Creativity under the gun

How threat features and personal characteristics motivate creative responding

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Publication date
2017
Document Version
Other version
License
Other

CHAPTER 2

The Effect of Threat on Cognitive Inclusiveness: Generic Narrowing or Domain-Specific Broadening?

People regularly face and respond to events that endanger one's health and well-being. How humans cope with and respond to, for example, exposure to pathogens and contagious diseases, or aggressive encounters with animals or humans, determines their survival probability. Although adaptive threat-responding requires some level of flexibility, many studies revealed that threat exposure actually constricts the range of perceptual cues that are being processed, deplete attentional resources, and impair working memory capacity (Easterbrook, 1959; Schmader & Johns, 2003; Wachtel, 1968). Accordingly, threat exposure is generally taken as resulting in black-and-white thinking, rigid and constricted information processing, and decreased cognitive flexibility (Keinan, 1987; Staw, Sandelands, & Dutton, 1981).

This so-called threat-rigidity principle seems at odds with the notion that human threat-response systems generally have strong adaptive functionality (Neuberg, Kenrick, & Schaller, 2011). Indeed, threats also appear to trigger cognitive processes that facilitate threat-responding, including vigilant information processing (Ioannou, Mogg, & Bradley, 2004), heightened attention (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van IJzendoorn, 2007; Mogg et al., 2000), and enhanced executive control (Johns, Inzlicht, & Schmader, 2008; Koch, Holland, Hengstler, & van Knippenberg, 2009). Importantly, some evidence indicates that threat exposure may also lead to more flexible information processing (Mayer & Mussweiler, 2011), and higher inclusion of disparate information (De Dreu & Nijstad, 2008).

To integrate these divergent viewpoints regarding the relation between threat and inclusive information processing, we argue that threat exposure motivates people to prioritize their limited cognitive resources on the information that is relevant and functional to effectively escape, neutralize, or otherwise regulate the threat: Even disparate material that potentially relates to the specific threat should become more accessible, whereas information that is deemed threat-irrelevant and cannot help to deal with the aversive situation becomes less accessible. This reasoning leads to our motivated focus hypothesis that threat exposure broadens cognitive processing when information is threat-related and narrows cognitive processing of information that is threat-irrelevant. Specific predictions derived from this motivated focus principle were tested in two studies on cognitive inclusiveness, in which different threats were primed and a newly developed category inclusion task was used.

Cognitive Inclusiveness

People categorize objects and information in their environment to understand, predict, and act on their environment. Such categorization relies on stimulus's attributes, such as physical characteristics (e.g., their color or shape), relational concepts (e.g., whether they are taller or smaller), function (e.g., whether they help achieve specific goals) or parts (e.g., a house is composed of its walls, floors, and ceilings) (Mervis & Rosch, 1981). Accordingly, people categorize stimuli in their environment into separate groups in which objects are treated as equivalent to other members of the same category and different from members of other categories (Dean, Keim, Clark, & Hyatt, 2007; Rosch, 1975).

When thinking about a category and the stimuli it contains, people usually come up with a set of exemplars of that category. For instance, the category "vehicle" includes exemplars such as "car", "airplane" and "camel". These exemplars are not equally representative. For instance, category prototypes are exemplars that have the most common attributes shared by other members of the category and the least overlap with members of other categories (e.g., "car" and "bus" for the category "vehicle"). All members of a category can be ordered from strong (e.g., bus) to weak exemplars (e.g., camel) according to their degree of representativeness (Rosch & Mervis, 1975).

Individuals agree which items are most representative of a category (Rosch, 1975). However, there is more disagreement among individuals concerning the membership of non-prototypical items (e.g., whether a "camel" belongs to the category "vehicle"), since they share fewer common attributes with members of their referential category and often contain attributes that overlap with members of other categories (McCloskey & Glucksberg, 1978). The inclusion of atypical items into a referential category requires people to thoroughly process potential relatedness among items, to iteratively compare and identify less obvious attributes shared by atypical and prototypical category members, and even to generate some original linkages (Baughman & Mumford, 1995). Put differently, higher cognitive inclusiveness means that people include more distant and disparate items as members of the same category (Rosch, 1975). For example, Isen and Daubman (1984) asked participants to rate how representative given items were for a particular category (e.g., vehicle), with some items being highly prototypical for that category (e.g., "bus"), some moderately prototypical (e.g., "airplane"), and others being weakly prototypical (e.g., "camel"). Especially the representativeness ratings for the weak items reflected people's cognitive inclusiveness. Results showed that people clearly distinguished between more or less prototypical exemplars, and that their inclusiveness levels for weak items varied

across individuals and situations (Isen & Daubman, 1984; also see De Dreu, Baas, & Nijstad, 2008; Mikulincer, Kedem, & Paz, 1990a).

Threat and Cognitive Inclusiveness

Threats refer to environmental events that signal a loss of resources (e.g., health, property, relationship, prestige), and have impending negative consequences (Marks & Nesse, 1994; Staw et al., 1981). Threats and the anticipation thereof arouse anxiety (Barlow, 2002; Jonas et al., 2014). Indeed, many studies employed experimental manipulations of threats to induce anxious feelings (Barlow, Sakheim, & Beck, 1983) or used self-reported anxiety to verify the adequacy of an experimental manipulation of threat (Heatherton, Herman, & Polivy, 1991).

Threat-related anxiety is usually associated with narrowed categorization and lower levels of cognitive inclusiveness. For example, Mikulincer and colleagues (1990a; 1990b) discovered that anxious people perceived less relatedness between atypical and prototypical items of the same category and saw fewer relationships and commonalities between properties of objects, thus sorting objects into more categories. Furthermore, it has been argued that threats deplete cognitive and attentional resources (Eysenck, Derakshan, Santos, & Calvo, 2007), thereby lowering the processing and storage capacity of working memory (Darke, 1988; Schmader & Johns, 2003), restricting the scope of both perceptual and conceptual attention (Derryberry & Tucker, 1994; Easterbrook, 1959; Friedman & Förster, 2010), and increasing the reliance on chronically accessible, automatically activated information, scripts, and schema's (Chajut & Algom, 2003). This, in turn, reduces cognitive inclusiveness. Indeed, Carnevale and Probst (1998) showed that expecting an upcoming threatening conflict rather than a benign cooperation resulted in a reduced tendency to rate low-prototypical items as belonging to a particular category (i.e. reduced cognitive inclusiveness). Relatedly, compared to neutral and positive film clips, threatening film clips resulted in a narrowed focus on detailed and concrete features of information and a restricted range of generated thoughts and activities (Fredrickson & Branigan, 2005).

Although these findings may suggest that threat and threat-related anxiety are consistently linked with lower levels of cognitive inclusiveness, other research shows no or even opposite findings. Using a task in which participants sorted given words in self-chosen categories, Dean and colleagues (2007) found that state anxiety was not associated with the number of formed categories. This suggests that anxiety neither associates with

increased or decreased levels of cognitive inclusiveness. At the same time, other evidence indicates that anxious people sorted semantic stimuli into fewer groups in a categorisation task–they saw more relationships and commonalities among properties of objects, enabling them to assign objects to the same category (Keinan, Friedland, & Arad, 1991). Likewise, Mayer and Mussweiler (2011) observed that relative to control and benign situations, social threat induced distrust engendered a greater tendency to include low prototypical exemplars in a given category.

That threat exposure both narrows and broadens cognitive inclusiveness is inconsistent with a threat-rigidity principle but resonates with the idea that threat-responding has adaptive functionality and, more specifically, with a motivated focus account. The motivated focus account holds that threat exposure should lead to more inclusive processing of threat-related materials, and to more restricted processing of threat-irrelevant materials. The idea is that facing dangerous or harmful situations activates the avoidance motivation system that recruits cognitive and physical resources to help to evaluate, escape, or resolve the threat (Elliot, 2008; Lang, Davis, & Öhman, 2000; Woody & Szechtman, 2011). Because of limited energy and cognitive resources, humans cannot afford to process all available information. Threat-induced avoidance, therefore, triggers a highly specific processing style and the allocation of limited energetic and cognitive resources away from irrelevant material, and onto threat-related material (Chajut & Algom, 2003; Easterbrook, 1959; Roskes, Elliot, & De Dreu, 2014). The motivated focus is adaptive and functional because it facilitates the adequate detection and processing of cues and information pertaining to the potential risks, along with possibilities to escape or resolve the danger.

Some first evidence for this motivated focus principle derives from a study on conflict mental sets by De Dreu and Nijstad (2008), who distinguished between neutral categories (e.g., vehicle, furniture) and conflict-related categories (e.g., weapon, army). When participants anticipated a hostile, rather than a cooperative negotiation, they had higher inclusiveness ratings for conflict-related categories but lower inclusiveness ratings for neutral categories. Unfortunately, the role of motivation was never empirically validated, and results may reflect the priming of knowledge about conflict (vs. cooperation). Furthermore, it cannot be excluded that conflict (compared to cooperation) was perceived as a challenge rather than a threat, with concomitant approach rather than avoidance motivation relating to higher cognitive inclusiveness (Friedman & Förster, 2010; Tomaka,

Blascovich, Kelsey, & Leitten, 1993). In addition to addressing these issues, the current study intended to generalize this motivation-driven effect on cognitive inclusiveness from conflict to health threats. Both physical safety and health are closely tied to human survival and reproductive fitness. Humans often live and operate interdependently in densely populated communities. This not only exposes individuals to potential conflict or violence, but also introduces potential health threats, such as transmitting diseases and alcohol abuse in social gatherings (Neuberg et al., 2011). Findings that would be expected on the basis of a motivated focus account resonate with those obtained in studies on health threat-related cognitive bias. For example, both external representations (e.g., images, media reports) and bodily sensations of health threats trigger health anxiety (Warwick & Salkovskis, 1990), with health anxiety associating with an attentional bias towards health-/illness-related information as well as decelerated disengagement of attention from health-threat material (Jasper & Witthöft, 2011; Lee et al., 2013). Moreover, perceiving disease-connoting cues, for instance, seeing skin lesions or other people sneeze, triggers disgust and activation of the disease-avoidance system that evolved to protect against and avoid infectious risks (Curtis, Aunger, & Rabie, 2004; Schaller, Miller, Gervais, Yager, & Chen, 2010; Tybur, Lieberman, Kurzban, & De Scioli, 2013). The disease-induced disgust, in turn, increases the allocation and sustainment of attention to health threat-related information, such as infections, health, and contamination (Armstrong, Olatunji, Sarawgi, & Simmons, 2010; Charash & McKay, 2002). Therefore, information implying health risks are preferentially attended to, and disease-relevant concepts are activated into working memory (Ackerman et al., 2009; Park, Schaller, & Crandall, 2007).

To test the motivated focus account of cognitive inclusiveness under health threat, we conducted two studies. In Study 2.1, we primed high versus low self-relevant health threats by asking participants to read information about negative consequences of alcohol abuse for themselves or senior citizens and to generate risk factors about health that were either relevant to themselves (high self-relevant health threat) or to others (low self-relevant health threat; see Pilot-study), after which participants completed the category inclusion task with health-related (vs. neutral) items to establish health-related (vs. neutral) cognitive inclusiveness. In Study 2.2, participants completed the category inclusion task while pictures emerged on the screen that elicited health-threat (vs. violence-threat) concerns. Our motivated focus hypothesis predicts that compared to participants in the low self-relevant (Study 2.1) or violence threat condition (Study 2.2), those facing a high self-relevant health threat would show relatively more inclusive thinking about the

health-specific material. Specific hypotheses are made in the introduction of each study. For both studies, we report how we determined our sample sizes, all data exclusions, all manipulations and all measures in the studies. Appendix 2.1 shows the observed study power and sample sizes needed to replicate our findings.

Pilot Study

We ran a pilot study to validate our manipulation of high versus low self-relevant health threat.

Method

Participants. Sixty-three students (46 females, M_{age}=21.73, *SD*=4.57) were randomly assigned to the high or low self-relevant health threat condition. The sample size required to get adequate power was estimated based on previous studies using a similar self-relevance manipulation (Rothman & Schwarz, 1998) and the consideration of participant availability.

Procedure. Participants were seated in individual cubicles equipped with a computer that showed all materials and recorded all responses. Participants were told, as a cover story, that they would do a task about how people remember information about risks. Participants were shown a text about a broad range of health problems associated with alcohol abuse for three minutes and were instructed to study it seriously, because later in the experimental session, they would receive a memory test (this was done to ensure that participants would carefully attend to the text). In both conditions, the text (based on information sampled from websites on alcohol abuse) described the relation between alcohol use and a broad range of health problems (e.g., poor mental health, increased risk of brain damage, heart failure, liver problems, and obesity). In the high (low) relevance health threat condition, it was emphasized that college-age students (senior citizens) are especially susceptible to this health risk because they tend to drink more than others. The text was followed by an open question asking participants to generate two factors that may increase their personal (senior citizen's) risk to alcohol abuse (cf. Rothman & Schwarz, 1998).

Participants subsequently completed a recall task consisting of four questions about the content of the text they had read (condition did not influence the number of correct answers, $F(1,61)=2.16$, $p=.146$). Thereafter, participants indicated their *health concerns,*

perceived *personal relevance* of the text, and *alcohol consumption*.

Measures. Dependent variables were self-reported health concerns and self-relevance of the threat. *Health concerns* were measured with 8 items using a 7-point Likert scale (ranging from 1: *not at all,* to 7: *very much;* Cronbach's α=.70), sample items are "I feel worried and anxious about my health" and "I can easily visualize health problems that could happen to me". *Personal relevance* was measured with a single item how personally relevant the text was. Finally, as a control variable, alcohol consumption was measured with the question "how many glasses of alcohol do you consume per week?"

Results

After excluding those participants that were above 30 years of age and/or abstained from drinking alcohol (and for whom our manipulation would be meaningless), 55 participants (41 females, M_{age}=21.11, *SD*=2.81; high relevance: 27, low relevance: 28) were retained for analyses. ANOVA revealed a main effect of threat condition on health concerns, $F(1,53)=4.36$, $p=.042$, $\eta_p^2=.08$, and self-relevance ratings, $F(1,53)=4.06$, $p=.049$, $\eta_p^2=.07$. Participants in the high self-relevant threat condition reported stronger concerns about their health (*M*=3.91, *SD*=0.84) and indicated the text was more self-relevant (*M*=3.67, *SD*=1.62) than those in the low self-relevant threat condition (*M*=3.45, *SD*=0.80, and *M*=2.82, *SD*=1.49, respectively).

Study 2.1

Having established the effectiveness of our manipulation, we proceeded to Study 2.1 in which we examined the influence of high versus low self-relevant health threat on cognitive inclusiveness of health-related and neutral material. If, as the threat-rigidity principle suggests, threat would lead to a generic narrowing of information processing, we would expect reduced cognitive inclusiveness for both neutral and health-related material in the high as compared to the low self-relevance health threat condition. However, based on the logic of the motivated focus account, we hypothesized that there would be an interaction between self-relevance of threat and type of material. Strong evidence for the motivated focus account is reflected by (a) more inclusive thinking about health-related material and less inclusive thinking about neutral material in the high, as compared to low self-relevant health threat condition, and (b) greater inclusiveness of health-related material than of neutral material within the high self-relevant health threat condition, and

no differences in inclusiveness ratings of health-related and neutral material within the low self-relevant health threat condition.

Method

Participants. Seventy-four undergraduate students (53 females, M_{age}=21.47, *SD*=2.74) were randomly assigned to high or low self-relevant health threat conditions. The sample size was determined by the consideration of participant availability, the need for adequate power to test our predictions, and potential exclusion of participants that abstained from drinking alcohol.

Procedure. Figure 2.1 shows an illustration of the procedure. Participants were tested individually in cubicles equipped with a computer. Participants first provided demographic information, such as age and gender. Participants were told that they would participate in two independent tasks. The first task was putatively about how people remember information about risks, and was actually used to manipulate self-relevance of health threat (see Pilot study). We then told participants that we were interested in the effects of delay on memory of risk information, and therefore they would first do an unrelated task. This second task putatively was about object perception, and actually measured cognitive inclusiveness (category inclusion task, see below). Upon completion of the category inclusion task, participants completed a recall task consisting of four questions about the content of the text on alcohol abuse (condition did not influence the number of correct answers, $F(1,72)=1.93$, $p=.170$) and indicated how many glasses of alcohol they consumed per week. Finally, participants were paid for participation and dismissed.

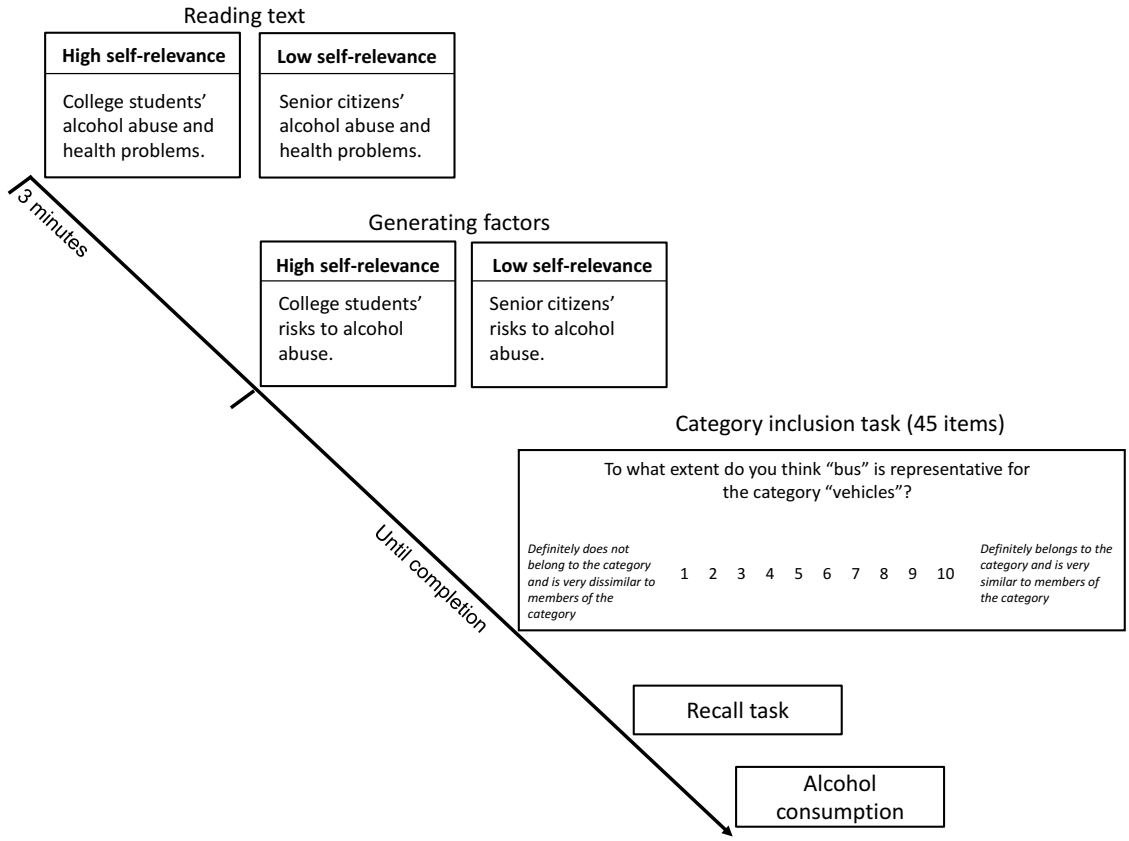


Figure 2.1. Schematic illustration of the procedure in Study 2.1. Participants first read a text about health problems associated with alcohol abuse for themselves or senior citizens, and generated two factors that may increase their personal (high self-relevant health threat) or senior citizens' (low self-relevant health threat) risk to alcohol abuse. Thereafter, participants completed the category inclusion task including health-related and neutral items to establish health-related and neutral cognitive inclusiveness. Subsequently, they completed a recall task about the content of the text they had read and indicated their alcohol consumption.

Measures. The main dependent variable was cognitive inclusiveness. We adapted the category inclusion task by Rosch (1975) to assess cognitive inclusiveness. In this task, participants are asked to rate how representative a given exemplar (e.g., bus or camel) is for a particular category (e.g., vehicle). We used four neutral categories of the original task: vehicle, vegetable, furniture, and clothes (Rosch, 1975). To these neutral categories, we added eleven health-related categories that were validated in a pre-test: disease symptoms, unhealthy environment, stress symptoms, mental illness, unhealthy thought patterns, unhealthy lifestyle, hygiene, healthcare, therapeutic activities, healthy diet, and healthy activities (see Appendix 2.3). Participants thus responded to fifteen categories in total that were presented in random order. Each category included three preselected exemplars that differed in typicality from high through moderate to low. For example, the neutral category

"vehicle" includes bus, airplane, and camel as strong, moderate, and weak exemplars; the health-related category "healthcare" includes hospital, dental check, and first-aid application as strong, moderate, and weak exemplars (exemplars for each category are included in Appendix 2.2).

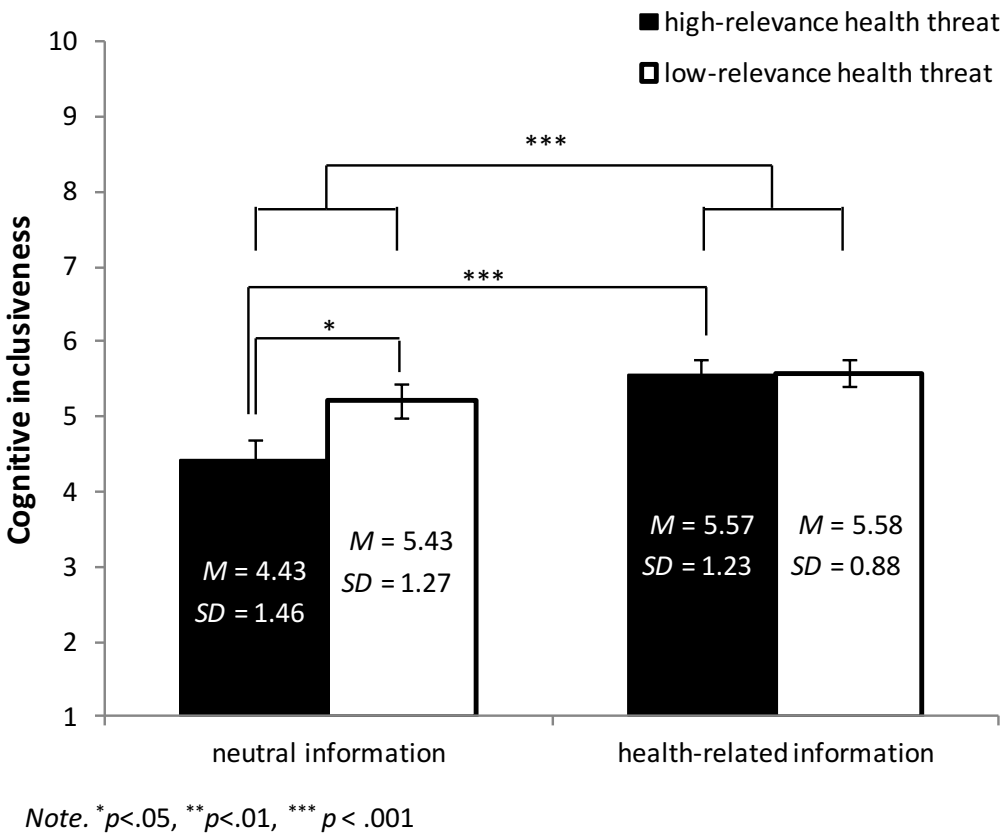
For each category, participants rated how representative the three exemplars were on a 10-point scale ranging from 1 (*definitely does not belong to the category and is very dissimilar to members of the category*) to 10 (*definitely belongs to the category and is very similar to members of the category*). Participants received detailed instructions about each scale-point. For example, a rating of 5 meant that the item did not belong to the category but was very similar to members of the category, while a rating of 6 indicated that the item did belong to the category but was not a good example of it (Mikulincer et al., 1990a, 1990b). In total, participants rated 45 exemplars (presented in random order within each category). The averaged ratings for strong, moderate and weak exemplars in both neutral and health-related domains significantly and unequivocally differed from each other (also see Appendix 2.3). Cognitive inclusiveness typically shows up in representativeness ratings for the weak exemplars rather than for the moderate or strong exemplars (Carnevale & Probst, 1998; De Dreu & Nijstad, 2008; Rosch, 1975), and analyses were thus focused on the ratings for weak exemplars of the neutral versus the health-related categories. Representativeness ratings for the weak exemplars in the four neutral categories were averaged into the index "cognitive inclusiveness in neutral domains" (Cronbach's α=.50), and representativeness ratings for the weak exemplars in the eleven health-related categories were averaged into the index "cognitive inclusiveness in health-related domains" (Cronbach's α=.69).

Results

All participants were first examined on age and alcohol consumption. No participants were excluded on the basis of their age (range: 17-30); but we excluded 9 participants who abstained from drinking and for whom the manipulation was rather meaningless. We retained for analyses 65 participants (45 females, M_{age}=21.34, *SD*=2.71; high self-relevant: 30, low self-relevant: 35).

Inclusiveness ratings for the neutral and health threat-related weak exemplars were submitted to a 2(high/low relevance) × 2(type of material) mixed-model Analysis of Variance with the second factor within-subjects. Relevance had no main effect,

$F(1,63)=2.30$, $p=.135$, $\eta_p^2=.04$; type of material did, $F(1,63)=25.81$, $p<.001$, $\eta_p^2=.29$: health threat-related items received higher ratings ($M=5.57$, $SD=1.04$) than neutral items ($M=4.85$, $SD=1.41$). A relevance by type of material interaction qualified this effect, $F(1,63)=6.94$, $p=.011$, $\eta_p^2=.10$. Figure 2.2 shows no effect of relevance on cognitive inclusiveness for health-related material, $F(1,63)<0.50$, $p=.967$, but lower inclusiveness ratings for neutral material in the high rather than low self-relevant threat condition, $F(1,63)=5.44$, $p=.023$, $\eta_p^2=.08$. Moreover, whereas no differences in inclusiveness ratings for the neutral and health threat-related weak exemplars emerged in the low self-relevant threat condition, $F(1,63)=3.24$, $p=.077$, $\eta_p^2=.05$, inclusiveness ratings for the neutral exemplars were lower than those for the health threat-related exemplars in the high self-relevant threat condition, $F(1,63)=27.64$, $p<.001$, $\eta_p^2=.31$.



Note. $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$

Figure 2.2. Inclusiveness ratings for neutral items and health-related items as a function of self-relevance level (displayed are means ± SE).

Discussion of Study 2.1

Study 2.1 showed an interaction between personal relevance of health threat and type of material: a personally relevant health threat narrowed cognitive inclusiveness of health-irrelevant material, but not of health-related material. This pattern of findings is inconsistent with a general threat-rigidity principle on the basis of which reduced inclusiveness ratings would be predicted regardless of the type of material that is being processed. Findings are more in line with a motivated focus account, although strong evidence for this account would have required higher inclusiveness ratings for threat-related material in the high as compared to low self-relevant threat condition. The absence of such positive evidence motivated Study 2.2, in which we tested the motivated focus hypothesis with a different manipulation of threat.

Study 2.2

In Study 2.2, several changes were implemented. First, we compared health threats (threats of contagious diseases) with violence threats (threats of physical attacks) and added violence-related items to the category inclusion task of Study 2.1. On the basis of the threat-rigidity principle that suggests a generic narrowing of information processing, there is no reason to predict that the type of material that is being processed should qualify the effect of type of threat on cognitive inclusiveness ratings. However, health threats specifically trigger the disease-avoidance system that evolved to enable people to effectively avoid infectious risks, whereas violence threats specifically trigger the self-protection system that evolved to protect humans from physical harm. Each system, therefore, is attuned to different threat cues and activates domain-specific cognitive associations (Neuberg et al., 2011). The logic of the motivated focus account dictates that we should see a significant interaction between threat and type of material. Strong evidence for the motivated focus account is reflected by (a) more inclusive thinking about health-related material, less inclusive thinking about violence-related material in the health threat, as compared to the violence threat condition, and no differences in inclusiveness ratings between threat conditions for the neutral items; and (b) and within the health threat condition, greater inclusiveness of health-related material than of health-irrelevant material; and within the violence threat condition, greater inclusiveness of violence-related material than of violence-irrelevant material. These predictions were tested in a study in which we manipulated health *vs.* violence threats by presenting pictures of infectious

diseases (health threat) or interpersonal violence (violence threat) and asking participants to imagine and describe their own reactions to the threats depicted in the pictures. This alternative manipulation was chosen because compared to verbal stimuli, pictorial stimuli more strongly activate processing of fear/anxiety-relevant information (Foa & Kozak, 1986; Lang, 1979). Following the threat manipulation, participants completed the category inclusion task that contained neutral, health-related and violence-related items.

Second, Study 2.2 allowed us to examine whether the relative threat-induced cognitive inclusiveness is tied to information about the specific threat that is targeted (infectious disease) or can be generalized to information about other health-related issues (e.g., mental health). Therefore, we added specific disease-related items to the category inclusion task of Study 2.1 and examined whether health threats that are specifically tied to transmitting diseases, compared to violence threats, led to more inclusive thinking about specific disease-related information only, or also about other health-related information. If threat-induced inclusive thinking is specifically tied to the information about the target threat, then it logically follows that compared to violence threat, health threats that were specifically aimed at transmitting diseases would lead to higher cognitive inclusiveness ratings for disease-related items rather than other health-related items. Alternatively, if threat-induced inclusive thinking can be generalized to other health-related materials, then we should see higher cognitive inclusiveness ratings for both disease-related items and other health-related items in the health threat condition as compared to the violence threat condition.

Third, although the four neutral items of the category inclusion task have been used in previous studies on category inclusiveness (Carnevale & Probst, 1998; De Dreu & Nijstad, 2008; Isen & Daubman, 1984), reliability was sub-optimal. Therefore, we added four neutral categories to those used in Study 2.1 (Rosch, 1975). The disease-related, conflict-related, and neutral items that were added to the category inclusion task were first validated in a pre-test (see Appendix 2.4).

Finally, to rule out the possibility that the threat-induced inclusiveness is caused purely by heightened accessibility of threat-related knowledge and that motivation plays no role, we measured individual difference in chronic and current concerns about transmitting diseases as well as knowledge about transmitting diseases. The motivated focus account predicts positive correlations of chronic and current concerns (but not knowledge) about transmitting diseases with inclusiveness ratings of health-related

material, but not of health-irrelevant material.

Method

Participants. Undergraduate students (N = 93, 65 females, M_{age} = 22.60, SD = 5.91) were randomly assigned to one of two self-relevant threat conditions (health vs. violence). The sample size was based on effect sizes in Study 2.1.

Procedure. Participants were tested individually in cubicles equipped with a computer. Figure 2.3 shows the schematic flow of the study. Participants first provided demographic information, and completed two questionnaires: one assessing their perceived vulnerability of catching diseases (Duncan, Schaller, & Park, 2009) and a bogus questionnaire to prevent hypothesis guessing. Thereafter, participants were told that they would participate in two independent tasks. The first task putatively was about how people process visual information, and was used to manipulate type of threat. In this task, participants were shown a slide show containing pictures and were instructed to process the pictures carefully, because later in the experimental session, they would answer some questions about the pictures. In both conditions, the slide show contained 10 different pictures that were displayed once in random order for 6s. In the health-threat condition, the pictures depicted people that directly faced the participants and showed characteristics or symptoms associated with infectious diseases (e.g., a person sneezing, a person whose face is covered with poxes; Schaller et al., 2010). In the violence-threat condition, the pictures depicted people with weapons (e.g., a gun, a knife) pointing directly at participants (Kveraga et al., 2015). To strengthen the personal relevance of the threat manipulation, the slide show was followed by an open question asking participants to imagine and write down at least two personal reactions if they would found themselves in the depicted situations.

As before, we told participants that we were interested in the effects of delay on visual processing and therefore they would first do an unrelated task about object perception – this was the category inclusion task. Participants completed this task while the same pictures they saw in the previous task emerged on the screen in random sequence for multiple times until the end of the task. Upon completion of the category inclusion task, participants answered some questions about their feelings regarding the pictures, indicated their current motivation to deal with risks of diseases and violence, and completed a questionnaire assessing their knowledge about diseases. Thereafter, participants were paid for participation and dismissed.

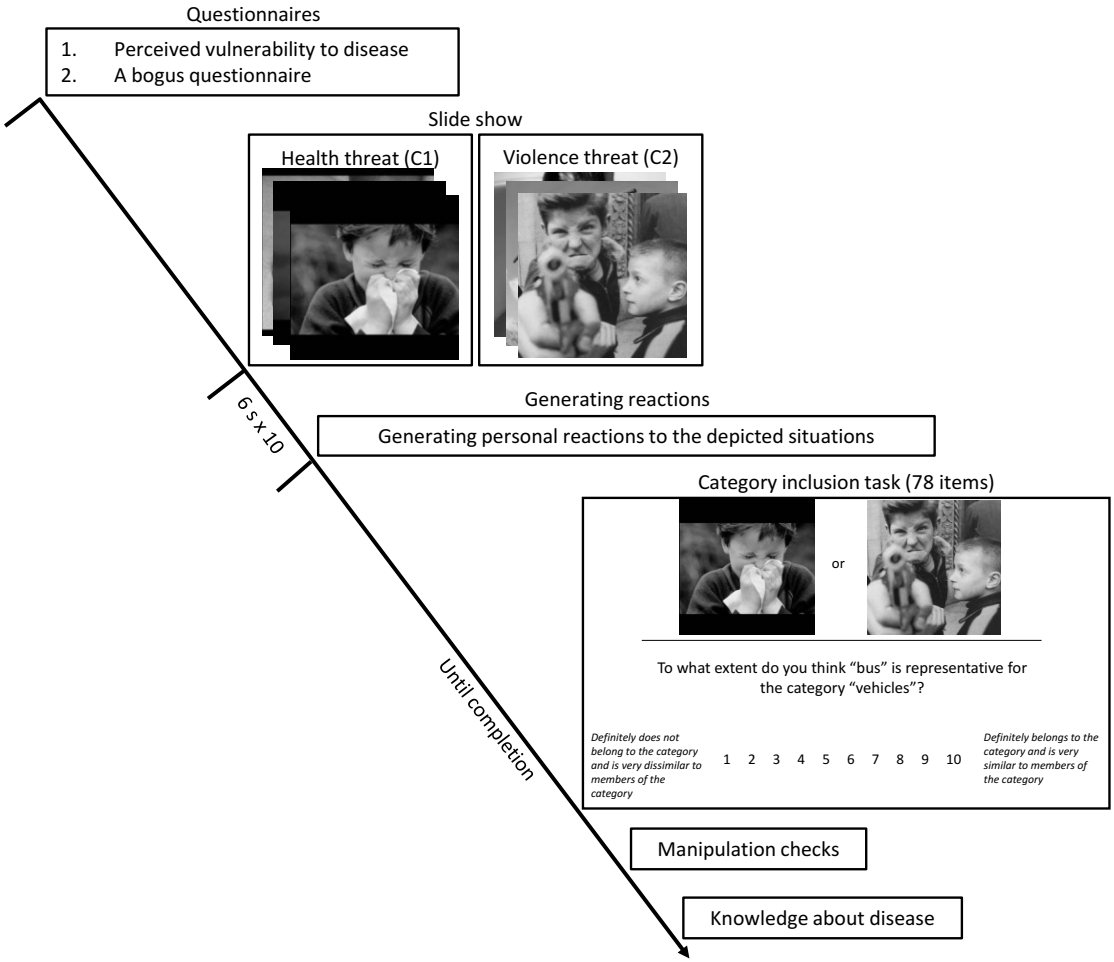


Figure 2.3. Schematic illustration of the procedure in Study 2.2. Participants first completed the perceived vulnerability to diseases questionnaire and a bogus questionnaire to prevent hypothesis guessing. Thereafter, they watched a slide show including 10 pictures depicting symptoms of contagious diseases (health threat) or violent aggressors (violence threat). Each picture appeared for 6s. The slide show was followed by an open question asking participants to generate personal reactions to the depicted situations. After the threat manipulation, participants completed the category inclusion task while the same pictures they saw during the slide show emerged on the screen in random sequence for multiple times until the end of the task. Finally, participants completed manipulation checks and a questionnaire assessing their knowledge about diseases. Note that C1 means health threat, and C2 means violence threat.

Measures. Participants completed the same category inclusion task as in Study 2.1, with new categories added. To improve the reliability of the neutral items, we added four neutral categories (with strong, moderate, and weak exemplars): fruit (apple, cranberry, avocado), bird (sparrow, condor, penguin), toy (doll, tricycle, book), and carpenter's tool (saw, awl, scissors) (Rosch, 1975). The four violence-related categories were weapon (gun, jet fighter, screwdriver), ammunition (bullet, dynamite, paving stones), army (Cavalry, Al

Qaida, hooligans), and fight (war, bombing, collective bargaining) (De Dreu & Nijstad, 2008). The five disease-related categories contained three newly developed categories: risks of contagion (coughs and sneezes, shaking hands, goodbye kiss), disease markers (coughing up blood, sore throat, itch), and sources of infection (rotten food, dish towel, doorknob), as well as two from the original health-related categories in Study 2.1: disease symptoms (fever, rash, muscle ache) and unhealthy environment (air pollution, noise, overpopulation). The other nine health-related categories were kept to measure the inclusiveness of other health-related information (e.g., the category "healthcare" includes hospital, dental check, and first-aid application as strong, moderate, and weak exemplars; the category "mental illness" includes depression, burn-out, and dyslexia as strong, moderate, and weak exemplars). The newly-added categories were validated in a pre-test, and the ratings for preselected strong, moderate, and weak exemplars in each category significantly and unequivocally differed from each other (see Appendix 2.4). Participants thus responded to eight neutral, four violence-related, five disease-related, and nine health-general categories that were presented in random order. *Cognitive inclusiveness* was based on the averaged ratings for weak exemplars of the neutral (Cronbach's α = .69), violence-related (Cronbach's α = .72), disease-related (Cronbach's α = .68) and health-related categories (Cronbach's α = .62).

Manipulation checks. Participants' feelings about the pictures were assessed with 10 items (1 = *not at all* to 7 = *very much*) which yielded three indexes: perceived threat level (4 items, Cronbach's α = .89; e.g., "I find the pictures threatening"), level of disgust (3 items, Cronbach's α = .89; e.g., "I find the pictures disgusting") and level of violence (3 items, Cronbach's α = .95; e.g., "I find the pictures violent"). As a measure of *disease (violence) concerns*, participants answered 12 items (1 = *not at all* to 7 = *very much*), with items such as "Upon viewing the pictures, I am more concerned about infectious diseases (armed violence)"; "I am motivated by the pictures to prevent the harmful effect of infectious diseases (violent situations)" (Cronbach's α = .90 for disease concerns, Cronbach's α = .96 for violence concerns).

Chronic concerns. Chronic concerns about transmitting diseases were measured with the 15-item perceived vulnerability to disease-questionnaire (1: strongly disagree, to 7: strongly agree; Duncan et al., 2009) (Cronbach's α = .82). Sample items include: "If an illness is 'going around', I will get it", and "I prefer to wash my hands pretty soon after shaking someone's hand".

Knowledge. To rule out the possibility that differences in knowledge would be responsible for the relation between chronic health concerns about transmitting diseases and category inclusiveness, participants' knowledge about health was measured with the item "I have a lot of knowledge about health" on a 7-point scale (1 = *extremely disagree* to 7 = *extremely agree*).

Results

Correlations and descriptive statistics. Seven participants with extremely short completion times (N = 3) and response sets (N = 4) were excluded. The final dataset had 86 participants (63 females, M_{age} = 22.55, SD = 6.10; health-threat condition: 42, violence-threat condition: 44). Table 2.1 shows, first, that chronic concerns about transmitting diseases were positively associated with cognitive inclusiveness ratings for disease-related and health-related information, but not for neutral and violence-related information. Second, the effect of chronic health concerns on both disease-related inclusiveness (β = .38, $t(83)$ = 3.69, p < .001) and health-related inclusiveness (β = .27, $t(83)$ = 2.49, p = .015) held while controlling for differences in knowledge about health. Moreover, state induced concerns about transmitting diseases only positively correlated with inclusiveness of disease-related material, and state induced violence concerns positively correlated with inclusiveness of violence-related material. Finally, knowledge about health did not significantly correlate with cognitive inclusiveness ratings.

Table 2.1. *Descriptive Statistics and Zero-Order Correlations for All Study Variables (Study 2, N=86)*

	M	*SD*	2	3	4	5	6	7	8	9
1. Disease-CI	5.53	1.45	.58**	.24*	.39**	.39**	.22*	.06	.12	.27*
2. Health-CI	5.84	1.05		.45**	.55**	.27*	.07	.22*	.05	.12
3. Violence-CI	4.10	1.33			.60**	.03	.03	.26*	-.08	-.16
4. Neutral-CI	5.28	1.26				.16	.08	.12	.06	.03
5. PVD	3.31	0.82					.31**	.06	.23*	.16
6. Disease concerns	2.52	1.47						-.18	.26*	.01
7. Violence concerns	3.03	1.89							.04	.23*
8. Health knowledge	4.59	1.30								.22*
9. Gender	1.73	0.45								1.00

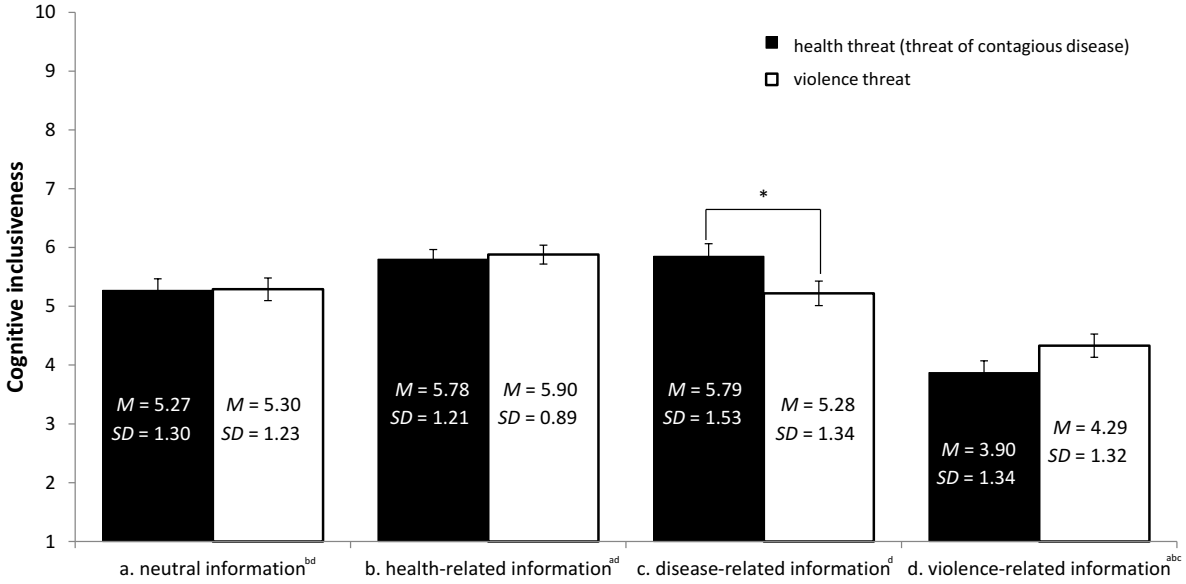
Note. CI = cognitive inclusiveness; PVD = perceived vulnerability to disease; Gender: 1=male, 2=female.

*p<.05, **p<.01

Manipulation checks. To verify the effectiveness of our manipulation, we first submitted threat, disgust and violence ratings of the pictures to separate ANOVAs with condition as the independent variable. For threat-ratings, no differences between threat conditions emerged, $F(1, 84) = 2.00$, $p = .161$, $\eta_p^2 = .02$; participants in both conditions perceived the pictures as equally threatening ($M_{\text{health-threat}} = 5.15$, $SD_{\text{health-threat}} = 1.34$; $M_{\text{violence-threat}} = 5.53$, $SD_{\text{violence-threat}} = 1.11$). However, there were significant effects of threat condition on disgust-ratings, $F(1,84) = 22.99$, $p < .001$, $\eta_p^2 = .22$, and violence ratings, $F(1,84) = 309.25$, $p < .001$, $\eta_p^2 = .79$. Disgust-ratings of the pictures were higher in the health-threat condition ($M = 5.27$, $SD = 1.59$) than in the violence-threat condition ($M = 3.57$, $SD = 1.70$), while violence-ratings of the pictures were higher in the violence-threat condition ($M = 6.27$, $SD = 0.70$) than in the health-threat condition ($M = 2.39$, $SD = 1.28$). Second, we submitted disease concerns and violence concerns to separate ANOVAs with condition as independent variable. Participants in the health-threat condition reported more health concerns ($M = 3.52$, $SD = 1.36$) but less violence concerns ($M = 2.02$, $SD = 1.25$) than those in the violence-threat condition ($M_{\text{health\_concerns}} = 1.56$, $SD_{\text{health\_concerns}} = 0.77$; $M_{\text{violence\_concerns}} = 4.00$, $SD_{\text{violence\_concerns}}=1.91$), $F(1, 84)=68.13$, $p<.001$, $\eta_p^2 =.45$, and $F(1, 84)=32.04$, $p<.001$, $\eta_p^2 =.28$, respectively. These results show that our manipulation of specific threats was successful.

Cognitive inclusiveness. To test the influence of type of threat on cognitive inclusiveness in different domains, we submitted inclusiveness ratings for weak exemplars to a 2(threat condition: health-threat/ violence-threat) × 4(type of material: neutral/violence-related/disease-related/general health-related) repeated measure ANCOVA with gender as a covariate. The latter was included because women score higher on disgust sensitivity (Haidt, McCauley, & Rozin, 1994) and perceived vulnerability to disease than men (Duncan et al., 2009); gender indeed had a strong interaction with type of material on cognitive inclusiveness ($F(3, 81) = 5.62$, $p = .001$, $\eta_p^2 = .17$). Whereas the effect of threat condition was not significant, $F(1, 83) < 0.10$, $p = .934$, the effect of type of material was, $F(3, 81) = 3.19$, $p = .028$, $\eta_p^2 = .11$: violence-related items received lower ratings than the neutral, disease-related and general health-related items, $ps < .001$, and general health-related items received higher ratings than neutral items, $p < .001$ (see Table 2.1). This effect was qualified by a significant threat condition × type of material interaction,

$F(3, 81) = 4.19$, $p = .008$, $\eta_p^2 = .13$. Figure 2.4 shows no effect of threat condition on cognitive inclusiveness ratings for neutral material, $F(1, 83) < 0.10$, $p = .942$, general health-related material, $F(1, 83) = 0.14$, $p = .708$, and violence-related material, $F(1, 83) = 2.55$, $p = .114$, $\eta_p^2 = .03$ (although means for the latter effect were in the expected direction. It also shows a significant effect of threat condition on cognitive inclusiveness ratings for disease-related material, $F(1, 83) = 4.48$, $p = .037$, $\eta_p^2 = .05$, with greater inclusiveness for disease-related material in the health-threat condition than in the violence-threat condition.



Note. $^*p<.05$.
The superscript letters correspond to the semantic domains and indicate the mean values are significantly different from each other at the .01 level.

Figure 2.4. Inclusiveness ratings for neutral, violence-related, disease-related and general health-related information as a function of threat condition (displayed are means ± SE).

A within-subjects planned comparison of disease- (violence-) relevant vs. irrelevant inclusiveness gave further support for the domain-specific broadening effect of type of threat. Because the inclusiveness ratings in different domains varied, and we were interested in the relative effects of threat on domain-specific cognitive inclusiveness, we averaged z-transformed inclusiveness ratings for neutral, violence-related and general health-related items as disease-irrelevant inclusiveness ratings, and z-transformed

inclusiveness ratings for neutral, disease-related and health-related items were averaged to form violence-irrelevant inclusiveness levels. We then submitted z-transformed inclusiveness ratings to a 2 (threat condition: health-threat vs. violence-threat) × 2 (type of material: disease-relevant, disease-irrelevant) repeated measure ANCOVA with gender as a covariate. There was a significant threat condition × type of material interaction, $F(1, 83) = 9.01$, $p = .004$, $\eta_p^2 = .10$. Greater inclusiveness for disease-related items than disease-irrelevant items was found under health threat, $F(1, 83) = 4.66$, $p = .034$, $\eta_p^2 = .05$; but lower inclusiveness for disease-related items than disease-irrelevant items emerged under violence threat, $F(1, 83) = 4.45$, $p = .038$, $\eta_p^2 = .05$. The 2 (threat condition: health threat/violence threat) × 2 (type of material: violence-relevant/violence-irrelevant) repeated measure ANCOVA with gender as a covariate also showed an interaction, $F(1, 83) = 6.93$, $p = .010$, $\eta_p^2 = .08$, with marginally higher inclusiveness for violence-related items than violence-irrelevant items under violence threat, $F(1, 83) = 3.42$, $p = .068$, $\eta_p^2 = .04$; and marginally lower inclusiveness for violence-related items than violence-irrelevant items under health-threat, $F(1, 83) = 3.58$, $p = .062$, $\eta_p^2 = .04$.

Discussion of Study 2.2

Taken together, the results of Study 2.2 revealed that compared to violence threat, disease-specific health threats resulted in greater inclusive thinking about disease-related information, and within the disease-specific health threat condition, inclusiveness of disease-related information was higher than of disease-irrelevant information. The trend for violence threat to produce greater violence-related inclusiveness was weaker, but in line with predictions. Furthermore, chronic concerns (rather than knowledge) about transmitting diseases positively predicted inclusiveness ratings for disease-related and health-related information, but not for neutral and violence-related information. We thus interpret these findings as further support for the motivated focus account of cognitive inclusiveness under health threat.

General discussion

Fueled by contradictions in the findings regarding the relation between threat and flexible and inclusive information processing, we advanced a motivated focus account of threat effects on category inclusiveness: threat exposure can both narrow and broaden

cognitive inclusiveness depending on the type of material that is being processed. If material is threat-relevant, higher inclusiveness levels are expected, whereas lower inclusiveness levels are expected if material is deemed threat-irrelevant. Indeed, we observed that compared to low self-relevant health threats, highly self-relevant health threats led to relatively higher cognitive inclusiveness of material in health-related (vs. neutral) domains (Study 2.1). Study 2.2 showed that compared to violence threats, health threats specifically aimed at transmitting diseases resulted in higher inclusiveness ratings on items that pertained to this specific threat, whereas violence threats tended to induce higher cognitive inclusiveness for violence-relevant materials rather than violence-irrelevant materials (marginal). Relatively higher inclusive thinking about specific threat-related (vs. threat-irrelevant) information resonates with the idea that motivated focus is adaptive because it enables individuals to use their limited energy and mental capacities to optimally deal with threat and to escape, neutralize, or otherwise resolve danger.

Our findings shed light on two proposed perspectives on narrowed attention under threats (Chajut & Algom, 2003). Much in line with the threat-rigidity principle, the so-called capacity-resource theory proposes that threats deplete attentional resources wherefore selective and functional responding fails for all but chronically accessible information, thus leading to highly constricted and shallow information processing (e.g., Bargh & Thein, 1985; Keinan, Friedland, Kahneman, & Roth, 1999). Alternatively, the selective attention perspective predicts selective improvement of the processing of task-relevant attributes under threats because of the reduced processing of task-irrelevant material (e.g., Huguet, Galvaing, Monteil, & Dumas, 1999). Our findings of domain-specific broadening under threats are clearly more in line with the selective attention perspective than with capacity-resource theory. That is, threatened people may selectively zoom in on, and thoroughly process potential relatedness among threat-relevant attributes, and thereby identify (remote) linkages among attributes. This, in turn, may result in higher cognitive inclusiveness in threat-relevant domains. Our findings also extend the selective attention perspective, which is silent about flexible and inclusive processing within a selective focus. Apparently, threat exposure leads to less inclusive thinking about material unrelated to the threat. At the same time, threat exposure leads to relatively more inclusive processing of threat-related material, which may be potentially useful in resolving, neutralizing, or escaping threatening circumstances.

That such focused and potentially adaptive processing is motivated follows from the fact that threat-specific inclusiveness emerged especially when threats were self-relevant (Study 2.1). Furthermore, our findings cannot be understood easily in terms of knowledge activation. First, although participants in Study 2.1 were exposed to the same health threat-related information, focused inclusiveness emerged especially when self-relevance of the threat was salient. Moreover, chronic health concerns, rather than knowledge, about transmitting diseases positively predicted inclusiveness ratings for disease-related and health-related information, but not for neutral and violence-related information (Study 2.2).

Our findings are consistent with recent work showing that compared to people anticipating a cooperative negotiation, those anticipating a conflictive negotiation include information in broader conflict-related cognitive categories, but use narrower cognitive categories when information is irrelevant to the conflict (De Dreu & Nijstad, 2008). We extend this work by taking an initial step to test the role of motivation in the link between threat and threat-relevant inclusive thinking. Second, we generalize this motivation-driven effect from conflict to health threats, and, to a lesser extent, violence threats. Finally, we identified an important boundary of threat-related inclusive information processing. Study 2.2 showed that threat-induced inclusiveness is specifically tied to the threat that is salient. We observed that compared to violence threats, health threats that were specifically aimed at transmitting diseases associated with relatively higher levels of cognitive inclusiveness in functional health-related (vs. violence-related) domains. Importantly, this relative threat-induced broadening was tied to information about the specific target threat (i.e. infectious disease) and did not generalize to information about other health issues (e.g., mental health). Apparently, people focus their precious resources on information that is most relevant to their current concerns. We note that highly self-relevant health threats led to relatively greater cognitive inclusiveness in broad health-related (vs. neutral) domains in Study 2.1 where a broad range of health effects pertaining to alcohol abuse was presented in the stimulus text. This notwithstanding, based on the findings of Study 2.2, we would predict even more inclusive processing of information that is more specifically tied to alcohol abuse.

Both violent situations and health risks are perceived as aversive and threatening. In response to these aversive situations, the avoidance system is activated that coordinates processes that help people to attend to, monitor, and assess the potential danger, and potentially escape or neutralize the threat (Dixon, 1998; Elliot, 2008; Neuberg et al., 2011).

When threatened, people are thus more sensitive and responsive to situation-specific stimuli, and we predict that the cognitive inclusiveness in threat-specific domains observed in the current study is applicable to other aversive situations that people may encounter. For instance, the threat of social exclusion is expected to lead to enhanced inclusiveness in domains that pertain to social rejection and ways to reconnect with others. Likewise, employees under high work pressure may show more inclusive thinking in domains related to stress and ways to relieve tension at work.

Although we expected a domain-specific broadening for both disease and violence threats, the effect of violence threats on violence-related inclusiveness was much weaker. Possibly, among our student population encounters of the depicted violence threats (e.g., aggressive people with weapons) are relatively rare, and thus deemed less relevant and motivating for participants than the presented health threats. Future work is needed to examine particular features of threat to understand its effect on cognitive inclusiveness. In addition to self-relevance and content, threats may also vary in strength, ambiguity, and imminence. Considering the importance of particular features of threat for understanding individual emotional and cognitive responding (Mobbs et al., 2007), it is essential to explore which of these features modulates the effect of threat on cognitive inclusiveness.

Although the category inclusion task has been used extensively in previous research, reliability assessments were not reported in those studies (Carnevale & Probst, 1998; Isen & Daubman, 1984; Mikulincer et al., 1990a, 1990b). Concerning the validity and reliability of the category inclusion task, our findings indicate that on the one hand, weak, moderate, and strong items unequivocally differed in terms of the prototypicality ratings they received, but that the reliabilities of the weak items of the category inclusion task were somewhat low and should preferably be improved. One could argue that null findings are difficult to interpret when reliability is suboptimal. For instance, it could be that our finding that inclusiveness ratings for threat-related material in the high as compared to low self-relevant threat condition was not significantly different from one another (Study 2.1) is a "true" null finding or caused by somewhat low internal consistencies of the threat-related and neutral scales. However and more importantly, across both studies, we consistently found the crucial interaction effects between condition and type of material being considered in the category inclusion task. This can only be interpreted as evidence for the motivated focus account and we suspect that with increased reliability of the scales stronger evidence for domain-specific broadening under threat may be obtained (cf. Hunter & Schmidt, 1990).

Finally, we should note that multiple conceptualizations of threats and avoidance exist in the literature. For example, people may differ in the assessment of their ability to deal with aversive situations (Tomaka et al., 1993). People may appraise the demands of the situation as exceeding their abilities (in coping research, this negative appraisal is labelled as "threat"), which leads to ineffective coping strategies (in coping research labelled as "avoidance"). However, our use of these terms builds on theories that treat the avoidance system as a threat response system with adaptive functionality (Elliot, 2008; Neuberg et al., 2011). Indeed, our findings show that people indeed regard health threats as aversive (perceiving them as threatening and disgusting), but are nonetheless motivated to deal with the particular threat (enhanced avoidance motivation), and show relatively higher inclusive thinking in threat-relevant domains. Although this suggests that people have a hardwired tendency to deal adaptively with threats, we also acknowledge that appraisals matter. Potentially, people may show higher inclusive thinking in threat-relevant domains especially when they appraise their abilities as exceeding the demands of the situation (i.e. when perceiving the situation as a challenge).

Conclusions

Taking a motivated focus perspective on threat-responding, we argued and showed that threat led to relatively more inclusive thinking in specific threat-related domains, but relatively restricted processing of threat-irrelevant information. In addition, this effect was associated with a stronger motivation to deal with the target threat. Thus, threatened people not necessarily show a generic narrowing in cognitive processes; in fact, they tend to show increased cognitive inclusiveness in threat-relevant rather than threat-irrelevant domains.

Appendix

Appendix 2.1

Table A2.1. *Observed study power, and sample sizes needed to replicate the interaction between threat condition and type of material (Study 2.1 & 2.2).*

		Study power	Required N
Study 2.1	Threat condition × Type of material	0.74	75
Study 2.2	Threat condition × Type of material	0.84	77[a]

Note. Using the G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007), we calculated the number of participants required to obtain a reliable literal replication of the effects at power = .80, with $p < .05$ (a priori).

a Analysis was done without controlling for gender.

Appendix 2.2

Category Inclusion Task

Below are questions about whether and how well particular items belongs to a given category. Using the response scale below, please indicate your answer to each question by clicking on the number of your choice:

1 = definitely does not belong to the category and is very dissimilar to members of the category
2 = does not belong to the category and dissimilar to members of the category
3 = does not belong to the category but seems somewhat similar to members of the category
4 = does not belong to the category but seems similar to members of the category
5 = does not belong to the category but is very similar to members of the category
6 = belongs to the category but is not a good example of the category
7 = belongs to the category and seems somewhat like a good example of category
8 = belongs to the category and seems like a good example of the category
9 = belongs to the category and is a good example of the category
10 = definitely belongs to the category and is a very good example of the category

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Neutral items:

1. To what extent do you think “bus” belongs to the category “vehicle”?
2. To what extent do you think “airplane” belongs to the category “vehicle”?
3. To what extent do you think “camel” belongs to the category “vehicle”?
4. To what extent do you think “couch” belongs to the category “furniture”?
5. To what extent do you think “lamp” belongs to the category “furniture”?
6. To what extent do you think “telephone” belongs to the category “furniture”?
7. To what extent do you think “carrot” belongs to the category “vegetable”?
8. To what extent do you think “potato” belongs to the category “vegetable”?
9. To what extent do you think “garlic” belongs to the category “vegetable”?
10. To what extent do you think “skirt” belongs to the category “clothes”?
11. To what extent do you think “shoes” belongs to the category “clothes”?
12. To what extent do you think “handbag” belongs to the category “clothes”?
13. To what extent do you think “apple” belongs to the category “fruit”?
14. To what extent do you think “cranberry” belongs to the category “fruit”?
15. To what extent do you think “avocado” belongs to the category “fruit”?
16. To what extent do you think “sparrow” belongs to the category “bird”?
17. To what extent do you think “condor” belongs to the category “bird”?
18. To what extent do you think “penguin” belongs to the category “bird”?
19. To what extent do you think “doll” belongs to the category “toy”?
20. To what extent do you think “tricycle” belongs to the category “toy”?
21. To what extent do you think “book” belongs to the category “toy”?
22. To what extent do you think “saw” belongs to the category “carpenter’s tool”?
23. To what extent do you think “awl” belongs to the category “carpenter’s tool”?

24. To what extent do you think “scissors” belongs to the category “carpenter’s tool”?

Violence-related items:

25. To what extent do you think “gun” belongs to the category “weapon”?
26. To what extent do you think “jet fighter” belongs to the category “weapon”?
27. To what extent do you think “screwdriver” belongs to the category “weapon”?
28. To what extent do you think “bullet” belongs to the category “ammunition”?
29. To what extent do you think “dynamite” belongs to the category “ammunition”?
30. To what extent do you think “paving stone” belongs to the category “ammunition”?
31. To what extent do you think “cavalry” belongs to the category “army”?
32. To what extent do you think “Al Qaida” belongs to the category “army”?
33. To what extent do you think “hooligans” belongs to the category “army”?
34. To what extent do you think “war” belongs to the category “fight”?
35. To what extent do you think “bombing” belongs to the category “fight”?
36. To what extent do you think “collective bargaining” belongs to the category “fight”?

Disease-related items:

37. To what extent do you think “fever” belongs to the category “disease symptoms”?
38. To what extent do you think “rash” belongs to the category “disease symptoms”?
39. To what extent do you think “muscle ache” belongs to the category “disease symptoms”?
40. To what extent do you think “air pollution” belongs to the category “unhealthy environment”?
41. To what extent do you think “noise” belongs to the category “unhealthy environment”?
42. To what extent do you think “overpopulation” belongs to the category “unhealthy environment”?
43. To what extent do you think “coughing and sneezing” belongs to the category “risks of contagion”?
44. To what extent do you think “shaking hands” belongs to the category “risks of contagion”?
45. To what extent do you think “goodbye kissing” belongs to the category “risks of contagion”?
46. To what extent do you think “coughing up blood” belongs to the category “disease markers”?
47. To what extent do you think “sore throat” belongs to the category “disease markers”?
48. To what extent do you think “itch” belongs to the category “disease markers”?
49. To what extent do you think “rotten food” belongs to the category “sources of infection”?
50. To what extent do you think “dish towel” belongs to the category “sources of infection”?
51. To what extent do you think “doorknob” belongs to the category “sources of infection”?

General health-related items:

52. To what extent do you think “depression” belongs to the category “mental illness”?
53. To what extent do you think “burn out” belongs to the category “mental illness”?
54. To what extent do you think “dyslexia” belongs to the category “mental illness”?
55. To what extent do you think “fear of failure” belongs to the category “unhealthy thought patterns”?
56. To what extent do you think “pessimism” belongs to the category “unhealthy thought patterns”?
57. To what extent do you think “doubts” belongs to the category “unhealthy thought patterns”?
58. To what extent do you think “smoking” belongs to the category “unhealthy lifestyle”?
59. To what extent do you think “drinking” belongs to the category “unhealthy lifestyle”?
60. To what extent do you think “practicing extreme sports” belongs to the category “unhealthy lifestyle”?
61. To what extent do you think “tenseness” belongs to the category “stress symptoms”?
62. To what extent do you think “headache” belongs to the category “stress symptoms”?
63. To what extent do you think “nightmares” belongs to the category “stress symptoms”?
64. To what extent do you think “washing hands” belongs to the category “hygiene”?
65. To what extent do you think “using sanitary gel” belongs to the category “hygiene”?
66. To what extent do you think “no touching of public buttons” belongs to the category “hygiene”?
67. To what extent do you think “jogging” belongs to the category “healthy activities”?
68. To what extent do you think “dancing” belongs to the category “healthy activities”?
69. To what extent do you think “walking your dog” belongs to the category “healthy activities”?
70. To what extent do you think “varied food” belongs to the category “healthy diet”?
71. To what extent do you think “biological food” belongs to the category “healthy diet”?
72. To what extent do you think “vegetarian food” belongs to the category “healthy diet”?
73. To what extent do you think “hospital” belongs to the category “healthcare”?
74. To what extent do you think “dental check” belongs to the category “healthcare”?
75. To what extent do you think “first-aid smartphone application” belongs to the category “healthcare”?
76. To what extent do you think “visiting psychologists” belongs to the category “therapeutic activities”?
77. To what extent do you think “keeping a diary” belongs to the category “therapeutic activities”?
78. To what extent do you think “running” belongs to the category “therapeutic activities”?

Note. Items in each category were sorted by their preselected prototypicality from high through moderate to weak. During the experimental task, items were presented randomly.

Appendix 2.3

Pilot Study 2.1

To develop a measure of cognitive inclusiveness of health-related information, we created a list of health threat-related categories that were focused on specific health concerns (e.g., diseases, bad habits) or health coping strategies (e.g., diet, health care). In line with the original category inclusion task, for each category we generated exemplars that varied in prototypicality (Isen & Daubman, 1984). The face validity of each category exemplar was evaluated by four colleagues, and the exemplars with low face validity were excluded. Retained items (87 exemplars in 22 categories) were rated by a sample of undergraduate students to decide which categories were retained and which items were included in each category.

Method

Thirty-eight undergraduate students (due to an administrative error, age and gender were not recorded) were asked to do the category inclusion task that was introduced as a task about object perception. The task contained twenty-six categories, four of which were neutral categories that were taken from the original category inclusion task (e.g., vegetables, furniture; Rosch, 1975). The other categories were newly generated to capture the health domain: eleven were about health threat coping strategies (e.g., healthy diet, health care) and eleven were about health concerns (e.g., disease, unhealthy lifestyle). There were three to six preselected exemplars within each category that differed in typicality, adding to a total of 99 exemplars (including the 12 exemplars for the neutral categories; see below). Participants rated the extent to which each exemplar belonged to the particular category (1 = *definitely does not belong to the category and is very dissimilar to members of the category* to 10 = *definitely belongs to the category and is very similar to members of the category*). Participants received detailed instructions about each scale-point. For example, a rating of 5 meant that the item did not belong to the category but was very similar to members of the category, while a rating of 6 indicated that the item did belong to the category but was not a good example of it (Mikulincer et al., 1990a, 1990b). The categories were presented in random order, and within each category, exemplars were also randomly presented.

Results

The four neutral categories from the original category inclusion task (with strong,

moderate, and weak exemplars) were: (1) Vehicle (bus, airplane, camel); (2) Vegetable (carrot, potato, garlic); (3) Clothes (skirt, shoes, handbag), and (4) Furniture (couch, lamp, telephone). First, ratings for preselected strong, moderate, and weak exemplars in each neutral category were submitted to repeated-measure ANOVAs separately. The ratings for preselected strong, moderate, and weak exemplars significantly and unequivocally differed from each other (see Table A2.3a). In addition, ratings for the weak exemplars were averaged and the same was done for the moderate and strong exemplars. The averaged ratings for weak, moderate, and strong exemplars in the neutral categories were then submitted to a repeated-measure ANOVA. Exemplars within the neutral category differed from each other, $F(2, 36)=217.79$, $p < .001$, $\eta_p^2 = .92$, with the strong items being strongly ($M = 9.50$), the moderate items being moderately ($M = 7.47$), and the weak items being weakly prototypical ($M = 4.66$).

Table A2.3a. Means and Standard Deviations for each exemplar in the neutral categories

Vehicle			Furniture			Vegetable			Clothes		
	M	*SD*		*M*	*SD*		*M*	*SD*		*M*	*SD*
bus	9.45^{bc}	0.86	couch	9.37^{bc}	0.97	carrot	9.50^{bc}	0.80	skirt	9.68^{bc}	0.62
airplane	8.97^{ac}	1.35	lamp	6.47^{ac}	2.68	potato	6.58^{ac}	2.78	shoes	7.84^{ac}	2.44
camel	4.16^{ab}	2.15	telephone	3.45^{ab}	2.11	garlic	5.66^{ab}	2.28	handbag	5.39^{ab}	2.64
F	126.32^{***}		*F*	156.81^{***}		*F*	60.45^{***}		*F*	51.57^{***}	

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

The superscript letters correspond to row numbers of items and indicate the mean values are significantly different from each other at the .05 level.

For the newly-created categories about health concerns and health coping strategies, ratings for exemplars within each category were submitted to separate repeated-measure ANOVAs. A category was retained only if its exemplars significantly and unequivocally differed from each other and thus could be decomposed into strong, moderate and weak exemplars (see Table A2.3b-A2.3c). As a result, six health-concerns categories (with strong, moderate, and weak exemplars) met this criterion: (1) Disease (fever; rash; myalgia); (2) Mental illness (depression; burn out; dyslexia); (3) Stress symptoms (tenseness; headache; nightmares); (4) Unhealthy environment (air pollution; noise; over population); (5)

Unhealthy thought patterns (fear of failure; pessimism; doubts); and (6) Unhealthy lifestyle (smoking; drinking; practicing extreme sports). For the health-coping categories, five categories were retained: (1) Therapeutic activities (visiting psychologist; keeping a diary; running); (2) Healthcare (hospital; dental check; first-aid smartphone application); (3) Hygiene (hand washing; sanitary gel; no touching of buttons in public transport); (4) Healthy diet (varied food; biological food; vegetarian food); (5) Healthy activities (jogging; dancing; dog walking). Ratings for the weak exemplars of all health-related categories (health concern *and* health coping) were averaged and the same was done for the moderate and strong exemplars. The averaged ratings for weak, moderate, and strong exemplars in the health-related categories were then submitted to a repeated-measure ANOVA, which showed that the exemplars significantly differed from one another in terms of prototypicality, with eleven being strongly (M = 8.79), eleven being moderately (M = 7.58), and eleven being weakly prototypical (M = 5.65), $F(2, 36) = 158.28$, $p < .001$, $\eta_p^2 = .90$.

In sum, the category inclusion task that was chosen for Study 2.1, contained fifteen categories (with strong, moderate, and weak exemplars). For the neutral domain, there were four categories: vehicle, furniture, vegetable and clothing; for the health-related domain, there were eleven categories: stress symptoms, disease, mental illness, unhealthy environment, unhealthy thought patterns, unhealthy lifestyle, hygiene, healthcare, therapeutic activities, healthy diet, and healthy activities.

Table A2.3b. Means and Standard Deviations for each exemplar in the health concerns categories

Unhealthy environment			Disease symptoms			Mental illness		
	M	*SD*		*M*	*SD*		*M*	*SD*
air pollution	9.34^{bc}	0.88	fever	8.95^{cde}	1.59	depression	8.82^{bc}	1.75
noises	7.18^{ac}	1.96	palpitations	8.16^{e}	1.87	burn out	7.68^{ac}	2.21
over population	6.26^{ab}	2.58	stomachache	8.03^{ae}	1.73	dyslexia	4.87^{ab}	2.59
			rash	7.87^{ae}	2.13			
			myalgia	4.39^{abcd}	2.66			
F	32.27^{***}		*F*	26.79^{***}		*F*	34.24^{***}	

Unhealthy thought patterns			Stress symptoms			Unhealthy lifestyle		
	M	*SD*		*M*	*SD*		*M*	*SD*
fear of failure	7.26^{cde}	2.02	tenseness	8.18^{bc}	1.56	smoking	9.00^{bc}	1.29
worrying	6.58^{ce}	2.30	headache	7.50^{ac}	1.93	drinking	7.58^{ac}	1.73
pessimism	6.24^{abd}	2.42	nightmare	6.74^{ab}	1.88	practicing extreme sports	4.92^{ab}	2.34
perfectionism	5.37^{abc}	1.97						
having doubts	4.71^{abc}	2.48						
F	15.42^{***}		*F*	14.61^{***}		*F*	42.16^{***}	

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

The superscript letters correspond to row numbers of items and indicate the mean values are significantly different from each other at the .05 level.

Table A2.3c. Means and Standard Deviations for each exemplar in the health coping categories

Healthy activities			Healthy diet			Hygiene		
	M	*SD*		*M*	*SD*		*M*	*SD*
jogging	9.03^{bcd}	1.08	biological food	7.87^{bc}	1.89	Washing hands	8.89^{cdef}	1.13
dancing	8.42^{ad}	1.61	varied food	8.68^{ac}	1.38	Washing clothes	8.47^{cdef}	1.64
sex	8.13^{ad}	1.55	vegetarian food	6.42^{bc}	2.58	regular mopping	7.61^{abde}	1.99
walking your dog	7.00^{abc}	1.41				using sanitary gel	7.32^{abde}	2.24
						taking off your shoes indoor	6.26^{abcd}	2.64
						no touching of public buttons	5.21^{abcd}	2.50
F	17.61***		*F*	13.32***		*F*	27.35***	

Healthcare			Therapeutic activities		
	M	*SD*		*M*	*SD*
hospital	9.34^{bcd}	0.99	visiting psychologists	9.00^{bcd}	1.41
vaccination	8.74^{acd}	1.48	keeping a diary	7.45^{acd}	1.67
dental check	8.00^{abd}	1.63	painting	6.18^{ab}	2.25
first-aid smartphone app	5.34^{abc}	2.12	running	5.97^{ab}	2.35
F	36.29***		*F*	24.87***	

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. The superscript letters correspond to row numbers of items and indicate the mean values are significantly different from each other at the .05 level.

Appendix 2.4

Pilot Study 2.2

For the purpose of Study 2.2, three disease-related, four conflict-related, and four neutral categories were added to the existing categories of the category inclusion task that was used in Study 2.1 (also see Appendix 2.3). These eleven newly-added categories were validated in a pre-test together with the fifteen categories that were used in Study 2.1.

Method

Participants were recruited during two weeks that the test was run. In total seventy-one undergraduate students (71.8% female; *M*age = 21.93) rated the extent to which each exemplar belonged to a particular category (1 = *definitely does not belong to the category and is very dissimilar to members of the category* to 10 = *definitely belongs to the category and is very similar to members of the category*; also see Appendix 2.3). To the original four categories (vehicle, furniture, vegetable, clothes), we added four neutral categories (with strong, moderate, and weak exemplars): fruit (apple, cranberry, avocado), bird (sparrow, condor, penguin), toy (doll, tricycle, book), and carpenter's tool (saw, awl, scissors) (Rosch, 1975). The four violence-related categories were weapon (gun, jet fighter, screw driver), ammunition (bullet, dynamite, paving stones), army (Cavalry, Al Qaida, hooligans), and fight (war, bombing, collective bargaining) (De Dreu & Nijstad, 2008). The five disease-related categories contained three newly developed categories: risks of contagion (cough and sneezes, shaking hands, goodbye kiss), disease markers (coughing up blood, sore throat, itch), and sources of infection (rotten food, dish towel, doorknob), as well as two from the original health-related categories in Study 2.1: disease symptoms (fever, rash, muscle ache) and unhealthy environment (air pollution, noise, overpopulation). The other nine health-related categories of the category inclusion task that was used in Study 2.1 were kept to measure the inclusiveness of other health-related information (stress symptoms, mental illness, unhealthy thought patterns, unhealthy lifestyle, hygiene, healthcare, therapeutic activities, healthy diet, and healthy activities). In total, there were 78 items in 26 categories. All categories were presented in a random order. Within each category, exemplars were also randomly presented.

Results

First, the ratings for preselected weak, moderate, and strong exemplars within each category were submitted to a repeated-measure ANOVA separately. For all the categories

including the eleven newly-added ones, the ratings for preselected strong, moderate, and weak exemplars significantly and unequivocally differed from each other (see Table A2.4a-A2.4d).

Ratings for the weak exemplars of each semantic domain (neutral, violence-related, disease-related, and general health-related domains) were averaged and the same was done for the moderate and strong exemplars. The averaged ratings for weak, moderate, and strong exemplars in each domain were then submitted to separate repeated-measure ANOVAs, which showed that for each domain, the exemplars were significantly different on prototypicality. Thus, for the neutral domain, we found the eight preselected strong items being strongly (M = 9.53), the eight preselected moderate items being moderately (M = 8.00), and the eight preselected weak items being weakly prototypical (M = 5.21), $F(2, 69) = 430.52$, $p < .001$, $\eta_p^2 = .93$. For the violence-related domain, the four preselected strong items were rated strongly (M = 9.24), the four preselected moderate items were rated moderately (M = 6.69), and the four preselected weak items were rated weakly prototypical (M = 3.70), $F(2, 69) = 381.37$, $p < .001$, $\eta_p^2 = .92$. For the disease-related domain, we found the five preselected strong items being strongly (M = 9.02), the five preselected moderate items being moderately (M = 7.01), and the five preselected weak items being weakly prototypical (M = 5.75), $F(2, 69) = 172.08$, $p < .001$, $\eta_p^2 = .83$. Finally, for the general health-related domain, we found the nine preselected strong items being strongly (M = 8.97), the nine preselected moderate items being moderately (M = 7.78), and the nine preselected weak items being weakly prototypical (M = 5.67), $F(2, 69) = 321.97$, $p < .001$, $\eta_p^2 = .90$.

Moreover, for each category, we calculated the percentage of participants whose ratings followed the preselected rank order from strong through moderate to weak. The results revealed that across all the categories, the percentage of participants who followed this preselected rank order ranged from 71.80 to 97.20, and the averaged percentage was 83.58.

Table A2.4a. Means and Standard Deviations for each exemplar in the neutral categories

Vehicle			Furniture			Vegetable			Clothes		
	M	*SD*		*M*	*SD*		*M*	*SD*		*M*	*SD*
bus	9.46^{bc}	0.89	couch	9.70^{bc}	0.57	carrot	9.13^{bc}	1.80	skirt	9.66^{bc}	0.76
airplane	9.13^{ac}	1.42	lamp	6.82^{ac}	2.54	potato	6.27^{ac}	2.63	shoes	8.08^{ac}	2.10
camel	4.34^{ab}	2.05	telephone	3.14^{ab}	2.15	garlic	5.10^{ab}	2.12	handbag	5.25^{ab}	2.23
F	206.82^{***}		*F*	305.76^{***}		*F*	99.20^{***}		*F*	131.82^{***}	

Fruit			Bird			Toy			Carpenter's tool		
	M	*SD*		*M*	*SD*		*M*	*SD*		*M*	*SD*
apple	9.82^{bc}	0.54	sparrow	9.59^{bc}	0.99	doll	9.35^{bc}	1.26	saw	9.52^{bc}	1.03
cranberry	9.11^{ac}	1.32	condor	8.49^{ac}	1.87	tricycle	7.83^{ac}	2.15	awl	8.25^{ac}	1.90
avocado	6.20^{ab}	2.56	penguin	6.59^{ab}	2.35	book	5.25^{ab}	2.30	scissors	5.80^{ab}	2.22
F	70.82^{***}		*F*	63.48^{***}		*F*	83.16^{***}		*F*	91.76^{***}	

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

The superscript letters correspond to row numbers of items and indicate the mean values are significantly different from each other at the .05 level.

Table A2.4b. Means and Standard Deviations for each exemplar in the violence-related categories

Weapon			Ammunition		
	M	*SD*		*M*	*SD*
gun	9.66^{bc}	0.74	bullet	9.37^{bc}	1.38
jet fighter	5.37^{ac}	2.36	dynamite	7.92^{ac}	1.93
screw driver	4.18^{ab}	1.82	paving stone	3.23^{ab}	2.04
F	368.95***		*F*	230.67***	

Army			Fight		
	M	*SD*		*M*	*SD*
cavalry	9.45^{bc}	0.95	war	8.49^{bc}	1.98
Al Qaida	6.41^{ac}	2.45	bombing	7.08^{ac}	2.45
hooligans	3.39^{ab}	2.25	collective bargaining	4.01^{ab}	2.33
F	243.9***		*F*	69.75***	

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. The superscript letters correspond to row numbers of items and indicate the mean values are significantly different from each other at the .05 level.

Table A2.4c. Means and Standard Deviations for each exemplar in the disease-related categories

Disease symptoms			Unhealthy environment			Risks of contagion		
	M	*SD*		*M*	*SD*		*M*	*SD*
fever	9.30^{bc}	1.21	air pollution	9.39^{bc}	0.9	coughing and sneezing	8.06^{bc}	1.89
rash	8.45^{ac}	1.65	noise	6.75^{ac}	2.45	shaking hands	5.28^{ac}	2.47
muscle ache	5.92^{ab}	2.71	overpopulation	5.89^{ab}	2.58	goodbye kissing	4.87^{ab}	2.6
F	50.09^{***}		*F*	72.13^{***}		*F*	61.85^{***}	

Disease markers			Sources of infection		
	M	*SD*		*M*	*SD*
coughing up blood	9.63^{bc}	0.87	rotten food	8.72^{bc}	1.65
sore throat	8.28^{ac}	1.64	dish towel	6.31^{ac}	2.2
itch	6.45^{ab}	2.41	doorknob	5.63^{ab}	2.54
F	72.51^{***}		*F*	44.72^{***}	

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. The superscript letters correspond to row numbers of items and indicate the mean values are significantly different from each other at the .05 level.

Table A2.4d. Means and Standard Deviations for each exemplar in the general health-related categories

Mental illness			Unhealthy thought patterns			Unhealthy lifestyle		
	M	*SD*		*M*	*SD*		*M*	*SD*
depression	9.28^{bc}	1.05	fear of failure	7.51^{bc}	1.96	smoking	9.39^{bc}	1.08
burn out	8.44^{ac}	1.72	pessimism	6.85^{ac}	2.34	drinking	7.32^{ac}	2.12
dyslexia	5.66^{ab}	2.95	doubts	3.97^{ab}	2.34	practicing extreme sports	4.76^{ab}	2.44
F	56.24***		*F*	67.59***		*F*	108.23***	

Stress symptoms			Hygiene			Healthy activities		
	M	*SD*		*M*	*SD*		*M*	*SD*
tenseness	8.58^{bc}	1.42	washing hands	9.61^{bc}	1.15	jogging	8.89^{bc}	1.43
headache	8.07^{ac}	1.50	using sanitary gel	8.63^{ac}	1.47	dancing	8.34^{ac}	1.47
nightmares	6.41^{ab}	2.10	no touching of public buttons	6.34^{ab}	2.56	walking your dog	6.39^{ab}	1.87
F	35.26***		*F*	47.53***		*F*	66.71***	

Healthy diet			Healthcare			Therapeutic activities		
	M	*SD*		*M*	*SD*		*M*	*SD*
varied food	8.79^{bc}	1.70	hospital	9.73^{bc}	0.63	visiting psychologists	8.96^{bc}	1.69
biological food	7.69^{ac}	1.94	dental check	8.30^{ac}	1.73	keeping a diary	6.39^{ac}	2.14
vegetarian food	6.07^{ab}	2.45	first-aid smartphone application	5.90^{ab}	2.29	running	5.49^{ab}	2.24
F	36.19***		*F*	115.36***		*F*	59.38***	

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. The superscript letters correspond to row numbers of items and indicate the mean values are significantly different from each other at the .05 level.