats.

The tactics generated by participants were coded into seven defense categories by two independent coders (Cohen’s K = .80, p < .001), and originality within each defense category was measured as in Study 3.1.

Results

Data-analytic strategy. Similar to the data-analytic strategy in Study 3.1, we first verified the effectiveness of our manipulation and whether participants differed in the type of threats they had in mind while generating tactics. We then continued testing the effect of threat direction and its interaction with nature of threat on originality within different types of defense categories. Finally, we combined the self-directed and other-directed threat conditions and compared them with the neutral condition to examine the effect of threat exposure and nature of threat on creative defense ideation.

Manipulation check. To verify the effectiveness of our manipulation, we submitted the ratings for the level of threat and arousal, self-relevance and perceived direction of the focal objects displayed in the pictures to separate ANOVAs with condition as between-subjects variable. For threat ratings, we obtained a main effect of condition, $F(2, 189) = 44.19, p < .001$, $\eta_p^2 = .32$. Post-hoc Tukey tests showed that threat ratings of the pictures in the self-directed and other-directed threat conditions did not differ ($M_{direct} = 5.06, SD_{direct} = 1.13; M_{other-directed} = 5.23, SD_{other-directed} = 1.03; p = .701$) but were higher than those in the neutral condition ($M = 3.49, SD = 1.28; ps < .001$). The same pattern was
obtained for the perceived level of arousal, \( F(2, 189) = 12.09, \ p < .001, \ \eta^2_p = .11, \) with post-hoc Tukey tests showing that arousal ratings made by participants in the self-directed and other-directed threat conditions did not differ (\( M_{\text{self-directed}} = 4.61, SD_{\text{self-directed}} = 1.21; M_{\text{other-directed}} = 4.38, SD_{\text{other-directed}} = 1.50; p = .632 \)) but were higher than those made in the neutral condition (\( M = 3.46, SD = 1.45; ps \leq .001 \)). Similarly, there was a main effect of condition on self-relevance, \( F(2, 189) = 5.04, \ p = .007, \ \eta^2_p = .05. \) Post-hoc Tukey tests showed that self-relevance ratings of the pictures did not differ between the self-directed and other-directed threat conditions (\( M_{\text{self-directed}} = 3.05, SD_{\text{self-directed}} = 1.36; M_{\text{other-directed}} = 2.71, SD_{\text{other-directed}} = 1.44; p = .315 \)), or between other-directed threat and the neutral condition (\( M = 2.30, SD = 1.15 \)), but participants in the self-directed threat condition perceived the pictures to be more personally relevant than those in the neutral condition, \( p = .005. \)

Moreover, for the perceived direction of the focal objects displayed in the pictures, we found a main effect of condition, \( F(2, 189) = 82.68, \ p < .001, \ \eta^2_p = .47. \) Post-hoc Tukey tests showed that participants in the self-directed threat condition reported the objects in the pictures to be more directed to themselves (\( M = 5.61, SD = 1.34 \)) than those in the other-directed threat (\( M = 2.40, SD = 1.25; p < .001 \)) and neutral conditions (\( M = 3.86, SD = 1.65; p < .001 \)), and participants in the other-directed threat condition reported the objects in the pictures to be less directed to themselves than those in the other two conditions, \( ps < .001. \) Finally, the main effect of condition was also obtained for the extent to which participants perceived the pictures to be especially threatening to themselves, \( F(2, 189) = 21.98, \ p < .001, \ \eta^2_p = .19, \) or to others, \( F(2, 189) = 39.25, \ p < .001, \ \eta^2_p = .29. \) Post-hoc Tukey tests showed that participants in the self-directed threat condition reported the pictures to be more threatening to themselves (\( M = 3.37, SD = 1.79 \)) than those in the other-directed threat condition (\( M = 2.05, SD = 1.19; p < .001 \)) and neutral condition (\( M = 1.97, SD = 0.92; p < .001 \)), but there was no difference between other-directed threat and neutral conditions, \( p = .943; \) and participants in the other-directed threat condition reported the pictures to be more threatening to others (\( M = 5.35, SD = 1.30 \)) than those in the self-directed threat condition (\( M = 3.50, SD = 1.43; p < .001 \)) and neutral condition (\( M = 3.25, SD = 1.67; p < .001 \)), but there was no difference between self-directed threat and neutral conditions, \( p = .614. \) In sum, pictures in both self-directed and other-directed threat conditions were equally threatening, arousing, and self-relevant, and more threatening and arousing than the pictures in the neutral condition. However, compared to pictures in the neutral
condition and other-directed threats, self-directed threats were more directed at, and threatening to, viewers themselves.

Finally, we verified whether participants in the self-directed, other-directed threat, and neutral conditions differed in the type of threats they had in mind while generating ideas. Chi-square tests revealed no effect of condition on whether participant had human threats, $\chi^2(2) = 0.85, p = .655$; animal threats, $\chi^2(2) = 1.83, p = .401$; or other types of threats in mind, $\chi^2(2) = 4.41, p = .110$.

**Threat direction.** We first explored whether threat direction and nature of threat influenced originality within different types of defense tactics. The results of a 2 (direction of threat: self-directed vs. other-directed threat) $\times$ 2 (nature of threat: human vs. animal) $\times$ 7 (defense category: flight, fight, freeze, risk assessment, cooperative approach, non-functional avoidance, and unspecified ideas) repeated measure ANOVA with the latter two factors within-subjects showed no effects involving direction of threat ($Fs < 1.19, ps > .320$). This suggests that direction of threat did not influence the originality of defensive tactics in this study. Because self-directed and other-directed threat conditions did not significantly differ from one another on the number of original defensive tactics, and both conditions stimulated equally high levels of threat, arousal and self-relevance, these two conditions were put together as threat condition in subsequent analyses.

**Threat exposure.** To test the effect of threat exposure and nature of threat on the number of original tactics in different defense categories, we submitted the number of original tactics generated within each tactic type to a 2 (threat exposure: threat vs. neutral) $\times$ 2 (nature of threat: human vs. animal) $\times$ 7 (defense category: flight, fight, freeze, risk assessment, cooperative approach, non-functional avoidance, and unspecified tactics) repeated measure ANOVA with the latter two factors within-subjects. We found a significant main effect of defense category, $F(6, 185) = 37.81, p < .001, \eta^2_p = .55$. In addition, there was a significant interaction between threat exposure and defense category, $F(6, 185) = 3.16, p = .006, \eta^2_p = .09$, and between nature of threat and defense category, $F(6, 185) = 3.83, p = .001, \eta^2_p = .11$. More important, these two-way interactions were qualified by a significant three-way interaction, $F(6, 185) = 3.41, p = .003, \eta^2_p = .10$. The main effect of threat exposure and nature of threat were not significant, $Fs < 0.51$.

We then did a simple effects analysis to inspect the pattern of the interaction between
threat exposure and defense category. Figure 3.2 shows that participants did not significantly differ in the number of original flight tactics \(F(1, 190) = 0.20, p = .654, \eta^2_p < .01\), freeze tactics \(F(1, 190) = 0.22, p = .642, \eta^2_p < .01\), cooperative approach tactics \(F(1, 190) = 0.98, p = .324, \eta^2_p < .01\), non-functional avoidance \(F(1, 190) = 2.88, p = .091, \eta^2_p = .02\) and unspecified tactics \(F(1, 190) = 0.08, p = .781, \eta^2_p < .01\). However, there was a significant effect of threat exposure on the number of original flight tactics, \(F(1, 190) = 8.39, p = .004, \eta^2_p = .04\), with more original flight tactics generated in the threat condition \((M = 1.76, SD = 1.86)\) than in the neutral condition \((M = 1.02, SD = 1.18)\). Moreover, an effect of threat exposure on the number of original risk assessment tactics, \(F(1, 190) = 7.39, p = .007, \eta^2_p = .04\), showed that more original risk assessment tactics were generated in the neutral condition \((M = 1.13, SD = 1.58)\) than in the threat condition \((M = 0.64, SD = 0.88)\).

![Figure 3.2. Number of original tactics in different defense categories as a function of threat exposure (displayed are means ± SE).](image)

Post-hoc contrasts of the three-way interaction (see Figure 3.3) revealed an interaction between threat exposure and nature of threat on the number of original cooperative approach tactics: In the threat condition, there was a significant effect of nature of threat on the number of original cooperative approach tactics, \(F(1, 190) = 44.60, \eta^2_p = .21\).
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$p < .001$, $\eta^2_p = .19$, with more original cooperative approach tactics being generated when exposed to human threat ($M = 0.89$, $SD = 1.06$) than animal threat ($M = 0.27$, $SD = 0.57$), but no difference was found in the neutral condition, $F(1, 190) < 1 (M_{human} = 0.48$, $SD_{human} = 0.80$; $M_{animal} = 0.49$, $SD_{animal} = 0.78$).

Moreover, we found a significant interaction between threat exposure and nature of threat on the number of original risk assessment tactics: In the threat condition, there was a significant effect of nature of threat on the number of original risk assessment tactics, $F(1, 190) = 5.08$, $p = .025$, $\eta^2_p = .03$, with less original risk assessment tactics being generated when exposed to human threat ($M = 0.24$, $SD = 0.50$) than animal threat ($M = 0.40$, $SD = 0.66$), but no significant difference was observed in the neutral condition, $F(1, 190) = 1.16$, $p = .284$, $\eta^2_p = .01 (M_{human} = 0.62$, $SD_{human} = 0.94$; $M_{animal} = 0.51$, $SD_{animal} = 0.90$). Finally, participants generated less original freeze tactics when they encountered humans as compared to animals in both threat, $F(1, 190) = 4.36$, $p = .038$, $\eta^2_p = .02 (M_{human} = 0.10$, $SD_{human} = 0.33$; $M_{animal} = 0.21$, $SD_{animal} = 0.51$), and neutral conditions, $F(1, 190) = 3.69$, $p = .056$, $\eta^2_p = .02 (M_{human} = 0.06$, $SD_{human} = 0.25$; $M_{animal} = 0.21$, $SD_{animal} = 0.45$).
Figure 3.3. Number of original tactics in different defense categories in threat condition (upper) and neutral condition (lower) as a function of nature of threat (displayed are means ± SE).

Discussion of Study 3.2

Findings across the first two studies consistently show that (a) threat direction did not influence overall threat, arousal and relevance levels and did not differentially influence the generation of original defensive tactics (disconfirming Hypothesis 1a and 1b); and (b) when threat conditions were combined and compared to a neutral condition, we observed that threat exposure did not influence the overall number of original defensive tactics, but differentially impacted the originality of certain types of tactics: threat exposure selectively facilitated the generation of original fight tactics, and hindered the generation of original
risk assessment tactics. We interpret these results as being consistent with our main prediction, indicating that confronted with threats people selectively generate more (less) original tactics within categories that are usually favored (ignored) in such circumstances. In addition, we found an interaction between threat exposure and nature of threat on different types of tactics. Consistent with our hypotheses, participants generated more original freeze tactics and risk assessment tactics, but less cooperative approach tactics when facing animals rather than humans. Moreover, this effect was observed in the threat rather than neutral condition.

**Study 3.3**

If the selectively enhanced effects on certain types of defensive tactics are due to increased motivation to cope with the specific threat, then we should find that these effects are stronger when individuals have high rather than low threat sensitivity. Moreover, although threat condition did not influence the type of threats participants had in mind while doing the idea generation task, moderation by dispositional sensitivity to threats also rules out the possibility that effects are primarily caused by primed knowledge. One key factor capturing individual responsiveness to threats is self-esteem. Individuals with lower self-esteem experience stronger anxiety and are particularly motivated to avoid negative outcomes in response to threatening situations (Baumeister et al., 1989; Greenberg et al., 1992). For these reasons, we included self-esteem in Study 3.3 as a continuous independent variable. Together with the findings of Study 3.1 and 3.2, we predicted that threat exposure would lead to more original fight tactics, especially in people that have low rather than high self-esteem. In addition, since the direction of threat did not influence the level of threat, arousal, and relevance, and did not differentially influence the generation of original defensive tactics, we focused on self-directed threats only in Study 3.3.

**Method**

*Design and participants.* Undergraduate students (N = 146, 105 females, M<sub>age</sub> = 21.66, SD = 2.74) were randomly assigned to one of two experimental conditions (threat and neutral condition). The dependent variables were manipulation checks and originality within each defense category. Self-reported self-esteem constituted a second, continuous independent variable.

*Procedure, manipulation and dependent variables.* Participants first completed the
ten-item Rosenberg Self-esteem Scale (Cronbach’s $\alpha = .90$, Rosenberg, 1979). Sample items include, “On the whole, I am satisfied with myself”, “I’m able to do things as well as most other people”, and “I feel I do not have much to be proud of (reverse scored)”. Participants rated their agreement with each item on a 7-point Likert scale ($1 = $strongly disagree$ to 7 = $strongly agree$). Thereafter, they did the idea generation task about how to deal with threatening situations. The procedure and manipulation were the same as in Study 3.1, except that we excluded the other-directed threat condition and used pictures depicting self-directed threats (vs. matched neutral pictures) only as manipulation of threat. As before, participants indicated the extent to which participants perceived the pictures as threatening (Cronbach’s $\alpha = .89$) and arousing (Cronbach’s $\alpha = .89$) as manipulation checks. Also, visibility (“I found the pictures unclear”, and “I found the pictures visible”; Cronbach’s $\alpha = .68$) of the pictures were rated on a 7-point scale ($1 = $strongly disagree$, to 7 = $strongly agree$). Finally, participants described what threats they had in mind during idea generation.

The tactics generated by participants were coded into seven defense categories by two independent coders (Cohen’s $K = .88, p < .001$), and originality within each defense category was calculated as before (Study3.1 and 3.2).

**Results**

**Screening of participants.** One participant that generated zero tactics and one participant who generated incomplete and nonsense tactics were excluded from further analyses, leaving a sample of 144 participants (104 females, $M_{age}=21.65, SD=2.76$).

**Data-analytic strategy.** First, we verified the effectiveness of our manipulation by examining whether threat condition induced higher levels of threat, anxiety and arousal. We then tested the effect of threat condition (vs. neutral condition) on originality of ideation in different defensive categories. Finally, the interaction between threat exposure and self-esteem was analyzed on originality in each defensive category separately.

**Manipulation check.** To verify the effectiveness of our manipulation, we submitted threat and arousal levels to separate ANOVAs with condition as between-subjects variable. For threat-ratings, we obtained a main effect of condition, $F(1, 142) = 108.41, p < .001, \eta^2_p = .43$. Compared to those in the neutral condition ($M = 2.94, SD = 1.39$), participants in the threat condition reported stronger feelings of threat ($M = 5.10, SD = 1.07$). The same pattern was observed for the perceived arousal, $F(1, 142) = 28.55, p < .001, \eta^2_p = .17$, with
higher arousal reported in the threat condition \((M = 4.69, SD = 1.30)\) than in the neutral condition \((M = 3.43, SD = 1.52)\).

We also verified whether participants in the threat condition and neutral condition differed in the specific threats they had in mind while doing the idea generation task. Chi-square tests revealed that conditions did not differ in whether or not participants had human threats, \( \chi^2(1) = 0.86, p = .354 \); animal threats, \( \chi^2(1) = 0.18, p = .674 \); or other types of threats in mind, \( \chi^2(1) = 3.00, p = .083 \). This excludes the possibility that our findings are caused by different types of primed threats due to the experimental manipulation.

Finally, to rule out the possibility that the visibility of the pictures differed between conditions, we submitted visibility ratings to an ANOVA with condition as between-subjects variable. There was no difference between the threat \((M = 5.86, SD = 1.01)\) and neutral condition \((M = 5.63, SD = 1.32)\) regarding the visibility ratings of the pictures, \(F(1, 142) = 2.01, p = .230, \eta^2_p = .01\).

**Threat exposure.** To test the effect of threat exposure on the number of original tactics in different defense categories, we submitted the number of original tactics generated within each type to a 2 (threat exposure: threat vs. neutral) \( \times 7 \) (type of tactics: flight, fight, freeze, risk assessment, cooperative approach, non-functional avoidance, and unspecified ideas) repeated measures ANOVA with the second factor within-subjects. There was a significant main effect of the type of tactics, \(F(6, 137) = 30.80, p < .001, \eta^2_p = .57\); the main effect of threat exposure was not significant, \(F(1,142) = 0.26, p = .614, \eta^2_p < .01\). Finally, the interaction between threat exposure and type of tactics was significant, \(F(6, 137) = 3.50, p = .003, \eta^2_p = .13\).

Figure 3.4 shows that there was a significant effect of threat exposure on the number of original fight tactics, \(F(1, 142) = 5.41, p = .021, \eta^2_p = .04\), with more original fight tactics generated in the threat condition \((M = 2.56, SD = 2.84)\) than in the neutral condition \((M = 1.61, SD = 1.95)\). Moreover, significant differences between the threat and neutral conditions were also found regarding the number of original risk assessment tactics, \(F(1, 142) = 9.16, p = .003, \eta^2_p = .06\), with more original risk assessment tactics generated in the neutral condition \((M = 0.50, SD = 0.89)\) than in the threat condition \((M = 0.15, SD = 0.40)\). Finally, we found a significant effect of threat exposure on the number of original unspecified tactics, \(F(1, 142) = 9.13, p = .003, \eta^2_p = .06\), with more original unspecified
tactics generated in the neutral condition than in the threat condition. ($M = 2.10, SD = 1.89$ vs. $M = 1.24, SD = 1.52$).

Figure 3.4. Number of original tactics in different defense categories as a function of threat exposure (displayed are means ± SE).

**Self-esteem and originality.** We tested the role of self-esteem in the link between threat exposure and the number of original defense tactics with hierarchical moderated regression analyses with mean-centered variables (Aiken & West, 1991). Separate regression analyses were performed using originality within each defense category as a dependent variable. In the first step, dummy-coded threat exposure condition (1 – threat, 0 – neutral) and mean-centered self-esteem were entered. In the second step, the interaction term of threat exposure and self-esteem was added. There were no significant interaction effects between threat exposure and self-esteem on originality of freeze, risk assessment, cooperative approach, non-functional avoidance, and unspecified tactics ($ps > .065$). The regression with originality of fight tactics as dependent variable revealed a significant effect in Step 1 for threat exposure: $\beta = 0.19, t(141) = 2.30, p = .023$. More interestingly, in Step 2 we found a significant threat exposure × self-esteem interaction on original fight tactics: $\beta = -0.16, t(140) = -1.98, p = .050$, see Figure 3.5A. Simple slope analysis showed that at lower self-esteem (-1 SD), exposure to threat elicited a greater number of original fight tactics, $B = 1.74, t(140) = 3.04, p = .003$. In participants who were high on self-esteem
(+1 SD), there was no significant effect of threat exposure, $B = 0.14$, $t(140) = 0.24$, $p = .812$. In addition, regression analyses with originality of flight tactics as the dependent variable revealed a marginally significant effect in Step 1 for self-esteem: $\beta = 0.16$, $t(141) = 1.93$, $p = .056$. In Step 2 we found a significant threat exposure $\times$ self-esteem interaction: $\beta = -0.19$, $t(140) = -2.34$, $p = .020$, see Figure 3.5B. Simple slope analysis showed that at lower self-esteem (-1 SD), people exposed to threat generated marginally more original flight tactics than those in the neutral condition, $B = 0.42$, $t(140) = 1.87$, $p = .064$. In participants who were high on self-esteem (+1 SD), there was no significant effect of threat condition, $B = -0.32$, $t(140) = -1.45$, $p = .148$. 
Figure 3.5. Interaction between self-esteem and threat exposure predicting the number of original fight tactics (Panel A) and the number of original flight tactics (Panel B).

Meta-analysis Across Studies

Although the influence of threat exposure on the generation of original defensive tactics across the three studies revealed a highly similar pattern, the significance levels of
the simple effects differed somewhat. Therefore, to get a more comprehensive picture of the data, we conducted a meta-analysis across all three studies (combined $N = 449$). From the generated ideas, we could also extract the number of non-redundant ideas within different defense categories (fluency) and here we will also provide meta-analytic results for fluency within different defense categories. We thus conducted four meta-analyses, two for the overall number of tactics (overall fluency) and original tactics (overall originality), one for the number of tactics in different defense categories (fluency within defense category), and a fourth one for the number of original tactics in different defense categories (originality within defense category). We only compared the standardized differences between threat condition with the neutral condition (collapsing the self-directed and other-directed threat conditions in Study 3.1 and 3.2, and ignoring the nature of threat in Study 3.2 and individual differences in self-esteem in Study 3.3). All analyses and computations were carried out using Comprehensive Meta-Analysis software, V2 (Biostat Version 2, 2007). These computations were based on means and standard deviations of fluency and originality across all defense categories and for each defense category separately within conditions. The effect size index we used for all outcomes is Cohen’s $d$; combined effect sizes and their 95% Confidence Intervals (CIs) are computed on the basis of a random effects model (Borenstein, Hedges, Higgins, & Rothstein, 2009).

Overall (i.e., standardized difference between conditions regarding the number of ideas across the different defense categories), participants in the threat condition generated more defensive tactics than those in the neutral condition, $d = 0.32$; 95% CI = 0.11; 0.53. In addition, the standardized differences in production between conditions depended on the type of defense category, $Q_b(6) = 53.45$, $p < .001$ (with $Q_b$ being similar to a main effect in an analysis of variance). Indeed, participants generated more flight tactics ($d = 0.32$; 95%CI = 0.04, 0.60), fight tactics ($d = 0.50$; 95%CI = 0.20, 0.79), and cooperative approach tactics ($d = 0.55$; 95%CI = 0.23, 0.88), and less risk assessment tactics ($d = -0.45$; 95%CI = -0.65, -0.26) and non-functional avoidance tactics ($d = -0.23$; 95%CI = -0.42, -0.03) in the threat condition than in the neutral condition. No differences between conditions were observed for freeze tactics and other tactics (See Table 3.1).

Regarding originality, overall (i.e., standardized difference between conditions regarding the number of original ideas across the different defense categories), participants in the threat condition did not generate more original defensive tactics than those in the neutral condition, $d = 0.03$; 95% CI = -0.16; 0.23. However, the standardized
differences in original ideation between conditions depended on the type of defense category, $Q_b(6) = 48.94, p < .001$. Indeed, participants generated more original fight tactics ($d = 0.45; 95\%CI = 0.26, 0.65$), but less original risk assessment tactics ($d = -0.43; 95\%CI = -0.62, -0.23$) and unspecified tactics ($d = -0.34; 95\%CI = -0.65, -0.02$) in the threat condition than in the neutral condition. No differences between conditions were observed for flight, freeze, cooperation, and non-functional avoidance tactics (See Table 3.1).

### Table 3.1

Meta-analytic results of the effect of threat on fluency and originality across three studies ($k = 3; N = 449$)

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<th>Variable</th>
<th>$d$</th>
<th>95% CI</th>
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<tr>
<td>Overall originality</td>
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<td>Fluency within category</td>
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<td></td>
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<td>freeze</td>
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<td>cooperative approach</td>
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<td>Originality within category</td>
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### General Discussion

The current research examined whether and when people, in the face of threat, generate specific creative defense tactics. Three studies revealed that the impact of threat on the generation of creative defense tactics strongly depends on the type of defense tactic, the nature of the threat, and individual differences in threat sensitivity, but not on threat direction - whether the threat is directed towards, or away from, the observer. First,
findings across three studies consistently revealed that compared to the neutral condition, threats led to more original fight tactics and less original risk assessment tactics, but did not influence other types of original defense tactics. Second, exposure to human rather than animal threats motivated original cooperative approach tactics, while exposure to animal rather than human threats motivated original freeze and risk assessment tactics, but these effects were absent in the neutral condition (Study 3.2), indicating that threatened people selectively generate more (less) original tactics within categories that are usually favored (ignored) in such circumstances. Third, results of Study 3.3 confirmed the idea that the motivation to avoid threats plays a crucial role in threat-related ideation by showing that threats stimulated more original fight and flight tactics only among individuals that are especially sensitive to threats (those scoring low on self-esteem. Fourth, inconsistent with our prediction that self-directed threats would specifically promote the generation of original active defense tactics, such as fight and flight behaviors, and other-directed threats would specifically promote the generation of original freeze tactics, we found that threat direction did not differentially influence the generation of original defensive tactics (Study 3.1 and 3.2); because we also observed that threat direction did not influence the feeling of threat, arousal, and self-relevance, it may be that in our study both self-directed and other-directed threats led to equally high levels of perceived threat imminence. Fifth and finally, regarding the sheer number of generated ideas (fluency), a meta-analysis of findings of our three studies showed that threats increased the overall productivity of defensive tactics, and particularly facilitated the generation of active defense tactics, such as flight, fight, and cooperative approach tactics, but hindered the generation of risk assessment and non-functional avoidance tactics (e.g., to ignore the threat). These findings have important implications for our understanding of the role of threatening states on creativity and for our thinking about the interrelation between threat features, individual differences in threat sensitivity, and creative defense ideation.

**Threat Exposure, Threat Features, and Creativity**

The results of three studies improve our understanding of the relation between threats and creativity. Past work roughly proposed two perspectives on creativity under threat. The threat-rigidity principle suggests threat exposure leads to black-and-white thinking, rigid information processing, and reduced creativity (Carnevale & Probst, 1998; Keinan, 1987; Staw, Sandelands, & Dutton, 1981). Accordingly, we should expect reduced original thinking in the threat as compared to the neutral condition regardless of the
creativity task and/or type of defensive tactic inspected. Our results are inconsistent with this principle because threat exposure did not affect overall originality and led to the generation of more defense tactics overall.

The motivated focus account of creativity offers another perspective by suggesting that threatened people are highly motivated to deal with their current situation and focus their cognitive resources on avoiding or neutralizing the threat and not on materials and tasks that are irrelevant to their current concerns. This motivated focus may ultimately enhance creativity, but only in the domains that are deemed threat-relevant (De Dreu & Nijstad, 2008). Our finding showing enhanced originality of specific defense tactics when exposed to threats are in line with this perspective. Importantly, earlier studies supporting the motivated focus account relied on creativity tasks that were somewhat remotely threat-relevant. For example, in an initial test of the motivated focus hypothesis, De Dreu and Nijstad (2008) had participants generate possible uses for a brick while participants were expecting a conflictive negotiation. Post-hoc, the generated ideas were coded as threat-related (e.g., a brick as a weapon, a brick to protect oneself) or threat-irrelevant (e.g., a brick to play with), and it was discovered that threat led to enhanced threat-related brick uses. Notwithstanding the value of this evidence, a true test of the motivated focus account would require a task in which threatened individuals can generate alternative ways to deal with threats. Therefore, we strongly increased the threat-relevance of the creativity task to examine whether and when threat exposure would enhance the generation of different types of creative defense tactics.

In doing so, our findings extend earlier work supporting the motivated focus account. That is, when specifically asked to think about possible tactics to cope with threats, threatened people may selectively focus their resources on the types of defense tactics that enable them to successfully deal with the threat at hand, and not on the types of defensive tactics that are less helpful for self-protection. Indeed, rather than a generalized impact on defensive originality, threat exposure selectively led to more original fight tactics but to less original risk assessment tactics. This fits earlier work on ecological defense behaviors that suggests that defenders’ responses vary systematically depending on whether threats are potentially present in the environment or at close distance and attacking (Fanselow, 1994; Fanselow & Lester, 1988): risk assessment is the most adaptive and likely response when threats are potentially present (D. C. Blanchard et al, 2011; Woody & Szechtmam, 2011), whereas fight is the most adaptive and likely response when the situation is highly
threatening and inescapable (D. C. Blanchard et al, 2001; Mobbs et al., 2015). In addition, participants in Study 3.2 generated more original cooperative approach tactics focusing on appeasement strategies and negotiation when facing human threats, and more original freeze and risk assessment tactics when facing animal threats. Indeed, language based defense tactics, such as negotiating, only make sense when being exposed to human threats (Perkins & Corr, 2006), whereas risk assessment and freezing are usually selected and adaptive in the face of imminent animal threats with no place to hide (Harrison, Ahn, & Adolphs, 2015). Our findings resonate with this work, indicating that people confronted with threats tend to generate creative defense tactics that fit the current circumstances, whereas less adaptive defensive tactics are suppressed or unaffected.

From the motivated focus account, it follows that threat-related creativity strongly relies on (avoidance) motivation. An alternative explanation would be that our findings are caused primarily by activation of primed knowledge. Earlier work on aggression suggests that exposure to violent stimuli automatically increases aggression-related thoughts, leading to aggressive behaviors (Anderson, Benjamin, & Bartholow, 1998; Anderson & Bushman, 2001). Accordingly, our finding that threats increased the number of original fight tactics could also be caused by a heightened accessibility of aggressive thoughts that were induced by violent/threatening stimuli. However, inconsistent with this alternative explanation, results showed that people that were exposed to threats also generated more benign cooperative approach tactics (meta-analysis) that were also more original when exposed to human threats (Study 3.2). Further support for the crucial role of motivation in explaining our findings comes from the moderation by individual differences in threat sensitivity in Study 3.3: Threats elicited more original fight and flight tactics only among individuals with low self-esteem (those that are especially anxious in response to threats; cf. Baumeister et al., 1989; Greenberg et al., 1992). This finding implies that threats increased creativity in adaptive defense categories only for those that are especially sensitive and vulnerable to threats and are thus strongly motivated to avoid and solve the problems at hand. We expect similar moderation effects for other individual differences implicated in threat sensitivity. One obvious candidate is avoidance temperament, people’s sensitivity for the presence and prospect of negative and harmful stimuli (Elliot & Thrash, 2010). Another candidate is sensation seeking – the need for varied, novel, and intense sensory stimulation (Zuckerman, 1994). Previous work has shown that sensation seeking is negatively associated with anxious reactivity to threatening events. Low sensation seekers perceived heightened danger and displayed elevated anxious arousal in aversive
situations (Franken, Gibson, & Rowland, 1992; Lissek et al., 2005). Future research may explore possible moderator functions of avoidance temperament and sensation seeking in the relation between threat and threat-related creativity.

In our study, we also examined the influence of threat direction on the generation of creative defense tactics. In Study 3.1 and 3.2, we manipulated the direction of threat by showing pictures in which aggressive humans or dangerous animals were directed towards, or directed away from, participants, and expected that self-directed threats would specifically lead to more original active defense tactics and other-directed threats would specifically lead to more original freeze tactics. However, in both studies, the direction of threat did not differentially influence creative ideation in different defensive categories. This differs from previous findings showing that self-directed threats evoke active defense reactions, whereas other-directed threats induce immobility reactions (Fernandes et al, 2013). One explanation may be that the threatening humans and animals in our experimental design were at close distance regardless of whether they were directed at the observer or not. Participants in the other-directed condition could, therefore, have believed that the aggressive animal or human could easily have turned from another person to themselves. Indeed, we observed equally high levels of perceived danger, arousal, and self-relevance evoked by self-directed and other-directed threats in the current research. In other words, participants in the other-directed threat condition did not perceive other-directed threat stimuli (e.g., a man points a gun at others) to be less dangerous and imminent than stimuli directed at themselves. The equally high levels of perceived imminence could, in turn, have led to equally high avoidance motivation and similar defensive tactics (e.g., fight) to deal with the threats, leading to no differential effect on creative thinking in different defensive categories.

**Study Limitations**

One issue that demands further research concerns other features of threats. Although we discovered that creative defense ideation is highly specific and depends on the nature but not on the direction of the threat, it should be noted that threats vary on other features, including strength and ambiguity. The context of the threat may also vary, such as whether escape routes are available and whether social support is present (D. C. Blanchard et al., 2001; Gawronski & Cesario, 2013). Notably, while flight is a common response to imminent physical threats, in our studies we did not find that threat increased the number of original flight tactics. One explanation may be that participants were sitting in a small enclosed
cubicle that provides less perceived possibilities to escape, thereby suppressing the
generation of original flight tactics in the threat condition. Indeed, research on the
influence of escape availability on defensive responses showed that threats led to greater
accessibility of fight responses when participants were sitting in an enclosed booth, and to
greater accessibility of flight responses when participants were sitting in an open field
(Cesario, Plaks, Hagiwara, Navarrete & Higgins, 2010). In addition, regarding the null
results pertaining to the effect of threat direction on perceived danger and arousal, we
know from earlier work that threat imminence can be influenced by multiple factors, such
as spatial distance and the available response time. For example, a proximal threat can
trigger periaqueductal gray (PAG) activity in humans, which is associated with heightened
fear and anxiety (Mobbs et al., 2007), and the more proximal a threat is, the greater anxiety
and stress it arouses (Monat, 1976; Paterson & Neufeld, 1987). These threat features may
therefore interact with the direction of the threat on perceived threat imminence and
threat-related creativity. Future work is needed to examine particular features of threat
and their interaction to understand which of them and how they would modulate the effect
of threat on creative thinking.

Another important methodological limitation of the current study is that the threats
that participants were exposed to were hypothetical, and participants did not have to
implement their responses. Accordingly, the findings should be interpreted cautiously
when generalizing them to real threats and actual responses. Whether people are similarly
creative when confronted with threats in real-life situations remains an empirical question.
To raise the ecological validity of the current studies, future studies may benefit from the
use of immersive virtual environment technology, which creates a real-life simulation
through multiple sensorial channels (Blascovich et al., 2002; Rovira, Swapp, Spanlang, &
Slater, 2009). Future threat-creativity studies can thus use this technology to immerse
participants into the computer-generated, threatening environments such that participants
perceive themselves to be involved in, and interacting with, real threats, thereby enhancing
the ecological validity while maintaining experimental control of every single variable.
Moreover, in the present study participants had quite some time to think about as many
tactics as possible. In a more realistic setting, people have to respond quickly and decide on
only one threat-response. Investigating whether our findings would generalize to a
situation in which participants have to think fast and select one immediate response is also
an important avenue for future research.

Conclusion
The motivated focus account of the threat-creativity relation suggests that threat exposure motivates the mobilization and focus of cognitive resources on dealing with the threat at hand, leading to more inclusive and original thinking within threat-relevant domains. Our work extends this account by examining the effects of threat features and individual differences in threat sensitivity on the generation of different types of creative defense tactics using a highly threat-relevant creativity task. Findings of three studies reveal that threats do not have a generalized impact on originality of defense tactics; rather, threat exposure selectively enhances (decreases) the number of original tactics that are adaptive (not adaptive) and usually favored (ignored) given the threatening circumstances people find themselves in. Moreover, this highly specific threat-induced creativity especially occurs in people who are sensitive to threats, indicating that motivation is crucial for threat-relevant creativity to occur. Thus, through motivated focus threatened people come up with specific original defense tactics that are appropriate and adaptive.
Appendix

Appendix 3.1. Examples of experimental stimuli used in the self-directed threat (left), other-directed threat (middle), and neutral (right) condition (for details K. Kveraga, http://martinos.org/~kestas/affcon)