The Effect of Threat on Creativity: Cognitive and Emotional Dual-Process Pathways

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Abstract

The impact of threat on creativity is a highly topical and controversial issue. Overall, three perspectives currently exist: threat impedes creativity, threat facilitates creativity, and an inverted U-shaped relationship between the two. However, the reasons underlying the divergence among these three perspectives and their intrinsic mechanisms remain unclear. This article reviews relevant research from cognitive and emotional perspectives, arguing that the aforementioned divergence stems from differences in threat levels, variations in creativity mechanisms, and related mediating/moderating variables. Future research could, from the perspective of cognitive and emotional interventions, systematically verify the reasons for the divergence in perspectives, and conduct in-depth analyses of the intrinsic mechanisms underlying threat and creativity, such as cognitive neuroscience and genetics.

Full Text

The Impact of Threats on Creativity: Cognitive and Emotional Dual-Processing Pathways

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Abstract

The impact of threats on creativity represents a controversial yet vital area of psychological research. Currently, three competing perspectives exist: threats

generally hinder creativity, threats can promote creativity under certain conditions, and there is an inverted U-shaped relationship between threats and creativity. However, the reasons underlying these divergent viewpoints and their internal mechanisms remain unclear. This article reviews relevant research from cognitive and emotional perspectives, concluding that these discrepancies stem from differences in threat levels, creativity mechanisms, and various mediating or moderating variables. Future research should systematically verify the sources of these divergent findings through cognitive and emotional interventions, while exploring the underlying cognitive neuroscience and genetic mechanisms of the threat-creativity relationship.

Keywords: threat, creativity, cognition, emotion

The ability to effectively respond to various situations, particularly those involving threats such as war, crime, peer ostracism, earthquakes, or pandemics, represents one of humanity' s most crucial capacities for survival and development. Much existing research has focused on how threats and their accompanying emotions of fear and anxiety reduce creativity and promote conformity (Raja et al., 2020; Van Hootegem et al., 2019). For instance, some individuals facing sudden earthquakes are unable to implement any self-rescue measures and can only helplessly await rescue. However, other studies emphasize that people selectively attend to relevant environmental information and actively respond to threats, thereby enhancing threat-related creativity (Baas et al., 2019), as exemplified by the phenomenon of "resourcefulness in crisis." Wars and major disasters pose enormous threats to both individuals and society. On one hand, they damage physical and mental health, reducing the likelihood of creative behavior; on the other hand, the urgency of such threats drives innovation in existing theories and technologies, accelerating the emergence of innovative products, as illustrated by the rapid development and deployment of penicillin and breakthroughs in nuclear technology during World War II.

Both threats and creativity are important subjects of psychological research. Over the past decade, researchers have conducted numerous fruitful studies on each construct independently. Regarding threats, most researchers define them as anticipated harm or loss that has not yet occurred. Studies indicate that threat stimuli can be broadly categorized into two types: physical threats and social threats. Physical threats refer to stimuli that can cause bodily harm (e.g., to health or life) (Bulley et al., 2017), characterized by their reality and directness (Mobbs et al., 2015). Social threats refer to stimuli that may affect an individual's social status, damaging personal resources or interests (Hirschberger et al., 2016), such as threats to economic status, stereotypes, social insults, rejection, exclusion, face, and social relationships. These threats are characterized by their potentiality and uncertainty (Barrett, 2006). Threats readily induce negative emotions like anxiety and fear, which subsequently affect cognition and creativity (Bulley et al., 2017). Creativity is defined as the capacity to actively engage in creative thinking based on certain goals, generating novel, useful, and socially valuable products (Mumford et al., 2012). Divergent thinking and con-

vergent thinking constitute the dominant components of creativity (Runco & Jaeger, 2012; Webb et al., 2017).

Although both threats and creativity have been extensively studied within their respective domains, systematic investigation of their relationship remains limited. Research suggests that both physical and social threats influence individual creativity (Li et al., 2017), but the specific direction of this influence remains controversial (Lee et al., 2017). Currently, three main perspectives exist regarding how threats affect creativity: threats hinder creativity, threats facilitate creativity, and there is an inverted U-shaped relationship where moderate threats are most conducive to creativity. While each perspective has theoretical and empirical support, no study has systematically analyzed the fundamental reasons for these divergent viewpoints. However, the distinction and connection between cognition and emotion may provide a reasonable framework for understanding the threat-creativity relationship. Therefore, this article reviews the main threads of research on threats and creativity, organizing theoretical and empirical studies supporting the three perspectives from cognitive and emotional angles. Based on a comparative analysis of previous research, we explore the reasons for discrepancies in existing findings and the underlying causes of these perspectives, while proposing new and feasible research directions.

1. Threats Hinder Creativity

The perspective that threat stimuli hinder and suppress individual creativity originates from the most representative threat-rigidity thesis in previous research. This theory posits that individuals' thinking tends to become rigid and limited when facing threat stimuli (Staw et al., 1981). Numerous empirical studies support this view, demonstrating that threats can slow cognitive processing (Hu et al., 2012), trigger anxiety, and restrict the generation of novel ideas (Xiao et al., 2015). The following research supports this perspective from both cognitive and emotional angles.

From a cognitive perspective, the threat vigilance and fixation hypothesis suggests that both physical and social threat stimuli can capture and fixate attention (Jiang et al., 2017), consuming substantial cognitive resources (Sheppes et al., 2013). Cognitive resources are limited (van der Wel & van Steenbergen, 2018), and when these limited resources are heavily occupied, subsequent tasks lack sufficient resources, forcing slower processing and poorer performance (Van Damme et al., 2008). For creative tasks, insufficient allocation of cognitive resources leads individuals to rely more on automated processing, with threat stimuli being handled only through previously established response patterns (Chajut & Algom, 2003), making it difficult to generate creative products. Previous researchers manipulated mild electrical stimulation to induce physical threats and subsequently measured cognitive fluency using a Stroop task, finding that participants exhibited slower cognitive speed and reduced fluency (Hu et al., 2012). Fluency is an important indicator of creativity (Kruglanski & Webster, 1996), and creativity positively correlates with the cognitive abilities assessed by the

Stroop task (Benedek et al., 2012). Therefore, slowed cognitive speed and reduced fluency under physical threat predict lower creativity. Other researchers examined the impact of potential terrorism on employees' task performance, finding that potential terrorism as a physical threat captured and consumed employees' physical, emotional, and cognitive resources, reducing creativity in task execution (De Clercq et al., 2017; Raja et al., 2020). Research on relationship conflict and creativity indicates that high levels of relationship conflict threaten employees' job security (Kahn, 1990), eliciting negative emotions, deteriorating interpersonal relationships, and triggering social threats, which prevent efficient information processing and consequently weaken individual creativity (da Costa et al., 2018).

From an emotional perspective, negative emotions often compete with cognitive processes for resources to influence creativity. Specifically, physical and social threats have strong emotional arousal effects that occupy cognitive resources needed for creative tasks, leading to poor performance (Huntsinger, 2013). The dual competition model proposes that negative emotions compete with creativity for limited cognitive resources, and emotions often prevail in this competition (De Martino et al., 2009). Consequently, negative emotions consume cognitive resources and affect creative task performance (Byron & Khazanchi, 2011; Tremoliere et al., 2016). The working-memory restriction theory of anxiety aligns with this view (Eysenck, 1979), suggesting that individuals under threat tend to invest cognitive resources in anxiety states, thereby inhibiting cognitive flexibility (Gawda & Szepietowska, 2016). Additionally, threats induce rumination (Curci et al., 2013), which, together with resource investment and cognitive interference, seriously affects cognitive processes essential for creativity, such as working memory (Orth et al., 2019). Lindstrom and Bohlin (2012) manipulated physical threat conditions using negative images (spiders and snakes) versus neutral images (mushrooms and flowers), examining fear' s impact on working memory through n-back and modified go/no-go tasks. Results showed that physical threat negatively affected working memory, manifested by increased reaction times and error rates in both tasks. Working memory is a crucial component of creative processes (Orth et al., 2019), used to inhibit interference from irrelevant information, maintain new information in an active state, and simultaneously consider multiple ideas to generate more novel solutions (Zabelina et al., 2019). Therefore, reduced working memory capacity may impair creativity (Chein & Weisberg, 2014). Tohill and Holyoak (2000) divided participants into threat and control groups, requiring threat group participants to count backward from 1000 by 13s while being told their counting speed was too slow, thereby inducing self-esteem threat (social threat) and anxiety. Results showed that, compared to the control group, the threat group solved fewer analogy reasoning tasks. Researchers argued that individuals under social threat invested primary cognitive resources in their anxiety symptoms, leaving fewer resources available for creative problem-solving (Akinola & Mendes, 2008), resulting in fewer solved tasks. Research indicates that job insecurity, as a social threat with high uncertainty, can deprive individuals of control, damage socioeconomic sta-

tus, and threaten self-esteem (Shoss, 2017). The most direct manifestation of job insecurity is negative emotions such as anxiety. Jiang (2018) examined the relationship between job insecurity and creative advertising generation tasks, finding a negative correlation: higher social threat levels corresponded to lower creativity. Studies show that job insecurity reduces creativity by triggering negative emotions and impairing or reducing working memory capacity.

In summary, when individuals respond to threat stimuli, they are easily affected by emotions, and cognition and emotion share neural pathways (Pessoa, 2008). Once emotional stimuli capture resources (Peyk et al., 2008) and compete with cognitive processes, individuals ultimately lack sufficient cognitive resources for creativity (Buhle & Wager, 2010; Shackman et al., 2011). Thus, in the perspective that threats hinder creativity, the interaction between cognition and emotion manifests as competition for cognitive resources. These studies used threat images or mild electrical stimulation to construct physical threats and negative feedback to manipulate social threats, verifying threats'negative impact on creativity. While these results seemingly support the threat-hindrance perspective, current evidence for limited cognitive resources is insufficient (Vadillo et al., 2016), and most studies have not directly demonstrated resource depletion caused by threats. More importantly, this perspective overlooks the role of personal motivation: when threatened, individuals actively mobilize cognitive resources and invest them in urgent situations, potentially enhancing creative problem-solving abilities (Cheng et al., 2018). Although the inhibition perspective has received considerable support, emerging research has raised questions, with researchers finding that threats do not always play an "inhibitor" role and can sometimes enhance creativity, acting as a "facilitator" (Baas et al., 2019).

2. Threats Stimulate Creativity

Some researchers argue that the urgency and uncertainty of threats attract cognitive resources to process the threat, thereby stimulating creativity (Johnson et al., 2019). Others propose that threats increase arousal levels, prolong information processing time, and enhance information processing depth, thus promoting creativity (Cheng et al., 2018). This perspective can also be understood through cognitive and emotional lenses.

From a cognitive perspective, the motivated focus hypothesis proposes that stress and threat stimuli can activate domain-specific cognitive associations in working memory, triggering cognitive resource allocation that provides necessary resources for creativity (Baas et al., 2019). De Dreu and Nijstad (2008) randomly assigned participants to interpersonal cooperation or conflict groups (social threat), requiring them to list cooperation/conflict strategies within a time limit. Results showed that participants under social threat actively mobilized resources to manage the threat, generating more conflict-related ideas that were more creative. The attention reduction model suggests that both physical and social threats prompt individuals to reduce processing of task-irrelevant stimuli and selectively focus attention on the task at hand (Johnson et al., 2019),

facilitating task execution and increasing creativity in the process. Research on malevolent creativity reached similar conclusions: Baas et al. (2019) investigated the impact of social threat on malevolent creativity using a modified prisoner' s dilemma task to manipulate social threat and the Alternate Use Task (AUT) to measure creativity. Results indicated that social threat increased aggressive cognition and malevolent creativity, with threatened individuals more frequently mentioning malicious uses for bricks (e.g., hitting someone) and demonstrating higher creativity levels, thus validating the attention reduction model.

From an emotional perspective, negative emotions triggered by threats can promote introspection and extend thinking time to enhance creativity (Verhaeghen et al., 2005). Cognitive regulation theory supports this view, proposing that individuals in negative emotional states tend to use rigorous, deliberate thinking styles (Shen et al., 2019), which facilitates sustained problem processing (Hommel, 2015). This cognitive persistence enhances creativity (Baas et al., 2013). Riley and Gabora (2012) required participants to rate and describe stories for photos varying in physical threat level, finding that threat level positively correlated with story novelty—more threatening images elicited more creative descriptions. Researchers argued that threat images induced negative emotions, which increased information processing depth and enhanced creativity. External stimuli can induce emotions, and emotions can influence how stimulus information is processed (Mastria et al., 2019). Akinola and Mendes (2008) validated cognitive regulation theory by threatening participants' self-esteem through simulated interview negative feedback, which induced negative emotions. In evaluating artistic collages (a reliable method for measuring artistic creativity), they found that individuals in negative emotional states scored higher on artistic creativity. Researchers suggested these individuals tended to conduct bottom-up stimulus analysis, generating more novel processing methods. Additionally, negative emotions may increase the frequency of creative problem-solving, particularly in divergent thinking and analogy problems.

Compared to cognitive regions in the cerebral cortex, the amygdala can respond to threat stimuli more quickly and decisively, but these responses are not mediated by cognitive processes (Fanselow, 1994). Emotions typically respond early to threat stimuli, while cognitive involvement prompts individuals to evaluate and process stimuli, investing longer processing time that ultimately promotes creativity. Thus, in the perspective that threats stimulate creativity, the interaction between cognition and emotion manifests as emotions promoting creativity by altering cognitive approaches. Although these experiments support the threat-facilitation hypothesis from cognitive and emotional angles, critics argue that broad attention scope and cognitive search ability are fundamental to creative work (Ansburg & Hill, 2003). The aforementioned threat-enhanced creativity comes at the cost of narrowed attention scope, and when attention scope is too narrow, individuals struggle to consider other contextual cues, potentially impairing creativity (Yüvrük et al., 2020). Therefore, this perspective requires further verification.

To date, the aforementioned research supports and validates both the inhibition and facilitation perspectives from cognitive and emotional angles, yet the two viewpoints remain far apart. Some scholars have attempted to reconcile these positions, proposing that the relationship between threats and creativity is not black-and-white but rather follows an inverted U-shaped relationship, where moderate threats represent the optimal level for creativity.

3. The Inverted U-Shaped Relationship Between Threats and Creativity

The inverted U-shaped perspective moves beyond simply emphasizing either threat inhibition or facilitation, positing that threats do not uniformly destroy or enhance creativity but that a critical threshold exists. Before this threshold, increasing threat intensity enhances creativity; once exceeded, additional threat intensity damages creative production. The following theoretical and empirical research provides reasonable explanations for this perspective from cognitive and emotional orientations.

From a cognitive perspective, individuals invest the most cognitive resources under moderate threat levels, which is most conducive to creativity (Byron et al., 2010). A series of studies demonstrate this: Byron et al. (2010) conducted a meta-analysis of 76 experiments (82 independent samples), finding that moderate and controllable social threats could promote creativity through rational use of cognitive resources, confirming the inverted U-shaped relationship between threats and creativity. Similarly, organizational research shows that task conflict may be perceived as a social threat that reduces social status (O' Neill & McLarnon, 2018). When facing high task conflict, employees tend to use competitive thinking to consolidate their status, easily triggering fight-or-flight responses and cognitive rigidity (O' Neill, McLarnon, Hoffart et al., 2018), substantially reducing creativity. Moderate task conflict can increase individuals' motivation for reevaluation, generating more creative solutions (Li et al., 2019). Mehta et al. (2012) examined participants' performance on the Remote Association Test (RAT) under noise threat stimuli (physical threat), finding that moderate threat levels enhanced abstract cognitive ability and creativity, while high threat levels reduced information processing scope and weakened creativity.

From an emotional perspective, activation theory proposes that moderate emotional arousal most effectively enhances creativity. Low arousal levels cause individuals to neglect information and lack motivation for tasks; high arousal levels may create excessive pressure, with overwhelming stimuli perceived as threats (Burns & Egan, 1994) that interfere with cognition and impair creativity (De Dreu et al., 2008). Lee et al. (2013) applied activation theory, using scales to examine the relationship between supervisory abuse (a source of social evaluation pressure, a social threat) and employee creativity in a Korean company, finding an inverted U-shaped relationship. Specifically, when supervisory abuse was excessive or absent—that is, when social evaluation threat was too

high or lacking—negative emotions were triggered, reducing control and creativity. Conversely, moderate evaluation had positive arousal effects, stimulating creative thinking and motivating employees to focus on problem-solving strategies (Anderson et al., 2004).

Although inverted U-shaped theory can partially explain contradictions between the previous two perspectives, current supporting theories and research are limited, with most studies focusing on social threats from a single angle. Few studies have directly demonstrated the inverted U-shaped relationship between varying threat intensities and creativity. Therefore, future research should systematically investigate this perspective by manipulating threat intensity. In summary, based on summarizing all cognitive and emotional pathways, this article reorganizes the logic through a variable relationship diagram, shown in Figure 1 [Figure 1: see original paper].

Figure 1 Variable relationships in the impact of threats on creativity

4. Reasons for Inconsistency Among the Three Perspectives

By comparing differences in threat manipulation methods, creativity measurement approaches, and results across studies, several factors may explain inconsistent conclusions.

4.1 Differences in Threat Levels

Integrating threat manipulation methods reveals three primary types: pictorial manipulation, textual manipulation, and harm-based manipulation. Pictorial manipulation uses threatening faces or spider/snake images to manipulate threat stimuli (Cheng et al., 2018; Tupak et al., 2014). Textual manipulation typically uses experimental instructions or negative feedback to construct threatening scenarios that make participants feel immersed, such as describing potential diseases or social exclusion situations (Niessen & Jimmieson, 2016; Walton & Kemmelmeier, 2012). Harm-based manipulation uses noise or mild electrical stimulation to induce threats (Kroes et al., 2019; Lobue, 2014) (see Table 1 for representative experiments). Most studies use pictorial manipulation, but researchers note that threat faces (pictorial manipulation) represent low-level threat stimuli that merely indicate threat presence and cannot represent dangerous sources that harm life and health. In contrast, harm-based threats (electrical stimulation) are high-level threat stimuli (Hu et al., 2012). Research indicates that although threats always capture attention and receive priority processing, their impact on subsequent tasks largely depends on threat level differences. High-level threats command sufficient attention, causing more extreme resource allocation and greater impact on other tasks—this represents "hard priority" in threat processing. Low-level threat stimuli serve as additional information with weaker impact on other tasks, potentially even improving performance on other tasks—this represents "soft priority" (Bishop, 2007). In summary, different

threat manipulation methods reflect differences in threat levels, with high- and low-level threats having opposite effects on other tasks and potentially different impacts on creativity. Specifically, high-level threats may impair task performance, while low-level threats may improve it, though future experiments are needed to verify this.

4.2 Differences in Creativity Mechanisms

Notably, studies employ vastly different creativity task types and difficulty levels, but these differences may only be superficial reasons for divergent results. The deeper cause may lie in different mechanisms across creativity dimensions. Current research primarily defines individual creativity through divergent and convergent thinking, using AUT tasks to measure divergent thinking and RAT tasks to measure convergent thinking. Most studies use only one measurement method, predominantly assessing divergent thinking (see Table 1 for representative experiments). However, previous researchers simultaneously measured divergent and convergent thinking under pressure, yielding contradictory results: pressure impaired divergent thinking but had no effect on convergent thinking (Krop et al., 1969). Although divergent and convergent thinking are both subcomponents of creativity, their mechanisms differ (Mekern et al., 2019; Shen et al., 2018). Divergent thinking involves generating many possible solutions for an ill-defined problem and is part of the creative behavior process (Nijstad et al., 2010), whereas convergent thinking relies on quickly identifying the best, correct solution for a well-defined problem, requiring a strict and careful search process (Lee & Therriault, 2013). Divergent thinking benefits from flexibility emphasis, while convergent thinking depends on persistence emphasis (Zhang et al., 2020). Threat stimuli can distract individuals and inhibit cognitive flexibility (Gawda & Szepietowska, 2016), but without time pressure, individuals can increase creativity through persistent thinking (Baas et al., 2013). Thus, different creativity dimensions are affected differently by threats.

Malevolent creativity differs mechanistically from general creativity. Research shows that when individuals engage in malevolent creativity, activity in the right postcentral gyrus decreases, possibly reflecting suppressed emotional processing when generating malicious ideas. Once individuals no longer need to regulate their negative emotions or perceive victims' emotions, they can generate malicious ideas without moral burden (Chikazoe et al., 2009). Compared to general creativity, threatening environments more easily trigger malevolent creativity responses (Cheng et al., 2018; Harris & Reiter-Palmon, 2015). Threats trigger avoidance motivation, aggressive cognition, and fighting tendencies. Simultaneously, threatened individuals' attention and resources focus on coping with the threat, making them more likely to generate threat-related malevolent creativity (Baas et al., 2019). Creativity task difficulty also influences results; complex tasks place higher demands on working memory systems and consume more cognitive resources than simple creative tasks, typically leading to poorer performance (Eysenck et al., 2007). Drace et al. (2020) required participants

to complete simple Raven' s Progressive Matrices (RPM) and complex Operation Span Task (OSPAN) under stereotype threat (social threat) to examine stereotype threat' s impact on different difficulty levels. Results showed better performance on simple tasks and poorer performance on complex tasks.

Table 1 Threat manipulation methods and creativity measurement approaches

Study	Threat Manipulation Method	Creativity Measurement Method
Baas et al., 2019	Modified prisoner' s dilemma game	Study 1: AUT (brick); Study 2: Negotiation task
Riley & Gabora, 2012	Photos with varying threat levels	Creative story generation
Kemmelmeier & Walton; Walton & Kemmelmeier, 2012	Two-company competitive survival	Threat solution task; AUT (brick)
Chamorro-Premuzic & Reichenbacher, 2008	Told participants task would be recorded and compared with others	AUT (paperclip, pencil, etc.)
Mehta et al., 2012	Noise threat	RAT task
Liu et al., 2017	Others' negative evaluation	AUT (brick)
Akinola & Mendes, 2008	Others' negative feedback	Artistic collage
Hu et al., 2012	Mild electrical stimulation	Stroop task
Tohill & Holyoak, 2000	Others' negative feedback	Analogical reasoning task

Study	Threat Manipulation Method	Creativity Measurement Method
Drace et al., 2020	Negative stereotype	RPM task
Cheng et al., 2018	Snake or gun images	Creative answer selection or generation
Lindstrom & Bohlin, 2012	Snake and spider images	n-back task/modified go/no-go
Jiang, 2018	Job insecurity	Creative advertising generation task
Probst et al., 2007	Job insecurity	Study 2: RAT task; Study 1: Duncker functional fixedness

4.3 Differences in Mediating/Moderating Factors

Some researchers directly investigate the mechanisms through which threats affect creativity (Baas et al., 2019; Riley & Gabora, 2012), while others argue that mediating or moderating factors may exist in studies examining antecedents of the threat-creativity relationship (Yeh et al., 2015). These different mediating/moderating factors may cause divergent results. For example, researchers experimentally investigated how stress affects cortisol hormone secretion and negative emotions, which in turn influence creativity in gaming contexts. Results showed that differences in mediating variables caused different creativity outcomes: under stress, cortisol secretion could enhance creativity by improving working memory, or reduce creativity by triggering negative emotions (frustration and anger) (Yeh et al., 2015). This demonstrates that mediating variable differences produce different results. Similarly, researchers measured employee creativity, task conflict (social threat), and information elaboration, finding that information elaboration positively mediated the relationship between task conflict and creativity. Specifically, excessive task conflict triggered self-motivation, leading individuals to use biased information processing methods, such as focusing only on information consistent with their own views (Li et al., 2019). This processing style is detrimental to evaluating and integrating other perspectives and negatively affects creativity (De Dreu et al., 2008). Moderate task conflict triggered cognitive motivation, promoting information elaboration and encouraging employees to reevaluate others' perspectives (Farh et al., 2010), thereby enhancing creativity.

Appropriate emotional regulation strategies play a key role in creativity when facing threat stimuli, not only mitigating negative emotions under threat (He et al., 2018). Emotion regulation (ER) refers to controlling and changing one's own

and others' emotional experiences and expressions through appropriate use of effective regulation strategies (Parke et al., 2015). Emotional information processing theory proposes that individuals skilled in emotion regulation can maximize harmful emotional state reduction and maintain task-focused attention through emotional management (e.g., using emotional promotion strategies), enhancing thinking and decision-making abilities and stimulating creativity (Mayer et al., 2008). Poor regulators struggle to alleviate negative emotions, thus distracting individuals and leading to higher stress levels and lower cognitive flexibility (Kanfer & Ackerman, 1989). Based on this analysis, emotion regulation may be an important mediating/moderating factor between threat and creativity. Empirical research confirms this: a study manipulating social threat by simulating company survival threats found that threatened individuals showed greater performance decline and slower recovery compared to controls. However, emotion regulation mitigated resource loss, with regulators performing better than non-regulators after task changes (Niessen & Jimmieson, 2016). Therefore, physical/social threats may affect individual creativity through different mediating/moderating factors, suggesting we should focus not only on threats' impact on creativity but also on potential mediating/moderating variables.

5. Future Research Directions

5.1 Exploring the Impact of Different Threat Levels on Different Dimensions of Creativity

Integration of threat manipulation methods reveals that different methods construct different threat types, and the same threat type can construct different threat levels. Regardless of method, auxiliary validity questionnaires or behavioral tests are needed to verify successful threat induction. For future research, first, few experiments have examined threat level as a variable, so attention should be paid to how different threat levels affect individual creativity. Second, real-world threat complexity far exceeds laboratory stimuli, so future research examining specific threat stimuli should measure multiple aspects (cognitive or physiological) to more effectively verify successful threat manipulation. Additionally, current research primarily measures creativity from the divergent thinking perspective, with limited exploration of convergent thinking, yet these dimensions differ substantially and are affected differently by threats. Therefore, subsequent research should investigate how different threat levels affect convergent thinking.

5.2 Systematically Exploring Potential Mediating/Moderating Variables

Threat is not the only factor affecting creativity; it may simultaneously be influenced by personal or social factors, requiring attention to mechanisms involving other relevant variables. Currently, few researchers have systematically explored potential mediating/moderating variables between threat and creativity, and conclusions about threat inhibition or promotion lack boundary con-

ditions. However, based on previous research, certain variables may serve as mediators/moderators, such as emotion regulation ability. Whether emotion regulation is included and which strategies are used may produce different experimental results. Additionally, self-affirmation has proven to be an effective threat coping mechanism that typically increases creative input and output (Lannin et al., 2019). Self-efficacy regarding creative product invention and exploration of new things can motivate individuals to take measures to solve problems in specific activities and positively affects negative environment assessment (Liu et al., 2016; Ng & Lucianetti, 2016). Future research could explore the roles of emotion regulation ability, self-affirmation, or self-efficacy in the threat-creativity relationship, or investigate other potential mediating/moderating variables. This would positively contribute to expanding research in this field and exploring boundary conditions for threat' s impact on creativity.

5.3 Emphasizing Inverted U-Shaped Perspective Research

The inverted U-shaped perspective provides new insights for threat-creativity research, but supporting theories and empirical studies are scarce, with most conclusions based on meta-analyses or organizational psychology findings lacking basic research support. Additionally, existing research has limitations, such as the vague term "moderate level." However, summarizing previous research reveals that high-level threats trigger stronger negative emotions. Emotion and motivation are closely related (Pavelescu, 2019): first, emotions shape motivation, with positive emotions enhancing and maintaining motivation and negative emotions hindering it; second, motivation affects emotional states, with strong motivation enabling individuals to experience stronger arousal and induce positive emotions (Pekrun et al., 2011). The balance between emotion and motivation can improve or impair task performance, depending on their interaction with executive control mechanisms (Pessoa, 2009). Executive control mechanisms have limited processing resources; when sufficient resources are available, higher negative emotion levels receive more prioritized attention and cognitive resource allocation (Pessoa, 2005). However, this resource allocation is simultaneously regulated by motivation, which can redistribute individual resources and affect task performance (Pessoa, 2009).

Research on emotion and motivation' s impact on executive control mechanisms leads us to hypothesize that the critical point in inverted U-shaped theory depends on the balance between motivation and emotion. When individuals perform creative tasks, gradually increasing threat levels attract more attention and cognitive resources, promoting creative task performance, with emotion playing a positive role in resource allocation. However, when motivation participates in resource allocation, emotion gradually loses its initiative, with motivation allocating resources to other tasks and weakening creativity. Thus, motivation dominates resource allocation. In summary, inverted U-shaped theory can be analyzed from the perspective of emotion and motivation participating in cognitive resource allocation. Previous research confirms that both emotion and

motivation affect cognition, with positive emotions enhancing cognitive flexibility by strengthening working memory updates (Dreisbach, 2006) and motivation activating and maintaining attention to goal information (Padmala & Pessoa, 2011).

5.4 Exploring Cognitive Neuroscience and Genetic Mechanisms While Emphasizing Applied Value

This review found that while all three perspectives have supporters, related brain imaging research remains exploratory, lacking clear cognitive neuroscience mechanisms. Functional magnetic resonance imaging (fMRI) studies show that prefrontal regions, particularly the dorsolateral prefrontal cortex (DLPFC), play crucial roles in emotion and creativity research (Langner et al., 2018). Genetic research reveals that the catechol-O-methyltransferase gene (COMT), a key metabolic enzyme responsible for catecholamine degradation including dopamine (DA) and norepinephrine (NE), is associated with prefrontal executive functions and cognitive functions including working memory and attentional control, playing a positive role in creativity (Colzato et al., 2014). NE can regulate cognitive flexibility (Khalil et al., 2019) and is central to emotional arousal and regulation (Hu et al., 2007). Other genes also relate positively to emotional responses, such as the fatty acid amide hydrolase C385A gene (Hashimoto, 2019). Future research could combine different brain imaging techniques to examine brain regions responsible for threat information processing and emotion, as well as functional connectivity between them, and could integrate cognitive neuroscience techniques with genetic analysis. This would not only effectively support theoretical hypotheses but also help clarify the essence of this issue.

From an applied perspective, clarifying threats'impact on creativity and whether cognitive-emotional regulation can play a positive role helps researchers understand which types or levels of threats enhance creativity, providing reference for cultivating creativity in real-world contexts. It benefits the development of creative solutions for sudden physical threats (e.g., life threats), helping individuals solve problems more effectively, and can help individuals regulate emotions and improve creativity when facing potential social threats (e.g., social exclusion). For society and nations, exploring the threat-creativity relationship can positively contribute to stable and rapid development amid increasing global uncertainty risks.

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Zhang, W. T., Sjoerds, Z., & Hommel, B. (2020). Metacontrol of human creativity: The Metacontrol of human creativity: The neurocognitive mechanisms of convergent and divergent thinking. Neuroimage, 210, The impact of threats on creativity based on cognitive and emotional processes YIN Junting1, WANG Guan2, LUO Junlong1 (1Department of Psychology, Shanghai Normal University, Shanghai 200234, China) (2College of Education Science, Huaiyin Normal University, Huaian 223300, China) Abstract: The impact of threats on creativity is one of the concerned and controversial topic in the field of psychology. Currently, there are three viewpoints: threats can hinder creativity generally; threats can promote creativity, under some certain conditions; there is an inverted U-shaped relationship between threats and creativity. However, the reasons for the divergence of these three viewpoints and the underlying mechanism are still unclear. This article review them from the perspectives of cognition and emotion and conclude that the divergence comes from differences in threat levels, creativity mechanisms and additional mediator/modulator variables. Therefore, future research can focus on systematically verifying the reasons for the divergence from the perspectives of cognitive and emotional intervention and exploring the cognitive neuroscience and genes mechanisms of the relationship between threat and creativity.

Key words: Threat, Creativity, Cognition, Emotion

Note: Figure translations are in progress. See original paper for figures.