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The role of competence-related attentional bias and resilience in restoring thwarted feelings of competence

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Abstract

The key goal of the present study was to examine how people deal with feelings of failure stemming from negative feedback. Specifically, we investigated whether individuals, and in particular those high in resilience, would display an attentional bias for competence-related cues after receiving competence-thwarting (i.e., negative) feedback. First, we validated a dot probe task tapping into competence-related attentional bias in a pilot study with 80 participants (M_{age} = 19.06, SD_{age} = 3.91; 84% female). Subsequently, in the main study, another group of 60 participants (M_{age} = 21.95, SD_{age} = 3.00; 68% female) were randomly provided with either positive or negative feedback after participating in a puzzle task. Subsequently, participants' puzzle-task competence and their attentional bias were assessed, while their behavioral persistence during a free-choice period was recorded. First, results showed that participants in the negative, relative to the positive, feedback condition experienced higher levels of puzzle-task related competence frustration and displayed a stronger attentional bias for competence-related words. Next, regression analyses revealed that only individuals high in resilience displayed an attentional bias towards competence-related words in response to negative feedback. Finally, we found that such attentional bias was functional for a recovery in feelings of competence over time among those who received negative feedback. The discussion focuses on the role of attentional bias as a potential need-restoring coping mechanism.

Keywords Resilience · Attentional bias · Need frustration · Negative feedback · Self-determination theory

In daily life, people are from time to time exposed to failure, which often goes hand in hand with the experience of competence frustration (Deci and Ryan 1985). Individuals can doubt their competence when receiving criticism from others, when encountering demanding tasks, or when failing to attain personally valued goals. Previous research have repeatedly shown that competence frustration relates to a host of negative outcomes, including anxiety (Niemann et al. 2014), reduced interest in the task at hand (Mabbe et al. 2018) and eventual disengagement from the activity (Anderson and Rodin 1989). Although the costs associated with competence frustration have been well-documented, less attention has been devoted to the strategies individuals employ to restore their feelings of competence after having encountered failure (e.g., Legault and Inzlicht 2013; Skinner et al. 2003). This study aims to add to this limited body of work by examining the role of attentional bias for competence-related cues after encountered failure in restoring a sense of competence. Additionally, such attentional bias may especially emerge among individuals high in resilience. Indeed, as the concept of resilience implies, resilient individuals have been argued and found to react in a more adaptive way when facing adversity (Sarkar and Fletcher 2015), a reaction which may contribute to the restoration of their thwarted competence. The primary aim of the present experimental study was, therefore, to investigate the role of competence-related attentional bias and resilience in restorative reactions to encountered failure stemming from negative feedback.

Competence from a need-based perspective

Competence denotes people's feelings of effectiveness and mastery when interacting with the environment (White 1959) and plays a central role within several motivational theories, such as self-efficacy theory (Bandura 1997),

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expectancy-valence models (Wigfield and Eccles 2000), control theory (Carver and Scheier 1982), and self-determination theory (SDT; Ryan and Deci 2017). Within SDT, competence is conceived (together with autonomy and relatedness) as a basic psychological need that serves as a universal nutrient for growth, integrity, and psychological well-being. Indeed, previous studies have found that competence satisfaction relates to diverse positive outcomes, such as greater vitality (Kasser and Ryan 1996), more autonomous or volitional motivation (Black and Deci 2000) and better task performance (Mabbe et al. 2018). On the other hand, competence frustration, that is, the experience of failure and inadequacy, has been found to predict disengagement (Earl et al. 2017; Jang et al. 2016), ill-being (Bartholomew et al. 2011) and even psychopathology (see Vansteenkiste and Ryan 2013 for an overview).

Within SDT, the social context is said to play a major role in the support and thwarting of individuals' feelings of competence (Deci and Ryan 1985), for instance through the provision of feedback (e.g., Mouratidis et al. 2008; Vallerand and Reid 1984). Feedback denotes the provision of competence-related information regarding a person's performance on a task (Stone and Stone 1984), which can differ in its valence (negative or positive). As summarized in a meta-analysis by Fong et al. (2018), dozens of studies have found the experimental provision of negative, relative to positive feedback, to predict higher competence frustration, a finding that was obtained among diverse populations, including elementary school children (e.g., Mabbe et al. 2018), secondary school children (e.g., Mouratidis et al. 2008), university students (e.g., Hagger et al. 2015; van der Kaap-Deeder et al. 2016) and employees (Grouzet et al. 2004).

In some studies (e.g., Fransen et al. 2017), a condition involving negative feedback was contrasted with a control condition, which either involved the provision of no feedback or neutral feedback. In those studies, negative feedback was found to lower participants' competence, suggesting that negative feedback has a competence-undermining effect as such. Studies concerning the outcomes of feedback have focused not only on feelings of competence, but also on the degree to which individuals persist at a certain task. Although research indicated that the provision of positive feedback promotes individuals' objective task-persistence (Burgers et al. 2015; Ryan 1982), negative feedback may also prompt behavioral persistence at the same or at another activity (e.g. Fang et al. 2018; Radel et al. 2013). Yet, the reasons for persisting under positive versus negative feedback circumstances can be very different, with the persistence being driven by interest in and enjoyment of the activity (i.e., undergirded by intrinsic motives) in the case of positive feedback and being driven by self-worth and ego-validating concerns (i.e., undergirded by introjected motives) in the case of negative feedback (Ryan 1982; Vansteenkiste and Deci 2003).

Competence-related attentional bias as a competence-restoring mechanism

While past work has mostly focused on the costs associated with competence frustration, less is known about the strategies individuals employ when encountering competence-frustrating experiences. Specifically, less is known about the question whether individuals can overcome their thwarted competence and whether there exist inter-individual differences in this need-restoration process. That is, some individuals may recover quickly from a blow to their competence while other individuals may react in a more helpless way after defeat, thereby giving up further attempts to regain a sense of competence (Abramson et al. 1978). Although individuals are vulnerable to disengagement and passivity in response to encountered failure, they also have the propensity to overcome the setbacks after encountering a need-frustrating event (Deci and Ryan 2002). In this context, individuals' elevated desire to get their needs fulfilled may signal individuals' urge to restore their frustrated needs. Congruent with this reasoning, Sheldon and Gunz (2009) showed through a series of three studies that the experience of need frustration in general, and the experience of competence frustration in particular, predicted an elevated desire to get the frustrated needs met. What is still unclear to date is whether such a salient need desire elicits a greater pursuit of need satisfaction and, thereby, activates an eventual compensation of the thwarted need.

While need desire reflects a more affective reaction to the encountered need frustration, a number of cognitive mechanisms may also get activated in this need-restorative process. A few studies (e.g. Aarts et al. 2001; Fang et al. 2017) have shown that need-relevant information becomes more salient to individuals whose needs are frustrated (Strack and Deutsch 2004). Such elevated salience manifests through greater accessibility and attention to need-relevant information, which would be critical to overcome the encountered need frustration or to seek new opportunities for need satisfaction (Baron 2008). Radel et al. (2011, 2013) provided evidence for such a facilitated accessibility of autonomy-relevant information among individuals thwarted in their need for autonomy. Similar to hungry participants noticing food-related pictures faster than other types of pictures (e.g. Mogg et al. 2016), Radel et al. (2011, 2013) showed faster response times on a lexical decision task for autonomy-related words in a group of autonomy-thwarted participants. Extending this work, Fang et al. (2018) reported neural evidence for a stronger orientation towards winning among participants whose competence need got frustrated in another preceding task. Although such research demonstrates a relation between need frustration and an increased cognitive accessibility for need-related stimuli, to date, it remains unclear

whether such an attentional bias is functional, that is, conducive to the eventual restoration of the thwarted need.

Resilience as a protective factor

Most studies so far have documented the costs (i.e., main effects) associated with competence thwarting (e.g. Mabbe et al. 2018; Patall et al. 2008). Only a few studies examined whether there exist inter-individual differences in the way how individuals react to competence-frustrating experiences, such that the costs may be more elevated for some and less pronounced for other individuals. For instance, emotionally instable participants reported higher feelings of anxiety and anger after receiving negative feedback in comparison to more emotionally stable participants (Niemann et al. 2014). Additionally, individuals high, relative to those low, in self-critical perfectionism reported more avoidance and less acceptance of a competence-frustrating experience 1 week after the experimental exposure to a negative feedback induction (Van der Kaap-Deeder et al. 2016). Because the costs associated with competence frustration have been found to be more pronounced among emotionally unstable and self-critical individuals, these two inter-individual difference variables can be regarded as vulnerability factors when encountering failure. Less is known, however, about possible buffering factors that attenuate rather than exacerbate the costs associated with competence frustration. Herein, we considered the role of resilience as such a possible protective personal factor.

Resilience is a rather generic construct that denotes a better than average reaction in the face of adversity (e.g., Fletcher and Sarkar 2012; Luther et al. 2006). Resilience has been conceptualized as a dynamic and interactive process that captures individual differences in people's capacity to adequately respond to multiple stressors (Fletcher and Sarkar 2012; Nichols 2013; Rutter 1987). Several, albeit primarily correlational, studies found self-reported resilience to relate positively to adaptive outcomes (e.g., Luthar et al. 2000; Masten 2001; Richardson 2002), including better achievement and higher psychological well-being (Hosseini and Besharat 2010), better adaptation to negative life events and fewer emotional problems and symptoms of psychopathology (e.g., Masten et al. 2006).

Such studies leave open the question whether resilience plays a truly moderating role towards thwarted competence, as theoretically hypothesized. That is, individuals scoring high on resilience may as well retrospectively infer greater resilience from constructively handling negative life events. To address whether individuals scoring high on resilience would be better able to withstand and handle encountered stressors like negative feedback, an experimental set-up is needed. That is, being exposed to a standardized and experimentally induced stressor, it can be examined whether individuals high, relative to those low, in resilience react differently to experimentally-induced stressors, such as negative feedback (Vansteenkiste and Ryan 2013). The very reason why individuals high in resilience may better adapt to the negative feedback is because they are better capable to shift and focus their attention when dealing with demanding and stressful situations (Masten and Tellegen 2012; Parsons et al. 2016). To illustrate, a strong association has been reported between resilience and an attentional bias towards positive stimuli (e.g., happy faces) in a dot probe task (Thoern et al. 2016). Such findings provide preliminary evidence for the claim herein that individuals high in resilience may display a more elevated cognitive bias vis-à-vis competence-related cues in response to negative feedback.

The present research

The purpose of the current study was to examine how people handle feelings of competence frustration, thereby addressing three lacunae in the current literature. First, although previous research indicated a positive relation between autonomy frustration and an autonomy-related attentional bias (e.g., Radel et al. 2011), no study so far examined such an attentional bias with respect to the need for competence. Second, previous research has not examined resilience as a possible moderator in the relation between competence frustration and an attentional bias. Third, it has not been formally examined whether need-related attentional bias increases the likelihood of need restoration (Radel et al. 2011, 2013).

To address these lacunae, we set up an experimental study to examine the role of competence-related attentional bias and resilience in the reaction to a competence-thwarting experience, which was experimentally induced through the provision of negative feedback. Specifically, after random assignment to one of two experimental conditions, participants worked on a Tangram puzzle task (TPT) which was said to carry high diagnostic value for performance and effectiveness. Participants' feelings of competence and level of attentional bias were assessed directly following the provision of feedback, which was followed by a free-choice period (Deci et al. 1999) during which participants had the opportunity to continue working on the puzzle task or to disengage. To examine whether a restoration process had taken place, participants' feelings of competence were assessed a second time, that is, after the free-choice period.

We postulated the following three hypotheses. First, we expected participants in the negative, relative to those in the positive, feedback condition to report a higher level of competence frustration and to display a stronger attentional bias for competence-related cues (cfr. Radel et al. 2011). Second, we expected that especially individuals scoring high

(compared to those scoring low) on resilience would display a strong attentional bias towards competence-related information after encountering failure. Finally, we expected a higher level of competence-related attentional bias to relate to a decrease in feelings of competence frustration over time (i.e., from post-task to post-free-choice assessment).

As this study was the first to assess participants' attentional bias towards competence-related cues, we first developed and validated a measure for such a bias in a preliminary study. In doing so, we made use of the dot probe task, a well-validated paradigm to measure changes in attentional processes with respect to particular information (MacLeod et al. 1986; Thoern et al. 2016). Because no research has implemented this paradigm in the context of SDT up until today, we first aimed to validate the newly developed measures of competence- and incompetence-related attentional bias. In this preliminary study, we did not use an experimental induction as our goal was more simply to examine whether participants' effectiveness and mastery to solve puzzles would relate to an attentional bias. We expected that participants who would feel more incompetent during the puzzle task would display a stronger attentional bias towards competence-related stimuli in the dot probe task.

Preliminary study

Method

Participants

Using an online system panel for assignment, 80 undergraduate students in psychology (M_{age} = 19.06, SD_{age} = 3.91; range 17–36; 84% female) at Ghent University participated in return for a course credit. All tasks and instructions were provided in Dutch.

Procedure

Upon arrival in the laboratory, all participants were informed about the study procedures (including their right to withdraw their participation at any time). Subsequently, they were asked to provide informed consent and were tested individually. Participants were informed that the aim of the study was to examine visual information processing by means of both a puzzle and a computer task. Subsequently, the study consisted of three phases: (1) engagement in a TPT, (2) assessment of momentary feelings of task-related competence, and (3) completion of a dot probe task to assess participants' attentional bias towards competence-related stimuli. Finally, participants were thanked and dismissed. Participants were debriefed both verbally and via an information letter about the goal and the procedure of the study. In return for their participation, they received one course credit. The study was approved by the University's Ethical Committee.

Tangram puzzle task First, we introduced the TPT, which has been used in past competence-related research (Van der Kaap-Deeder et al. 2016). The goal of this task is to compose a given black silhouette using seven geometrically different pieces. After introducing the basic rules (i.e., using all pieces and solving the puzzles in chronological sequence), the experimenter demonstrated how to solve two puzzles. Participants were then introduced to the practice phase in which they were provided with one easy and one difficult puzzle figure. They were given 4 min to solve these puzzles. Subsequently, the test phase was introduced, in which participants were asked to try to solve five puzzles within 10 min. As no time limits were set on solving a given puzzle, participants could skip puzzles, yet, they were not allowed to return to non-solved puzzles. A digital clock was set in front of participants to enable them to check the passing time. To make the experience of success or failure more salient, participants were asked during both the practice and the test phase to indicate on a sheet of paper whether they had succeeded in completing a puzzle or had failed to do so before moving on to the next puzzle.

Dot probe task Participants were seated in front of a computer while the experimenter launched the dot probe task. In this task, two stimuli (i.e., words) are presented simultaneously on the left and right side of the screen for a short period of time (i.e., between 500 and 1000 ms), after which one of the stimuli is replaced by a probe (i.e., a dot). Participants were instructed to locate the probe as fast and accurately as possible by using the corresponding mouse button (i.e., left side: left-key, right side: right-key). The experimenter supervised a short practice phase to ensure that participants performed the task correctly. Next, instructions on the screen guided participants to the test phase which included five series of stimuli, interrupted by four small breaks, totaling approximately 19 min to complete.

Self-report measures

Background variables Participants were asked to indicate their age and gender, following the puzzle task.

Task-related outcomes We measured feelings of competence frustration with respect to the puzzle task with four items of the Dutch version of the Basic Psychological Need Satisfaction and Need Frustration Scale (BPNSNF; Chen et al. 2015). Items were slightly adapted as to refer to competence specifically in the context of the puzzle task. For example, "While engaging in the puzzle task, I felt disappointed in the things I did". All items were rated on a 5-point Likert scale

ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). This scale was reliable (α = .86).

Stimuli selection Stimuli employed in the dot probe task were selected in a two-step procedure based on the procedure of Montalan et al. (2011). First, based on a literature search and a large-scale Dutch language dataset of Moors et al. (2013) including 4300 valued Dutch words, we composed a list consisting of 60 competence-related, 60 incompetence-related and 60 neutral words. In total, 226 undergraduates, who did not participate in either the preliminary or the main study, voluntarily rated these 180 words on a 7-point scale ranging from 1 (*negative*) to 7 (*positive*) during the break of a psychology course. Based on the average ratings, all words were categorized into one of three categories: negative words (< 2.50, $n = 27$), neutral words (3.50–4.50, $n = 121$) and positive words (> 5.50, $n = 22$).

In a second step, eight experts in the field of SDT were asked to further categorize each of the identified positive and negative words as fitting within the categories 'competence-related', 'incompetence-related' and 'other'. When a word was assigned to a category by more than six of the eight assessors, it was assumed to be prototypical of that category, resulting into a further selection of competence-related (i.e., 12) and incompetence-related (i.e., 13) words. From the list of neutral words (as rated by undergraduates) and category-relevant words (resulting from the experts' evaluation), trials of word pairs were composed involving words of equal length (in Dutch, the participants' native language). We ended up with 12 competence-related trials involving the combination of a competence-related word and a neutral word (e.g., *capable–scooter*), 12 incompetence-related trials involving the combination of an incompetence-related word and a neutral word (e.g., *fail–table*), 12 neutral trials involving 2 neutral words (e.g., *plow–ceiling*) and 12 contrasting trials involving both an incompetence- and a competence-related word (e.g., *embarrassment–expert*). Note that competence- and incompetence-related words of, respectively, the competence–neutral and incompetence–neutral trials were used to create these contrast-related trials. Selected words (in Dutch and English) with their average valence, number of letters and assigned category can be found in Appendix.[1]

Assessment of attentional bias The dot probe task was programmed using E-Prime software to record reaction times (RTs) of participants detecting the location of a dot. The stimuli were displayed in the Courier font in black on a white background. Participants were seated at eye level approximately 50 cm from a computer display with a resolution of 1536 × 960 pixels. Both mouse buttons recorded responses with the left key for probes appearing on the left side and the right key for probes on the right side.

Each trial (see Fig. 1) started with a black fixation cross ("+") in the center of a white screen, with a duration randomly varying between 500 and 1000 ms to avoid a routine-based pattern of answering. Next, two words with an equal length were presented simultaneously on, respectively, the left and right side of the screen. The response mapping was programmed in such a way that both congruent and incongruent words were presented as many times on both sides of the screen. Immediately after the presentation of these words, a black dot appeared on the same location of one of the two words. In congruent trials, the dot replaced competence- or incompetence-related words. With respect to the contrasting trials, in which trials consisted of a competence- and incompetence-related word, congruent trials were defined when the dot appeared on the location of the incompetence-related word. Participants had a maximum response time of 1000 ms. When a response was registered, the dot disappeared and the next trial was initiated. When no response was given, the following message appeared: "no response was detected".

In total, the task contained 404 trials. In the training phase, participants completed 20 trials in which meaningless strings of letters with equal lengths were presented as stimuli (e.g., *bbbb–bbbb*). The test phase contained four blocks, each including 96 trials. Within each block, all four trial types were presented twice with equal numbers of trials ($n = 12$). Across the test phase, the response mapping for each word pair was presented twice.

Attentional bias: bias index score For each trial type we subtracted mean RTs for congruent trials from mean RTs for incongruent trials, resulting in scores for competence bias, incompetence bias and contrast bias. A positive competence bias score then reflects selective attention towards competence-related words, while a negative incompetence bias score indicates avoidance of incompetence-related words (e.g., Mogg et al. 2000). In case of bias scores for contrasting trials, a negative contrast bias score reflects more focus on competence-related words.

Results and brief discussion

Data preparation

We sorted data of the dot probe task by removing all incorrect responses and outliers from the data analyses (Koster

[1] At the end of the lab session in the preliminary study, we checked whether participants of the preliminary study understood and interpreted the presented words in the dot probe task in accordance with the set categories. While all 'competence-related' and 'incompetence-related' words were correctly classified into their respective categories, 21 neutral words were not correctly interpreted. These words were replaced in preparation of the main experiment (see Appendix).

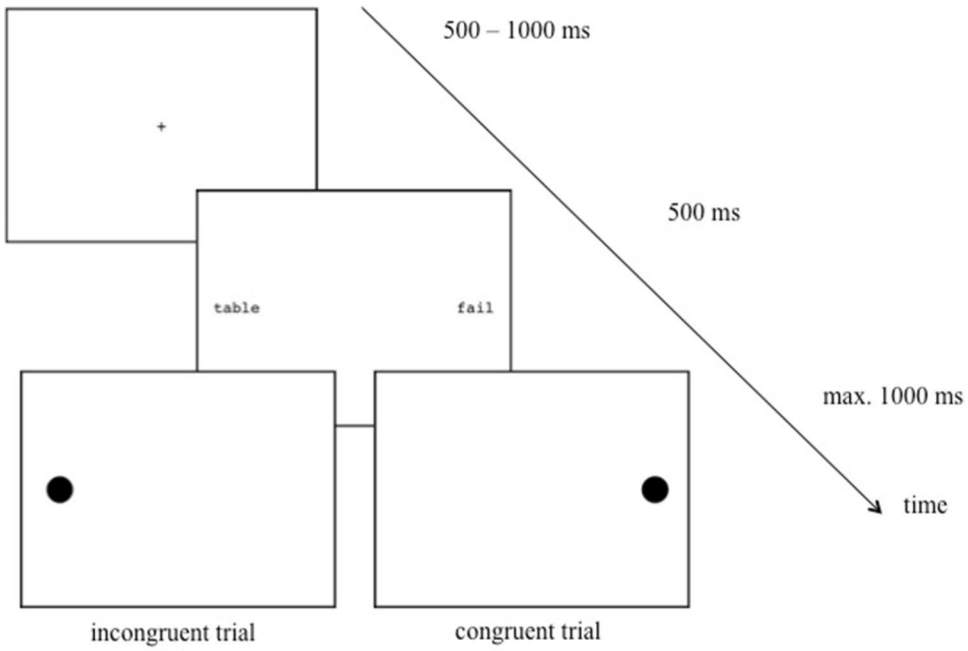

Fig. 1 Visual presentation of a congruent and incongruent incompetence-related trial in the dot probe task

et al. 2004). Individual outliers were defined as all RTs of the correct responses with a deviation of more than two standard deviations from the mean RT. In total, 3.10% of the data contained errors and individual-aggregated outliers made up for 3.97% of all remaining correct responses (M_{low} = 227.74, SD = 31.09; M_{up} = 542.04, SD = 69.95; range 145.49–809.96).

Background variables

ANOVA tests revealed no effect of age and gender on the dependent variables (all F-values had $p > .05$).

Reliabilities and correlations

First, we calculated the split-half reliabilities for all trial types employing a Spearman–Brown correction. All trial types were highly reliable (with reliabilities ranging between .91 and .99). Second, correlations revealed a positive association between feelings of competence frustration during the puzzle task and competence bias scores (r = .34, $p < .001$). Such a pattern of correlates was not observed for incompetence (r = .17, p = .14) or for the contrast bias score (r = − .12, p = .32).

This preliminary study indicated that an attentional bias towards (in)competence-relevant cues can be assessed in a reliable way and that experienced competence frustration during a preceding puzzle task relates to a heightened accessibility of competence-related cues. Equipped with this measure to tap into attentional bias, we proceeded to the main study, which involved experimentally exposing participants to different types of feedback (i.e., negative and positive) as to examine whether this attentional bias could be experimentally induced and would foster a process of need-restoration.

Main study

Method

Participants Sixty undergraduates (M_{age} = 21.95, SD_{age} = 3.00; range 17–32; 68% female) studying psychology at Ghent University participated in the main study. None of these participants participated in the preliminary study. The experiment lasted for 1 h and participants received 10 Euros upon termination. Prior to participation, all participants were informed that participation was voluntary, that they could withdraw at any moment and they were asked to complete an informed consent.

Procedure

After on-line registration, participants completed an online questionnaire which concerned their age, gender and resilience. In the lab, participants were introduced to the TPT in a similar way as in the preliminary study.

Participants were randomly assigned to either a mild positive or a mild negative feedback condition. Upon completion of the puzzle task, participants in the positive and negative feedback condition were informed that they, respectively, scored better or worse than 50% of their peers. To further strengthen this manipulation of participants' competence

feelings, the level of difficulty of the provided puzzles across conditions was varied. While participants in the positive feedback condition received four easy and one difficult puzzle, their peers in the negative feedback condition received four difficult puzzles and one easy puzzle. Importantly, all puzzle books had the same title ('Puzzle book') as to mask any differences in the difficulty level. After receiving condition-congruent feedback, participants' feelings of competence and the perceived task difficulty was assessed.[2]

After completing the first questionnaire, participants moved on to the dot probe task (cfr. the preliminary study). After finishing the dot probe task, participants were asked to wait for a little while as the next participant had already arrived and needed to be introduced first. Participants were told to stay in the room until the experimenter returned. Although some studies observed participants' urge to restore their competence in another task (e.g. Fang et al. 2018; Radel et al. 2013), here participants were given the opportunity to continue working on either the old puzzles or three new puzzle books (Vansteenkiste and Deci 2003). While the experimenter pretended receiving a new participant, in reality he observed participants covertly for 7 min behind a one-way mirror and recorded their behavioral persistence (i.e., free-choice paradigm; Deci 1971). After 7 min, the experimenter re-entered the room and asked the participants to complete the last questionnaire tapping into their feelings of competence frustration for a second time. Upon completion, participants were debriefed about the procedure and goal of the study (including detailed information about the manipulation), they received 10 Euros in exchange for their participation and were thanked. The study was approved by the University's Ethical Committee.

Measures

Resilience We measured levels of resilience using the Connor–Davidson Resilience Scale (Campbell-Sills and Stein 2007) (e.g. "Coping with stress makes me stronger"; α = .86; 10 items). In contrast to other context-specific questionnaires (e.g. Cassidy 2015), the 10 item-CDRS is a widely recognized and well-validated measurement of resilience (see Windle et al. 2011 for review) in different cultures (e.g. Notario-Pacheco et al. 2011) and populations (e.g., Wang et al. 2010). Responses were given on a 5-point Likert scale ranging from 1 (*not at all true*) to 5 (*totally true*).[3]

Task-related outcomes As in the preliminary study, feelings of competence frustration were assessed with four items of the BPNSNF scale (Chen et al. 2015). In contrast with the preliminary study, this scale was now completed not only immediately following the puzzle task (α = .84), but also after the free-choice period (α = .86). All participants, irrespective of whether they continued with the puzzle task or not, completed both measures.[4,5]

Persistent behavior During the free-choice period, the experimenter recorded the time spent by the participants on the puzzle task (in seconds). Persisting participants spent on average 186.25 s on solving the puzzle task. No differences were found between the number of persisting and non-persisting participants in both conditions [$\chi^2(1) = 1.875$, $p = .17$].

[2] In addition to the operationalized negative and positive feedback conditions, 30 participants (60% female; $M_{age} = 22.01$, $SD_{age} = 4.45$; range 18–37) received no feedback after solving a combination of difficult and easy puzzles. A MANOVA contrasting the negative with the no feedback condition produced similar results as those obtained for the comparison of the positive and negative feedback condition (Wilks' Lambda = .80, $F(5, 53) = 2.66$, $p = .03$). Participants who did not receive feedback reported significantly lower competence frustration [$F(1, 57) = 4.47$, $p = .04$], higher intrinsic motivation [$F(1, 57) = 4.48$, $p = .04$], a lower competence bias [$F(1, 57) = 4.86$, $p = .03$] compared to those in the no feedback condition. Additionally, there were no differences in terms of the duration of persistent behavior [$F(1, 57) = .63$, $p = .43$] and feelings of competence frustration after the free-choice period [$F(1, 57) = .02$, $p = .90$].

[3] One of the reviewers raised the question to what extent the concepts resilience and competence satisfaction are similar measurements. To explore this issue, we performed additional analyses. Specifically, we performed two confirmatory factor analyses with the first analysis modeling two separate factors (i.e., items relating to resilience and competence satisfaction were modeled as two factors) [CFI = .89, AIC = 1678.75, $\chi^2(76) = 121.97$, $p = .001$] and the second analysis modeling a single-factor [CFI = .82, AIC = 1703.48, $\chi^2(77) = 148.70$, $p = .000$]. A Chi square comparison test between both models revealed that the first model, including two factors, had a significant better fit with respect to the data ($\chi^2_{diff}(1) = 26.73$, $p < .001$).

[4] In addition to feelings of competence frustration, we also measured feelings of competence satisfaction. Participants in the negative, relative to those in the positive, feedback condition reported less competence satisfaction after the puzzle task (but not after the free-choice period). In addition, the restorative movement over time was also found for competence satisfaction such that participants, who received negative feedback, reported significantly improved competence satisfaction in case they had a strong attentional bias for competence-related words.

[5] In the main study, participants' level of intrinsic motivation with regard to the puzzle task was assessed using the subscale 'pleasure and interest' of the Intrinsic Motivation Inventory (McAuley et al. 1989; 4 items; $\alpha_{main} = .90$). Self-reported intrinsic motivation correlated negatively with feelings of competence frustration ($r = -.46$, $p < .01$) and participants who received positive feedback reported higher intrinsic motivation ($M = 5.28$, $SD = 1.13$) compared to participants who received negative feedback [$M = 4.23$, $SD = 1.37$; $t(87) = 3.27$, $p < .01$], a finding documented in earlier research (e.g., Vansteenkiste and Deci 2003).

Table 1 Descriptive statistics and Pearson correlations between the study variables (main study)

		M	*SD*	1	2	3	4	5	6
Baseline assessment									
(1)	Resilience	2.87	0.58	–					
Assessment after puzzle solving activity									
(2)	Competence frustration	2.77	0.98	− .05	–				
(3)	Competence-related attentional bias	4.27	12.20	.10	.02	–			
(4)	Incompetence-related attentional bias	5.58	14.33	− .12	− .08	.06	–		
(5)	Contrast in attentional bias	1.26	10.53	.19	− .13	− .00	.09	–	
(6)	Behavioral persistence	167.58	174.51	.33*	− .16	.19	− .01	.09	–
Assessment after free choice period									
(7)	Competence frustration	2.55	0.97	− .45**	.49**	− .05	.11	− .19	− .24^{+}

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$

Results

Descriptive statistics and preliminary analyses

Data preparation

Similar to the preliminary study, data from the dot probe task were prepared by removing all incorrect responses (3.30% of the data; $M = 13.30$; $SD = 14.74$; range = 0–109) and all outliers (4.02% of correct responses; $M_{low} = 260.16$, $SD = 37.17$; $M_{up} = 554.58$, $SD = 69.39$; range = 51–995).

Background variables

Independent *t*-tests indicated that there were no significant differences in age and resilience (all *t*-values had $p > .05$) between the conditions, while a non-significant Chi square test indicated that male and female participants were equally distributed across both condition ($\chi^2 = 1.93$, $p = .17$). A multivariate analysis of variance analysis (MANOVA) involving gender as the independent variable and both resilience and assessed outcomes as dependent variables evidenced a multivariate effect [Wilks' Lambda = .70, $F(7, 51) = 3.07$, $p = .01$, $\eta^2 = .30$], with men and women differing in terms of resilience [$t(58) = 2.56$, $p = .01$], persistence [$t(58) = 2.23$, $p = .00$] and competence frustration after the free-choice period [$t(58) = 2.23$, $p = .03$]. All gender differences were in the same direction, with men reporting a higher level of resilience ($M = 3.12$; $SD = .48$), displaying more persistence ($M = 241.50$; $SD = 172.56$) and indicating less competence frustration ($M = 1.89$; $SD = .44$) compared to women (resilience: $M = 2.73$; $SD = .60$, persistence: $M = 135.90$; $SD = 169.28$, competence frustration: $M = 3.34$; $SD = .68$). Given these gender effects, we controlled for gender in all main analyses.

Correlations

In line with the preliminary study, the split-half reliabilities for all trial types in the dot probe task employing a Spearman–Brown correction showed highly reliable trial types (with reliabilities ranging between .91 and .98). Correlations between the study variables can be found in Table 1. Only a few correlations were found to be significant, with a positive correlation between resilience and persistence and a negative correlation between resilience and feelings of competence frustration after the free-choice period. Also, the two measures of competence frustration, collected at different time points, were positively correlated, indicating that participants who reported competence frustration after the puzzle task also reported competence frustration after the free-choice period.

Primary analyses

Hypothesis 1: effect of manipulation

Participants rated the experimentally varied feedback as highly credible on a 5-point Likert scale ($M = 4.18$, $SD = 0.87$). To examine the effect of feedback on the dependent variables, a multivariate analysis of covariance (MANCOVA) was performed with condition as a fixed factor, competence (after puzzle task and after free-choice period) and bias scores (competence, incompetence and contrast) as dependent variables and gender as a covariate. Overall, condition had a significant multivariate effect on the dependent variables [Wilks' Lambda = .70, $F(5, 53) = 4.64$, $p = .001$, $\eta^2 = .30$]. As we found a violated normality assumption for persistence, we performed an Independent-Samples Mann–Whitney U test, retaining the null hypothesis of equal distributions for persistence across condition. Means with standard deviations, confidence intervals, *F*-values and effect sizes are presented in Table 2.

Table 2 Means and standard deviations of assessed outcomes per condition together with F-value, *p* value and effect sizes of condition comparison (main study)

	Negative feedback *M* (*SD*) [95% CI]	Positive feedback *M* (*SD*) [95% CI]	*F*-value	*p*-value	η^2
Competence frustration (post-puzzle task)	3.10 (0.94) [2.76; 3.45]	2.43 (0.94) [2.09; 2.78]	8.29	.01	.13
Competence-related attentional bias	7.39 (9.84) [2.92; 11.86]	1.27 (13.80) [− 3.13; 5.66]	3.54	.06	.06
Incompetence-related attentional bias	3.39 (12.75) [− 1.97; 8.74]	7.80 (15.83) [2.54; 13.06]	1.58	.22	.03
Contrast in attentional bias	− .15 (11.64) [− 4.09; 3.80]	2.67 (9.51) [− 1.21; 6.55]	1.38	.25	.02
Behavioral persistence	184.52 (185.44) [119.36; 249.67]	151.20 (164.74) [87.14; 215.26]	.53	.48	.01
Competence frustration (post-free-choice)	2.42 (0.96) [2.06; 2.79]	2.70 (0.99) [2.34; 3.01]	.36	.55	.00

Table 3 Standardized beta-coefficients of multiple regression analyses with condition, resilience, and their interaction as predictors of the assessed outcomes (main study)

	Competence frustration (post-puzzle)	Competence-related attentional bias	Incompetence-related attentional bias	Contrast in attentional bias	Behavioral persistence
Gender	.09	− .01	− .12	− .08	− .21
Condition	− .38**	− .23^{+}	.15	.19	− .01
Resilience	− .09	.06	− .13	.21	.27*
Condition × resilience	− .26*	− .25^{+}	.06	− .19	− .16

Note. $^{+}p < .10$, $*p < .05$, $**p < .01$

Participants in the negative feedback condition reported significantly more competence frustration after the puzzle task (but not after the free-choice period) and displayed a marginally significantly stronger competence bias score compared to the participants in the positive feedback conditions. No other significant effects emerged.

Hypothesis 2: the role of resilience

To examine the moderating role of resilience in the relation between feedback and outcomes, a series of regression analyses were performed with condition, resilience, and their interaction as predictors. The interaction term was created by multiplying condition with the z-scored resilience (Schielhetz 2010). As can be noticed in Table 3, resilience was unrelated to experienced post-puzzle competence frustration and to attentional bias, but did predict greater behavioral persistence during the free choice period ($\beta = .27$, $p = .04$). Further, resilience interacted with condition in the prediction of both competence frustration ($\beta = -.26$, $p = .03$) and attentional bias ($\beta = -.25$, $p = .055$). As can be seen in Fig. 2a, participants scoring high and average on resilience (scoring one standard deviation above the mean and on average, respectively) benefitted more from receiving positive feedback, relative to receiving negative feedback [$t(4)_{\text{high resilience}} = 29.03$, $p < .001$; $t(33.94)_{\text{average resilience}} = 13.78$, $p < .001$; $t(5.12)_{\text{low resilience}} = -1.24$, $p = .27$]. The same effect was found for scores of competence-related attentional bias, such that participants scoring high and average on resilience had a stronger attentional bias towards competence-related words as a function of the experimental induced feedback [$t(4)_{\text{high}} = 27.84$, $p < .001$; $t(35.08)_{\text{average}} = 12.72$, $p < .001$; $t(4)_{\text{low}} = 1.73$, $p = .08$].

Hypothesis 3: the role of competence bias

Finally, we sought to examine whether the attentional bias scores would be functional with respect to a decrease in competence frustration over time. In doing so, we performed mixed-effects models in R with the lmer package (Bates et al. 2015, R Development Core Team 2011). Parameter estimates for the best fitting model are given in Table 4. First, we found a significant two-way interaction effect for time and condition, indicating a decrease of competence frustration over time for those participants who received negative feedback. Additionally, a significant three-way interaction effect for time, condition and competence bias scores indicates time-related changes in competence frustration occurring especially for participants in the negative feedback condition who displayed a positive competence bias (Fig. 3). Specifically, those participants reported a stronger time-related decrease in competence frustration after receiving negative feedback, which is indicative of a need-restoration process.

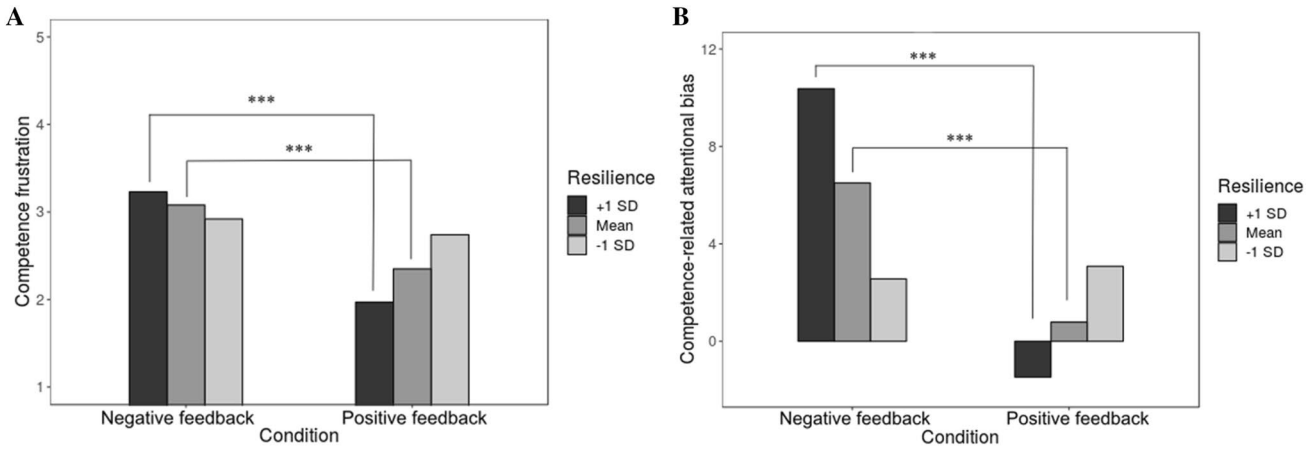

Fig. 2 The interaction between resilience and condition on post-puzzle competence frustration (**a**) and competence-related attentional bias (**b**) (main study)

Table 4 Main effects and interactions using linear-mixed models (main study)

	Estimate	SE	*df*	*t*-value	Pr > [*t*]	95% CI
Intercept	3.08	.39	110.17	7.84	< .001***	[2.31; 3.84]
Gender	.66	.25	55	2.68	.01**	[.18; 1.14]
Condition	− 1.37	.44	95.38	− 3.10	.003**	[− 2.24; − .50]
Competence-related attentional bias	.04	.03	98.28	1.57	.12	[− .01; .10]
Time	− .51	.19	56	− 2.62	.01*	[− .89; − .13]
Condition*bias	− .08	.04	99.27	− 2.34	.02*	[− .15; − .01]
Condition*time	.75	.25	56	3.02	.004**	[.26; 1.23]
Time*bias	− .03	.02	56	− 1.63	.11	[− .06; .01]
Condition*time*competence bias	.05	.02	56	2.38	.02*	[.01; .09]
R^2 *marginal*	.18					
R^2 *conditional*	.65					

Note. $^{+}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

General discussion

Competence is part of people's daily life. Now and then, people encounter competence-frustrating experiences, which can be very intense or rather mild. An increasing number of studies (e.g., Fong et al. 2018) have shown that the provision of negative feedback thwarts people's feelings of competence, a finding which got confirmed in the present study. In line with previous research (e.g., Vallerand and Reid 1984), participants who received negative feedback reported stronger feelings of competence frustration, relative to participants who received positive feedback. Fang et al. (2018) showed that such high levels of competence frustration result in a stronger subjective evaluation of the situation, as measured by a loss–win difference wave in EEG data. In particular, participants who solved a difficult task showed a stronger urge to experience success in a subsequent task compared to participants who solved an easy task. Thus, they displayed a stronger affective desire for competence. The current study aimed to add to this literature by examining whether an attentional bias is involved in people's handling of competence-thwarts and whether especially individuals scoring high on resilience would better deal with experiences of failure.

Attentional bias among individuals high in resilience

Previous research has shown that need-relevant information becomes more readily available when participants were thwarted in their need for autonomy (Radel et al. 2011, 2013). That is, participants had a stronger attentional bias for autonomy-related cues as assessed in a lexical decision task. However, the idea of an attentional bias as a restorative mechanism has not yet been examined with respect to the need for competence, another essential psychological nutrient for intrinsic motivation and well-being (Ryan and

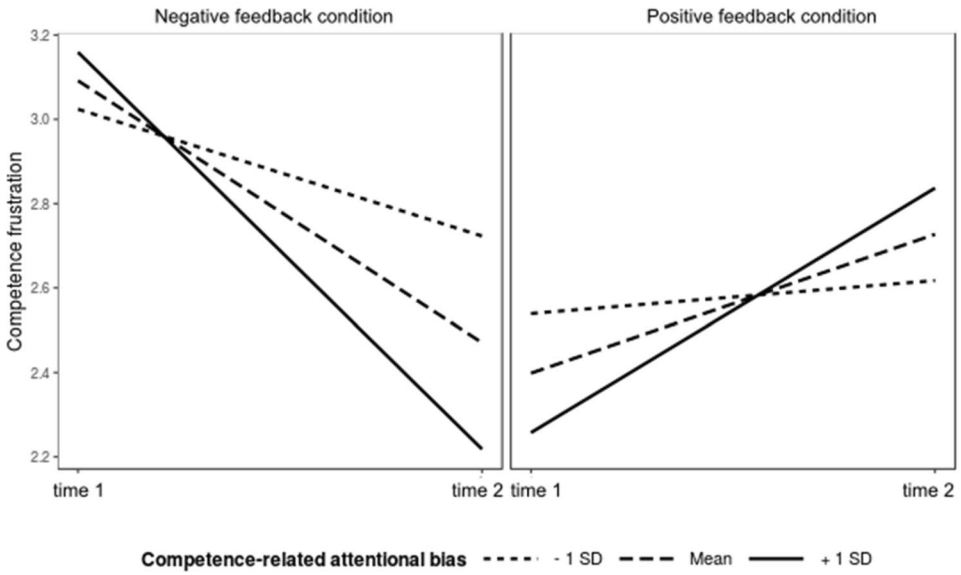

Fig. 3 Three-way interaction between time, competence bias and manipulated feedback on restoration in competence (main study)

Note. Time contains the levels (1) 'after puzzle task' and (2) 'after the free-choice period'

Deci 2017). In an attempt to contribute to this field, we first conducted a preliminary study using a dot probe task. Participants worked freely (i.e., under non-experimental circumstances) at a puzzle task. Those who reported higher feelings of failure and inadequacy (i.e., competence frustration) displayed a stronger bias for competence-related words. These findings indicate that the experience of competence frustration may come with a more pronounced attentional focus on competence-related information, although a similar bias for incompetence-related words was not evident.

In the main experimental study, we induced feelings of competence frustration and sought to investigate whether especially individuals scoring high on resilience would display an attentional bias. Resilience is a fairly generic concept that refers to people's capacity to display an adaptive reaction towards negative stressors and adversities in the environment (Fletcher and Sarkar 2012). Since this concept did not receive a lot of attention in the SDT-literature in particular, we experimentally induced such adversity through the provision of negative feedback. Confirming the induction of this adversity, participants reported higher feelings of competence frustration after receiving negative feedback, together with an attentional bias for competence-related words in the dot probe task. Apparently, participants felt more insecure about their skills and capabilities to complete the puzzle task after receiving negative feedback, which may lead them to draw their attention more easily to competence-related cues. However, this effect only occurred among individuals who scored high and on average on resilience. Presumably, these individuals are more eager to try and to overcome setbacks and may therefore more easily draw their attention to competence-related cues. Possibly, also in the earlier work by Radel et al. (2011), the effect of autonomy-thwarts on participants' subsequent sensitivity for autonomy-related cues may have been more pronounced among individuals high in resilience.

Two additional findings deserve being noticed. First, an alternative, possibly more parsimonious, explanation for the moderating role of resilience in the prediction of an attentional bias is that the provided feedback, either positive or negative, affected the competence frustration of high resilient individuals only (see Fig. 2a). Because the negative feedback did not increase competence frustration among participants low in resilience, there was no need for them to orient their attention to competence-related cues. Notably, the enhanced sensitivity for either positive or negative feedback among individuals high in resilience is consistent with the differential susceptibility hypothesis (Belsky 1997). According to this perspective, difficulty susceptibility can be inferred when individuals display an enhanced susceptibility to the negative and positive effects of, respectively, growth-impeding and growth-conducive environments. This is exactly the pattern we noticed for individuals scoring high on resilience in both conditions.

Second, only the attentional bias towards competence-related and not incompetence-related cues got activated in response to negative feedback among individuals high in resilience. Possibly, the mild negative feedback, signaling participants they performed worse than 50% of their peers, may account for the observed *specificity* in the activated attentional bias. In case a stronger manipulation was used, participants' attention may also have been drawn to incompetence-related cues, thereby more readily instigating a process of helplessness (Seligman 1975). Future research

may examine the critical threshold for the attentional bias towards competence- and incompetence-related cues by systematically varying the intensity of the provided negative and positive feedback.

The need-restoring function of attentional bias

Next, we found some evidence for the proposed hypothesis that an elevated competence bias may represent a need-restorative mechanism. By measuring competence frustration immediately following the termination of the puzzle task and after the free-choice period, we could examine whether the elevated competence bias may contribute to a shift, that is, a decrease in competence frustration over time. This appeared to be the case, with individuals displaying the competence-bias being more capable of restoring their thwarted need. This finding is in line with the bio-psychological model (Borrell-Carrio et al. 2004) which maintains that exposure to a negative or harmful situation activates a number of brain networks oriented towards the handling—or coping with—the current situation (e.g. Turk and Monarch 2002). In particular, the visual–attentional system entails a change in one's awareness and perception towards stimuli that are congruent with the encountered negative feelings (Baron 2008; Pfabigan and Tran 2015). In the current study, the increased sensitivity for competence-related words reflects a biased attentional orientation of the visual–attentional system (van Elk 2015; Thorpe and Salkovskis 1997), which seems functional.

The present findings mesh with the idea that processes of attention deployment can reduce the emotional impact of the situation by shifting attention towards functional information (Gross 1998). By shifting the focus to competence-related cues, participants may have been able to maintain their focus during the puzzle solving during the free choice period. More generally, this finding is in line with past work among clinical populations, which indicated that training clients' attentional allocation to focus on positive stimuli resulted in reduced symptoms of anxiety and depression (e.g. MacLeod et al. 2002).

At the same time, this finding should not be overstated and deserves replication. In particular, it is still unclear for which reasons such a competence bias may be functional for participants to restore their thwarted need. Such an attentional bias represents a rather *mechanistic* process which by itself may not suffice to achieve recovery of one's thwarted needs. Said differently, it may represent only a first step in a full-fletched process of need restoration, with other critical coping mechanisms required for the thwarted need to get compensated. The activated attentional bias may be part of an early alarm stage (Radel et al. 2011), which sets in motion a variety of coping strategies that not only mobilize, orient, and guide participants' attention, as studied herein, but also their behavior and emotions (Skinner and Zimmer-Gembeck 2007). As a result, other coping strategies are likely to be involved, with some of these strategies specifically activated under competence thwarting conditions (e.g., problem solving, helplessness; Skinner et al. 2003). Specifically, the herein detected process of attentional bias may trigger subsequent processes of adaptive emotional and behavioral regulation (e.g. Tugade and Fredrickson 2004; Wadlinger and Isaacowitz 2008) that further help to account for the restoring effect of attentional bias. Preliminary evidence for this possibility comes from past work showing a reduction in stress after participants' attention was drawn to positive stimuli (e.g. Johnson 2009; Lee and Telch 2008; Luecken et al. 2004), which may positively impact on participants' capacity to engage in successful problem solving.

Notably, the activation of these coping strategies may also help explain why the manipulated feedback did not affect participants' persistence during the free-choice period, as documented in earlier research (Vansteenkiste and Deci 2003). That is, the attentional bias and associated coping strategies could overpower the persistence-undermining effects of negative feedback. Alternatively, participants' reasons for persisting in both conditions may have been different, with those in the negative feedback condition displaying more introjected and less intrinsic reasons for persistence (Ryan 1982; Vansteenkiste and Deci 2003; Van der Kaap-Deeder et al. 2016).

Limitations

First, given the choice of a convenience sample (i.e., university students) and the choice of our measure tapping into attentional bias (i.e., dot probe task), the present findings are in need of replication before drawing any general conclusions. Different samples (e.g. clinical groups, children, parents) and different behavioral reaction time measures, such as the Stroop task (1935), Posner Cueing task (1980) or the Visual Search task (Treisman and Gelade 1980), could be used in future work. Additionally, reaction times only provide a specific and instant measurement of allocated attention, while methodologies like event-related potentials in EEG data enable us to explore more temporal dynamics of attentional processes (Pfabigan and Tran 2015).

Second, our used measure of resilience exclusively taps into intrapersonal features of resilience, thereby failing to assess interpersonal features (e.g. Nichols 2013) that may also be operative in individuals' attentional bias. For example, previous research has found that individuals have the tendency to respond to stressors like a traumatic event by seeking social support from friends and family members (e.g., Martin et al. 2015; Walsh 2012).

Conclusion

The goal of this study was to investigate how people deal with feelings of competence frustration. We found evidence for resilience as a critical factor predicting participants' attentional bias towards competence-related information in response to negative feedback. In turn, this activated attentional bias contributed to a restoration of participants' thwarted competence. Despite the added value of these findings to basic psychological need theory, more research is needed to examine the functional role of an activated attentional bias in handling need restoration, by preference in combination with task-specific coping styles.

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Compliance with ethical standards

Conflict of interest Authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with animals performed by any of the authors. All procedures performed in studies involving human participants were in accordance with the Ethical Standards of the Institutional and/or National Research Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Appendix

List of stimuli as a function of trial types with number of letters (N) and average valence

	Word (*English*)	N	Valence	Word (*English*)	N	Valence
Incompetence versus neutral trials						
(1)	Inefficiënt (*inefficient*)	11	2.12	Hoogachtend (*sincerely*) Bijenhoning (*honeybee*)	11	4.15 4.37
(2)	Floppen (*flop*)	7	2.49	Pleiten (*argue*) Brengen (*bring*)	7	4.04 4.48
(3)	Falen (*fail*)	5	1.64	Tafel (*table*)	5	4.04
(4)	Onbekwaam (*inept*)	9	2.10	Gemiddeld (*average*) Afrikanen (*Africans*)	9	3.74 3.86
(5)	Afgang (*embarrassment*)	6	1.76	Kikker (*frog*)	6	4.19
(6)	Blunder (*blunder*)	7	2.31	Gordijn (*curtain*)	7	4.08
(7)	Gefaald (*failed*)	7	1.71	Hagedis (*lizard*)	7	4.01
(8)	Misser (*miss*)	6	2.13	Paneel (*panel*)	6	4.11
(9)	Incompetent (*incompetent*)	11	2.02	Binnenschip (*barge*)	11	4.22
(10)	Misluk-keling (*failure*)	12	1.71	Sentimenteel (*sentimental*) Zwaarbewolkt (*cloudy*)	12	4.13 3.70
(11)	Buizen (*flunk*)	6	2.08	Ladder (*ladder*)	6	4.02
(12)	Incapabel (*incapable*)	9	2.14	Scharnier (*hinge*)	9	3.89
Competence versus neutral trials						
(1)	Vertrouwen (*confide*)	10	5.99	Verrichten (*conduct*) Aanbrengen (*affixing*)	10	4.31 4.03
(2)	Slim (*smart*)	4	5.97	Knop (*button*)	4	3.97
(3)	Talent (*talent*)	6	5.86	Orgaan (*organ*) Bouten (*bults*)	6	4.35 4.28
(4)	Capabel (*capable*)	7	5.58	Stempel (*stamp*)	7	4.15
(5)	Expert (*expert*)	6	5.53	Karton (*cardboard*)	6	3.86
(6)	Bedreven (*skilled*)	8	5.61	Vermogen (*power*)	8	4.16
(7)	Bekwaam (*capable*)	7	5.55	Scooter (*scooter*)	7	4.16
(8)	Behendig (*agile*)	8	5.54	Overgave (*submission*) Klassiek (*classic*)	8	3.78 4.10
(9)	Kennis (*knowledge*)	6	5.5	Knopen (*knots*)	6	3.95

	Word (*English*)	N	Valence	Word (*English*)	N	Valence
(10)	Succes (*success*)	6	5.96	Sessie (*session*) Figuur (*figure*)	6	3.96 4.18
(11)	Capaciteit (*capacity*)	10	5.63	Maarschalk (*marshal*)	10	3.74
(12)	Competent (*competent*)	9	5.56	Medeweten (*consent*) Kandelaar (*candle*)	9	4.01 3.96
Neutral versus neutral trials						
(1)	Vierkant (*square*)	8	4.15	Verbaasd (*surprised*) Overname (*takeover*)	8	4.12 3.78
(2)	Trechter (*funnel*)	8	3.89	Onbekend (*unknown*) Stelling (*claim*)	8	3.50 3.72
(3)	Grijnzen (*grin*) Spreiden (*spread*)	8	3.71 3.93	Delicaat (delicate) Voortuin (*front yard*)	8	3.90 4.05
(4)	Impulsief (impulsive) Nationaal (*national*)	9	3.67 3.63	Gewichtig (*momentous*) Televisie (*television*)	9	3.61 3.72
(5)	Vragend (*asking*) Browser (*browser*)	7	4.06 4.26	Terrein (*area*)	7	3.98
(6)	Tellend (*counting*) Anoniem (*anonymous*)	7	4.06 3.82	Staande (*standing*) Fontein (*fontain*)	7	4.09 4.15
(7)	Spoelen (*flush*)	7	3.93	Snellen (*rush*) Bestaan (*exist*)	7	3.97 4.11
(8)	Serieus (*serious*) Vroeger (*past*)	7	3.84 3.69	Schroef (*propeller*)	7	3.84
(9)	Schalen (*bowls*)	7	3.79	Rooster (*schedule*)	7	3.75
(10)	Ploeger (*plow*)	7	3.83	Plafond (*ceiling*)	7	3.94
(11)	Pamflet (*pamphlet*)	7	3.87	Makreel (*mackerel*)	7	3.77
(12)	Loodsen (*guide*)	7	3.58	Knippen (*cut*) Vliegen (fly)	7	3.91 4.45

	Word (*English*)	N	Valence	Word (*English*)	N	Valence
Incompetence versus competence trials						
(1)	Inefficiënt (*inefficient*)	11	2.12	Vertrouwen (*confide*)	10	5.99
(2)	Floppen (*flop*)	7	2.49	Capabel (*capable*)	7	5.58
(3)	Falen (*fail*)	5	1.64	Slim (*smart*)	4	5.97
(4)	Onbekwaam (*inept*)	9	2.10	Competent (*competent*)	9	5.56
(5)	Afgang (*embarrassment*)	6	1.76	Expert (*expert*)	6	5.53
(6)	Blunder (*blunder*)	7	2.31	Bekwaam (*capable*)	7	5.55
(7)	Gefaald (*failed*)	7	1.71	Talent (*talent*)	6	5.86
(8)	Misser (*miss*)	6	2.13	Succes (*success*)	6	5.96
(9)	Incompetent (*incompetent*)	11	2.02	Bedreven (*skilled*)	8	5.61
(10)	Mislukkeling (*failure*)	12	1.71	Capaciteit (*capacity*)	10	5.63
(11)	Buizen (*flunk*)	6	2.08	Kennis (*knowledge*)	6	5.51
(12)	Incapabel (*incapable*)	9	2.14	Behendig (*agile*)	8	5.54

Note. Numbers of letters are based on words translated in Dutch. Underlined words and averages scores refer to the replaced words (see preliminary study, word selection). For contrast-related trials, numbers of letters do not match exactly

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