



# Challenge and threat appraisal of entrepreneurial errors: a latent profile analysis and examination of coping responses

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Accepted: 4 February 2023 / Published online: 21 February 2023  
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## Abstract

According to transactional stress theory (TST), the extent to which entrepreneurs cope with errors by engaging in error damage control or ruminating about disengaging from their business goals depends on whether they interpret action errors as predominantly challenging or threatening. Using latent profile analysis (LPA), the current study investigates the existence of latent profiles of challenge and threat appraisal of entrepreneurial errors and their relationship with error damage control and rumination about business goal disengagement in a sample of 649 entrepreneurs. The results identify five appraisal profiles characterized by different challenge and threat appraisal intensities. The levels of error damage control and rumination about business goal disengagement differed between the profiles. Specifically, entrepreneurs high in challenge and threat appraisal showed higher levels of both forms of coping than those low in appraisal. Entrepreneurs falling into a high challenge and low threat appraisal profile exhibited the lowest level of business goal disengagement. Still, they showed similar levels of error damage control to those high on challenge and threat appraisal. Implications for the further development of TST and the development of effective error management interventions are discussed.

**Keywords** Entrepreneurs · Error management · Cognitive appraisal · Latent profile analysis

Entrepreneurs have to deal with high levels of uncertainty, which makes their jobs particularly demanding and stressful while also increasing the likelihood of encountering unforeseen work-related hassles, such as action errors. Action errors are unintended instances of goal non-achievement caused by deviations from plans, inadequate feedback processing, or a lack of knowledge (Frese & Zapf, 1994). They interfere with an intended course of action and are considered adverse work events (King & Beehr, 2017). However, according to the transactional stress theory (TST; Lazarus, 1966), adverse (work) events, such as action errors, may not necessarily lead to negative outcomes. Instead, the consequences of stressful encounters depend on the way they are appraised by the individual.

In other words, the appraisal of events (in this case, the action error) determines behavioral reactions. Individuals who appraise an event as a challenge with the potential for future growth and development are likely to make active attempts to mitigate the negative consequences of the event. This form of attempting to actively manage stressful events is called problem-focused coping. On the contrary, if individuals appraise an event as threatening, they may consider withdrawing from the source of the threat to mitigate the experience of negative emotions. The focus on dealing with negative emotions in response to the event is called emotion-focused coping (Folkman, 1984).

Error management theory (Frese & Zapf, 1994) applies the principles of TST to the context of dealing with action errors. Specifically, if individuals perceive action errors as challenges that can be overcome and that form a natural part of the learning process, they may engage in error damage control. This form of positive error handling represents a problem-focused coping strategy in line with TST. In contrast, if errors are perceived as events that should be avoided at all costs, entrepreneurs may interpret making errors as a sign of poor performance, thus starting to ruminate about whether or

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not they should continue striving to reach their business goals. In that case, actions necessary to correct the error may be delayed, and negative consequences have more time to unfold. This form of negative error handling represents an emotion-focused coping strategy in line with TST (Frese & Keith, 2015).

Research has framed challenge and threat appraisal as two mutually exclusive forms of cognitive appraisal. Some scholars have contested this conception (Searle & Auton, 2015; Webster et al., 2011). According to Webster et al. (2011), TST suggests that stressors can be appraised as both challenges and hindrances simultaneously. The first goal of the current research is to provide insights into the existence of cognitive appraisal profiles in terms of combinations of different levels of simultaneous challenge and threat appraisal of action errors (Searle & Auton, 2015; Webster et al., 2011). According to Webster et al. (2011), “the assumption that all people make the same appraisal under the same circumstances and that appraisal can only lead to one of two distinctions (challenge and/or hindrance), are not consistent with the basic tenets of the appraisal theories of stress” (p. 506). This is the first study that rigorously tests the tenets of TST in the entrepreneurship context by investigating the occurrence of appraisal profiles, thus potentially advancing entrepreneurial stress theory and research. In addition, while it has been shown that the appraisal of stressors matters for entrepreneurs’ coping responses (Bennett et al., 2021), we lack insight into the consequences of simultaneous challenge and threat appraisal in line with TST. Understanding the predictors of entrepreneurs’ coping is relevant because positive error handling (i.e., problem-focused coping) may enhance entrepreneurial learning and venture progress. In contrast, negative error handling (i.e., emotion-focused coping) may prevent learning from errors, thus leading to premature business closure (Atsan, 2016). Indeed, problem-focused coping was shown to influence entrepreneurs’ well-being and venture performance positively (Drnovsek et al., 2010; Patel et al., 2019). In addition, it was found that the well-being benefits of working self-employed accrue almost entirely because self-employed are more likely to use problem-focused coping as opposed to emotion-focused coping (Nikolaev et al., 2022). The second goal of the current research is to examine if and how appraisal profiles relate to problem-focused versus emotion-focused coping responses. In addition to the contribution to entrepreneurial stress theory and research, the study findings also have practical implications. Understanding how cognitive appraisal patterns relate to adaptive versus maladaptive ways of coping lays the foundation for the development of interventions that alter entrepreneurs’ appraisals of negative work events, thus increasing the likelihood of positive error consequences (Frese & Keith, 2015).

## Hypothesis development

### A person-centered approach to challenge and threat appraisal of action errors

Action errors are unintended and potentially avoidable non-achievements of goals caused by deviations from plans, inadequate feedback processing, or a lack of knowledge (Frese & Zapf, 1994). Entrepreneurial action errors may happen in various areas of daily business, such as meeting market demands (e.g., underestimating sales, resulting in a shortage of stock), achieving market presence (e.g., choosing inappropriate media for advertisement), or managing interpersonal activities (e.g., ignoring a stakeholder’s cultural background, leading to conflicts; Cardon et al., 2011). Action errors must be distinguished from business failures (the cessation of involvement in a venture due to poor economic viability), as action errors can, but do not necessarily, lead to business closure (Frese & Keith, 2015). Entrepreneurial stressors have been found to influence entrepreneurs’ well-being adversely (e.g., Stephan et al., 2022; Wach et al., 2020; Xu & Jin, 2022). Error cascades may develop and lead to severe losses if errors are not adequately addressed once they occur (Frese & Keith, 2015).

Drawing upon TST, Thompson et al. (2020) describe the process set in motion when entrepreneurs experience a disruptive event, such as an action error. The entrepreneur initially perceives the changed situation and then assesses whether the error affects the overall achievement of goals or standards. This assessment is known in TST as primary appraisal. Secondary appraisal involves evaluating whether anything could be done to overcome the adverse situation. Primary and secondary appraisal converge to determine whether the situation is perceived as mainly challenging (i.e., the stressor is relevant and poses a challenge that may be overcome) or threatening (i.e., the stressor is relevant and poses a threat to one’s development and well-being; Folkman, 1984; Lazarus, 1991). Indeed, meta-analytic evidence suggests that different stressors may have distinct effects on entrepreneurs’ performance and well-being outcomes (Lerman et al., 2021). Based on TST, Bennett et al. (2021) argue that “each entrepreneur may appraise the same experience differently” (p. 971). In support of their argumentation, venture-related stressors were found to be differently appraised as challenges, threats, or hindrances (Bennett et al., 2021). The appraisal of stressors as challenging increased entrepreneurs’ expected financial well-being and life satisfaction. In contrast, the appraisal of stressors as threatening was negatively related to expected financial well-being and increased exit intentions (Bennett et al., 2021). Webster et al. (2011) argue that stressors may

be perceived as both challenging and threatening at the same time. In support of their argumentation, the authors found that various stressors, such as role conflict or workload, were perceived as both a challenge and a threat. We argue that entrepreneurial action errors may lead to similarly intricate perceptions. Suppose that due to a lack of knowledge, an entrepreneur has spent a considerable amount of money advertising a product on a website seldomly visited by target customers. The entrepreneur may appraise this error as a threat to accomplishing a short-term goal, such as increasing the number of sales over a set time point. At the same time, she may appraise the error as a relevant cue to reconsider her advertising strategy, thus increasing sales in the longer term. The first goal of the current study is to investigate the existence of challenge and threat appraisal combinations of entrepreneurial action errors, considering the following questions: Which combinations of levels of challenge and threat appraisal exist? Is there a dominant profile?

The current study uses LPA to address these questions. In contrast to variable-centered approaches, such as regression analysis, LPA allows for testing the existence of different combinations of challenge and threat appraisal (Bouckenooghe et al., 2019). In addition, LPA may be used to relate the membership in different profiles (i.e., different combinations of levels of challenge and threat appraisal) to levels of error damage control and rumination about business goal disengagement (Bouckenooghe et al., 2019; Oberski, 2016). LPA is an inductive approach and does not allow for generating conventional predictions about the emerging profiles (Spurk et al., 2020). Accordingly, a research question is offered regarding the existence of different appraisal profiles:

**Research question 1** Do distinct profiles of challenge and threat appraisals of action errors exist, and how may they be described?

### The link between cognitive appraisal and coping with action errors

When individuals face obstacles that create discrepancies between their aspirations and actual circumstances, they can either deal with the adversity through corrective action or disengage from the goals perceived as being blocked (Arshi et al., 2021; Brandstätter et al., 2013; Lerman et al., 2020; Thompson et al., 2020). The following sections outline how entrepreneurs who exhibit different levels of challenge and threat appraisal may be drawn towards error damage control as problem-focused (i.e., positive error handling) and rumination about business goal disengagement as emotion-focused coping (i.e., negative error handling). Error damage control represents the active attempt to mitigate negative error consequences. Without controlling the damage caused

by the error, the emergence of positive error consequences is prevented, and more damage is likely to occur (Frese & Keith, 2015). Ruminating about whether or not one should continue striving to reach one's business goals enhances the perceived severity of an event and may prolong the negative activation generated (Wach et al., 2020). It may keep entrepreneurs from recognizing and harnessing positive error consequences (Frese & Keith, 2015) and increase the likelihood of anxiety (Thompson et al., 2020).

### Error damage control as problem-focused coping

Imagine an entrepreneur who, due to insufficient knowledge, has advertised her vegan fashion collection on a website promoting fur coats. She needs to mitigate negative error consequences, for example, by apologizing to her customers and removing the advertisement from the website to prevent further damage. According to error management theory, error damage control refers to the direct intervention undertaken to reduce negative error consequences (Frese & Keith, 2015). Because error damage control involves direct intervention, it is more likely to occur if challenge appraisal of the error is high. Challenge appraisal activates high-arousal positive emotions that facilitate active, problem-focused forms of coping (López & Neves, 2020). An entrepreneur who perceives an error as challenging may feel energized and motivated to solve the problem. The activation associated with challenge appraisal may provide essential resources to make sense of the adverse experience. A similar approach has been tested by Funken et al. (2020), who showed that problems have a positive effect on entrepreneurial learning and venture progress among entrepreneurs with a positive attitude towards errors (high error mastery orientation) compared to those with a negative attitude towards errors (low error mastery orientation). Finally, entrepreneurs' challenge appraisal of their entrepreneurial circumstances has been shown to be positively related to their engagement in proactive behavior (Chadwick & Raver, 2020).

Conversely, the negative emotions accompanying threat appraisal, such as anxiety or fear, may interfere with problem-focused coping attempts, as the entrepreneur will be preoccupied with regulating negative affective states and is therefore unlikely to engage with the error directly (Folkman, 1984; López & Neves, 2020; López et al., 2021). Indeed, threat appraisal of entrepreneurial constraints was shown to be negatively related to taking action (López et al., 2021) and positively to venture exit intentions (Bennett et al., 2021). Based on TST (Folkman, 1984) and previous research (Bennett et al., 2021; Chadwick & Raver, 2020; Funken et al., 2020; López et al., 2021), we propose:

Hypothesis 1: Entrepreneurs who fall into profiles with high challenge and low threat appraisal show higher

levels of error damage control than entrepreneurs who fall into profiles with low challenge and high threat appraisal.

It is less clear how levels of error damage control compare between entrepreneurs whose profiles are characterized by dominant challenge appraisal and those who experience both high challenge *and* high threat appraisal. On the one hand, intensely experienced opposite appraisal-based emotions have been shown to be positively related to event-related risk perception (Podoyntsyna et al., 2012), which, in turn, may motivate entrepreneurs to do something about the perceived source of risk to prevent further loss (Hunter et al., 2021). On the other hand, the emotional stress associated with intense appraisal ambiguity may promote symptoms of exhaustion and burnout (Lechat & Torrès, 2016). Accordingly, entrepreneurs may decide not to engage with the error to prevent feeling emotionally overburdened. Thus, we propose the following research question:

**Research question 2** How do levels of error damage control compare between entrepreneurs who fall into profiles with high challenge and high threat appraisal and entrepreneurs who fall into profiles with high challenge and low threat appraisal?

### Rumination about business goal disengagement as emotion-focused coping

Threat appraisal may thwart prolonged engagement in goal-driven behavior because it elicits adverse emotional reactions, such as fear of losing face. Individuals generally seek to avoid or mitigate negative affective experiences (Lazarus, 1991). Consequently, instead of dealing with the negative consequences of the error, entrepreneurs may be trapped in ruminative thinking about whether they should continue striving to reach their business goals. In line with this argument, it has been shown that venture exit intentions decrease with decreasing stressor hindrance appraisal (Zhu et al., 2017), and threat appraisal of venture-related stressors is positively related to exit intentions (Bennett et al., 2021). In contrast, if stressors are perceived as challenges, they elicit positive feelings of enjoyment and hope, thus likely preventing the emergence of dysfunctional thoughts about giving up entrepreneurial goals (Lazarus, 1991; Zhu et al., 2017). Accordingly, we propose:

**Hypothesis 2:** Entrepreneurs who fall into profiles with high threat and low challenge appraisal show higher levels of rumination about business goal disengagement than entrepreneurs who fall into profiles with low threat and high challenge appraisal.

It is less obvious how entrepreneurs high in challenge and threat appraisal compare to entrepreneurs high in threat and low in challenge appraisal. On the one hand, highly disruptive events characterized by high cognitive arousal (both positive and negative) have been proposed to elicit proactive response patterns, such as experimentation and risk-taking, instead of withdrawal intentions (Morris et al., 2012). On the other hand, according to TST, appraisal ambiguity may arise due to a lack of information or unclear cues (Lazarus & Folkman, 1984). The uncertainty and high emotional intensity associated with ambiguous cognitive appraisal may, in turn, increase tendencies to engage in ruminative thinking (Wach et al., 2020). Accordingly, we propose the following research question:

**Research question 3** How do levels of rumination about business goal disengagement compare between entrepreneurs who fall into profiles with high challenge and high threat appraisal and entrepreneurs who fall into profiles with high challenge and low threat appraisal?

In the current research, we apply latent profile analysis (LPA) as an inductive approach to establish cognitive appraisal profiles. In the first step, we use a data-driven procedure to examine whether quantitatively and qualitatively distinct cognitive appraisal profiles of action errors exist (e.g., Woo & Allen, 2014). In the second step, we use the emerging appraisal profiles to explore the relationship between cognitive appraisal and coping responses. This allows us to only make predictions about comparisons on outcome variables between the prototypical profiles we expect to emerge.

## Method

### Sample and procedure

In line with the definition of entrepreneurship applied in previous research, individuals who were business owners and involved in founding the business for which they worked self-employed were eligible to participate in the study (e.g., Rauch & Frese, 2000). Prolific, a professional research-focused participant platform was used to recruit individuals currently running a business. Eligible individuals were informed about the estimated completion time and the payment scale. After agreeing to participate, they were invited to complete an online questionnaire. Data obtained from Prolific have been shown to replicate existing results and to be of high quality compared to data from other sources (Peer et al., 2017). We collected data in November 2020 and April 2021. The size of the sample collected at the first time point was not large enough to ensure sufficient accuracy in

identifying the correct number of latent classes using LPA (Spurk et al., 2020). Accordingly, we undertook a second data collection effort. Study participants were reimbursed 1.25 GBP per ten minutes completing the questionnaire. The study was approved by the local university's ethical committee (University of Groningen, PSY-1920-S-0162). We applied the following inclusion criteria: Participants had to a) work self-employed, b) be involved in founding the business for which they currently work self-employed, c) have experienced a business-related action error over the past two weeks, and d) pass the two attention check items. In total, 760 eligible individuals participated in the survey. Of those, 76 were excluded because they indicated not to have experienced an action error over the past two weeks or because they described an event that did not meet the working definition of an action error (e.g., financial difficulties due to external circumstances). Furthermore, we excluded 29 entrepreneurs who failed at least one of two attention check items (Oppenheimer et al., 2009). Finally, six entrepreneurs with missing data on gender were excluded, leaving a sample of 649 entrepreneurs who were included in the analyses. On average, entrepreneurs were 39.62 years of age ( $SD = 12.34$ ). About half of the sample was female ( $n = 362$ , 55.78%), 287 were male (44.22%). Mean business age was 6.02 years ( $SD = 7.24$ ), 21 entrepreneurs did not provide this information (3.24%). Most participants worked in the wholesale and retail ( $n = 144$ , 22.04%), health, education, government, or social and consumer services ( $n = 132$ , 20.34%), and information, communications, or technology ( $n = 115$ , 17.72%) industries. More than one-third of the sample were self-employed before they founded their current business ( $n = 255$ , 39.29%). Of those who have not had any previous experience as entrepreneurs, most had worked as employees ( $n = 334$ , 51.46%), 36 had been unemployed (5.55%), 11 had been students (1.69%), and 13 had done something else (2.00%). Entrepreneurs' businesses were located in countries worldwide, with the vast majority operating in the United Kingdom ( $n = 484$ , 74.58%) and the United States ( $n = 89$ , 13.71%), followed by Portugal ( $n = 10$ , 1.54%), France ( $n = 8$ , 1.23%), and Poland ( $n = 6$ , 0.92%).

## Measures

### Action error

We asked entrepreneurs about the occurrence of action errors (in line with error management theory; Frese & Keith, 2015) to provide them with a reference for the cognitive appraisal assessment. That is, cognitive appraisal was measured in relation to the severest error that the entrepreneurs had experienced over the past two weeks. Before being asked about the occurrence of an action errors, participants read a short description of the concept: "Entrepreneurs make a

number of errors while leading their businesses. Errors are unintended deviations from plans, goals, or adequate feedback processing. Examples of entrepreneurial errors are investing too little in marketing or having too little margins". Next, entrepreneurs were asked to select a business area in which they experienced one or more errors over the past two weeks (e.g., errors related to meeting market demands, errors related to disregarding consumer behavior). The different possible areas of business errors were selected based on research by Cardon et al. (2011), who proposed nine categories of errors common in entrepreneurial businesses. A reference period of two weeks was chosen because action errors may not occur on a daily basis and errors that happened over the past two weeks should still be cognitively present. Similar reference points have been used in related studies (e.g., Funken et al., 2020). In addition to selecting at least one error that happened in a specific business area entrepreneurs were asked to describe each error briefly. If multiple errors were mentioned, entrepreneurs were asked to select the one that affected them the most. Cognitive appraisal was measured in relation to the severest action error. Most entrepreneurs (27%) indicated that the severest error happened with regard to disregarding time constraints, followed by achieving market presence (19%), interpersonal issues (16%), meeting market demands (9%), financial fail decisions (7%), innovation or investment mistakes (5%), disregarding consumer behavior (5%), and disregarding competing firms (4%). Eight percent indicated that the severest error happened in another category.

### Challenge appraisal

To measure challenge appraisal of the severest action error that happened during the past two weeks, we adapted items of the well-established challenge appraisal scale developed by LePine et al. (2016). The original items were developed to assess the appraisal of a work-related stressor as a challenge as defined by TST (Lazarus & Folkman, 1984). Specifically, we asked entrepreneurs to reflect on the severest action error that happened during the past two weeks and to indicate their agreement (1 = *strongly disagree* to 7 = *strongly agree*) on the following items: "The error helps me to improve my personal growth and well-being", "The error challenges me to achieve personal goals and accomplishment", and "In general, I feel that the error promotes my personal accomplishment". Cronbach's alpha was .78.

### Threat appraisal

To measure threat appraisal of the action error that affected entrepreneurs most, three items of the well-established hindrance appraisal scale developed by LePine et al. (2016) were adapted to align with the conceptualization of threat

appraisal that the current study applied. Because LePine et al. (2016) developed three items that assess harm appraisal, we changed the items to measure threat appraisal as the experience of anticipated harm or loss (Lazarus & Folkman, 1984). Specifically, we changed the term “thwarts my personal growth and well-being” into “The error threatens my personal growth and well-being”; the term “constrains the achievement of personal goals and development” into “I feel that the error makes it harder to achieve my personal goals and to develop”; and the term “hinders my personal accomplishment” into “In general, I feel that the error threatens my personal accomplishment” (LePine et al., 2016). The items were measured on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*). Cronbach’s alpha was .91.

### Damage control of the severest action error

In line with the error management theory conceptualization (Frese & Keith, 2015) of error damage control, entrepreneurs were asked how much effort they have put into preventing or mitigating the negative consequences of the action error they made. The answers were collected on a 5-point scale ranging from 1 (*no effort at all*) to 5 (*extremely much effort*).

### Rumination about business goal disengagement

To measure the extent to which entrepreneurs consider disengaging from their business goals, we used three items of the widely used action crisis scale developed by Brandstätter and Schüler (2013). This scale measures different aspects of the intrapsychic conflict between continued goal pursuit and goal disengagement. The items pertaining to the rumination about goal disengagement were adapted to the context of the current study. Specifically, entrepreneurs were asked to what extent they agree with the statements “I doubted whether I should continue striving to reach my business goals or withdraw from them”, “I thought of withdrawing from my entrepreneurial goals”, and “I repeatedly ruminated about whether to continue striving to reach my business goals” on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). Cronbach’s alpha was .84.

### Control variables and correlates of latent profiles

Entrepreneurs who have prior start-up experience were found to apply more effective coping strategies when dealing with work-related stressors than inexperienced entrepreneurs (Uy et al., 2013). In addition, previous research has found relationships between the appraisal of daily hassles and the choice

of coping strategies with gender and age (e.g., Matud, 2004). Accordingly, entrepreneurial experience (1 = *not previously worked self-employed*, 2 = *previously worked self-employed*), chronological age, and gender (1 = *male*, 2 = *female*) were assessed as control variables and correlates of latent profiles.

### Data analysis

Analyses were performed with *R* (R Core Team, 2019) using the *lavaan* package (for factor analysis, Rosseel, 2012), the *MplusAutomation* package (Hallquist & Wiley, 2018, for further processing of *Mplus* output in *R*), and *Mplus* Version 8.4 (for LPA Muthén & Muthén, 2017). First, a preliminary confirmatory factor analysis (CFA) with challenge appraisal, threat appraisal, damage control, and rumination about business goal disengagement was conducted. We assumed at least reasonable fit for models with comparative fit index (CFI) and Tucker Lewis index (TLI) values exceeding .95 (Hu & Bentler, 1999). Root-mean-square error of approximation (RMSEA) values smaller than .05 indicate close fit, and values smaller than .08 are considered acceptable (Browne & Cudeck, 1992). Finally, standardized root-mean-square residual (SRMR) values up to .08 are considered satisfactory (Hu & Bentler, 1999). Next, LPA was used to determine the appropriate number of profiles. Profile solutions with increasing numbers of profiles were specified until model fit no longer improved (Spurk et al., 2020). Profile solutions were compared using relative information criteria including Akaike information criterion (AIC), Bayesian information criterion (BIC); sample-size adjusted BIC (aBIC); Lo-Mendell-Rubin likelihood ratio test (LMR), bootstrap likelihood ratio test (BLRT); and entropy (see Spurk et al., 2020). Better fit is indicated by lower AIC, BIC, and aBIC, and larger entropy compared to other solutions. Moreover, LMR and BLRT statistics should be significant at  $p < .05$ . According to Tein et al. (2013), an emphasis should be put on BIC, LMR, and BLRT, rather than entropy and AIC, for selecting the best profile. First, the best profile solution was determined based on the criteria defined above. Finally, the manual BCH three-step approach was applied to estimate the mean differences in damage control and rumination about goal disengagement between the retained profiles, while controlling for the influence of business age, entrepreneurial experience, and the entrepreneur’s age and gender on profile membership and outcome variables (Asparouhov & Muthén, 2021; Bakk, & Vermunt, 2016; Vermunt, 2010). The manual BCH method substantially outperforms other methods used for estimating profile means across classes for a continuous distal variables (Asparouhov & Muthén, 2021).

**Table 1** Means, standard deviations, and correlations among study variables

Variable	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.
1. Challenge appraisal	4.70	1.20						
2. Threat appraisal	3.59	1.55	0.02					
3. Error damage control	3.04	1.09	0.26***	0.04				
4. Rumination	2.71	1.49	<0.01	0.30***	-0.16***			
5. Entrepreneurial experience	1.39	0.49	0.05	0.02	0.05	0.01		
6. Age	39.62	12.34	-0.10*	-0.04	-0.06	-0.13***	0.08*	
7. Gender	1.56	0.50	-0.05	0.01	-0.05	0.04	<0.01	0.01

*N*=649. Rumination = rumination about business goal disengagement; Entrepreneurial experience: 1 = no previous self-employment experience, 2 = previous self-employment experience; Gender: 1 = male, 2 = female

\**p* < .05, \*\* *p* < .01, \*\*\**p* < .001

**Table 2** Fit statistics for profile structures

Profile	LL	FP	aBIC	BLRT( <i>p</i> )	LMR( <i>p</i> )	AIC	BIC	Entropy
2	-2221.025	7	4465.15	<.001	<.001	4456.05	4487.38	0.649
3	-2200.141	10	4433.29	<.001	<.001	4420.28	4465.04	0.739
4	-2185.893	13	4414.69	<.001	.012	4397.78	4455.97	0.697
5	-2174.198	16	4401.20	<.001	.017	4380.40	4452.00	0.727
6	-2167.328	19	4397.36	<.001	.375	4372.66	4457.69	0.730
7	-2162.923	22	4398.46	.375	.061	4369.84	4468.30	0.736
8	-2157.452	25	4397.42	.118	.224	4364.90	4476.79	0.727

*N*=649. Profile = number of profiles; LL = log-likelihood; FP = free parameters; aBIC = adjusted BIC; BLRT(*p*) = *p* value for the bootstrapped likelihood ratio test; LMR(*p*) = *p* value for the adjusted Lo-Mendell-Rubin-Test; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion

## Results

### Descriptive statistics, correlations, and factor analysis results

Table 1 shows the means, standard deviations, and correlations among the study variables. Results of a CFA reveal that a model with challenge appraisal, threat appraisal, and the two coping styles loading on four separate factors yielded a good fit to the data:  $\chi^2 = 82.56$ ,  $df = 30$ ,  $p < .001$ , CFI = .981, RMSEA [90% confidence interval] = .052 [.039; .065], and SRMR = .035. All standardized factor loadings were > .670. The four-factor model fit the data better than four alternative models with (1) all variables loading on one factor ( $\chi^2 = 2283.66$ ,  $df = 35$ ,  $p < .001$ , CFI = .207, RMSEA = .315, SRMR = .258), (2) the two appraisals and the two coping styles loading on two separate factors factor ( $\chi^2 = 1494.06$ ,  $df = 34$ ,  $p < .001$ , CFI = .486, RMSEA = .257, SRMR = .213), (3) challenge and threat appraisal loading on one factor ( $\chi^2 = 1446.18$ ,  $df = 33$ ,  $p < .001$ , CFI = .502, RMSEA = .257, SRMR = .206), and (4) the two coping strategies loading on one factor ( $\chi^2 = 135.19$ ,  $df = 32$ ,  $p < .001$ , CFI = .964,

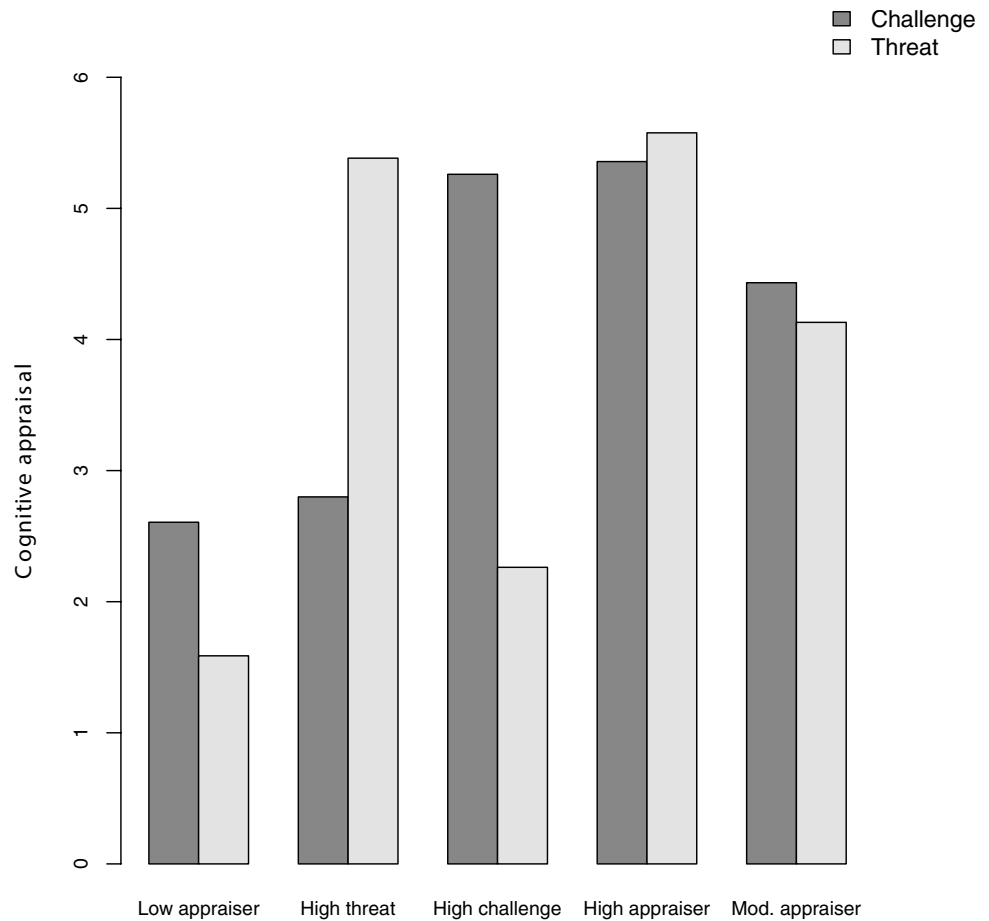
RMSEA = .070, SRMR = .065). Accordingly, it may be concluded that the four variables represent distinct factors.

### Identification of the number of latent profiles

An analysis of multivariate outliers (for challenge and threat appraisal), using Mahalanobis distance with a cutoff *p*-value of .001 revealed that no outliers existed in the data. An inspection of normality of the model variables using histograms and parameters of kurtosis and skewness indicated that the raw data were not normally distributed. Accordingly, robust maximum likelihood (MLR) estimation was applied (Spurk et al., 2020). The number of random starts was set to 7,000 and the final stage optimizations to 200. There were no error messages in the output information and the best log-likelihood value was replicated, indicating that the results were not due to local maxima (Spurk et al., 2020).

Table 2 shows the statistics for profile structures of increasing numbers of profiles. To address Research question 1, a stepwise procedure was chosen by starting with a two-profile solution and successively adding one profile in each step. Fit statistics were investigated for solutions with two to eight profiles. As a result of this procedure, a five-profile solution was

**Fig. 1** Unstandardized means in the indicators challenge and threat appraisal for the five-profiles solution



chosen as it yielded the best fit to the data (lowest BIC, significant BLRT, and the last significant LMR-test before adding a sixth profile, Tein et al., 2013). The entropy value of a solution with five profiles (0.73) showed that individuals could be allocated to the correct latent profile with acceptable certainty, although the threshold for high entropy (>.80) could not be reached (Clark & Muthen, 2009). Moreover, the five-profile solution was the last solution that contained at least 3% of the sample in the smallest profile (Spurk et al., 2020). Finally, the five-profile solution contained profiles that were sufficiently distinct from each other, thus offering a solution of theoretical interest. Figure 1 depicts the standardized means of challenge and threat appraisal for the selected five-profiles solution.

### Description of the retained profiles

An overview of the size of latent profiles and mean levels of challenge and threat appraisal per latent profile is shown in Table 3. The first extracted group was small to medium in size (n=40, 6%), and exhibited low levels in both challenge and threat appraisal (low appraiser profile). The second group was large in size (n=239, 37%), and was characterized by high levels in challenge appraisal and low levels in threat appraisal (high challenge profile). The third group was

of similar size as the second group (n=240, 37%). Individuals in this profile showed moderate levels in both challenge and threat appraisal (moderate appraiser profile). The fourth group was small in size (n=20, 3%) and was characterized by high levels in threat and low levels in challenge appraisal (high threat profile). Finally, the fifth group, which was moderate in size (n=110, 17%), exhibited high levels in both challenge and threat appraisal (high appraiser profile). To answer Research question 1, it may be concluded that there exist five profiles characterized by quantitative (i.e., low appraisal vs. high appraisal) and qualitative (i.e., challenged vs. threatened) differences in levels of challenge and threat appraisal of entrepreneurial action errors. The vast

**Table 3** Descriptive information per latent profile

Profile	Size	Percent	M Challenge	M Threat
Low appraiser	40	6	2.61	1.59
High threat	20	3	2.80	5.38
High challenge	239	37	5.26	2.26
High appraiser	110	17	5.36	5.58
Moderate appraiser	240	37	4.43	4.13

N=649



**Table 4** Business and demographic characteristics of profile members

Profile	Entrepreneurial experience	Age	Gender
Low appraisers	1.29	43.88 (> 3)	1.63
High threat	1.33	38.13	1.75
High challenge	1.39	38.37 (< 1)	1.54
High appraisers	1.41	39.00	1.59
Moderate appraisers	1.41	40.51	1.53

*N* = 649. Entrepreneurial experience: 1 = no previous self-employment experience, 2 = previous self-employment experience; Gender: 1 = male, 2 = female

The information in brackets represents significant differences between profiles at *p* < .05

the comparisons below the mean differences and indicated whether the comparison refers to a hypothesis or research question. Entrepreneurs in the high appraiser profile showed the highest level of error damage control, followed by those in the high threat, high challenge, and moderate appraiser profiles. Those in the low appraiser profile showed the lowest level of error damage control. Hypothesis 1 predicts that entrepreneurs who fall into profiles with high challenge and low threat appraisal show higher levels of error damage control than entrepreneurs who fall into profiles with low challenge and high threat appraisal. Hypothesis 1 could not be supported, given that there was no difference in damage control between the high challenge and high threat profiles. In fact, there were no differences between the threat

**Table 5** Mean differences in error damage control and rumination about business goal disengagement across profiles

Profile	<i>M<sub>dc</sub></i>	<i>M<sub>r</sub></i>	Low appraiser <i>LA</i>	High threat <i>HT</i>	High challenge <i>HC</i>	High appraiser <i>HA</i>	Moderate appraiser <i>MA</i>	
Low appraiser	<i>LA</i>	2.846	2.540	-	-0.751	-0.616**	-0.880**	-0.077
				<i>LA = HT</i>	<i>LA &lt; HC</i>	<i>LA &lt; HA</i>	<i>LA = MA</i>	
High threat	<i>HT</i>	3.598	3.500	-0.960	-	0.136	-0.129	0.675
				<i>HT = LA</i>	<i>HT = HC</i>	<i>HT = HA</i>	<i>HT = MA</i>	
High challenge	<i>HC</i>	3.462	2.653	-0.113	0.847	-	-0.264	0.539***
				<i>HC = LA</i>	<i>HC = HT</i>	<i>HC = HA</i>	<i>HC &gt; MA</i>	
High appraiser	<i>HA</i>	3.726	3.539	-0.999**	-0.039	-0.886***	-	0.803***
				<i>HA &gt; LA</i>	<i>HA = HT</i>	<i>HA &gt; HC</i>	<i>HA &gt; MA</i>	
Moderate appraiser	<i>MA</i>	2.923	3.475	-0.935**	0.025	-0.822***	0.064	-
				<i>MA &gt; LA</i>	<i>MA = HT</i>	<i>MA &gt; HC</i>	<i>MA = HA</i>	

*N* = 649. *M<sub>dc</sub>* = Conditional mean error damage control per latent profile; *M<sub>r</sub>* = Conditional mean rumination about business goal disengagement per latent profile. Values above the diagonal represent mean differences on error damage control; values below the diagonal represent mean differences on rumination about business goal disengagement

\**p* < .05, \*\**p* < .01, \*\*\**p* < .001

majority of entrepreneurs in the sample experienced action errors predominantly as challenging or as both challenging and threatening to moderate degrees.

Correlates of latent profiles were added in the third step of the manual BCH procedure. Table 4 provides an overview of business and demographic characteristics of profile members. There were no significant differences between entrepreneurs within different profiles for entrepreneurial experience and gender. Entrepreneurs in the low appraiser profile were the oldest entrepreneurs on average and significantly older than entrepreneurs in the high challenge profile, which included the youngest entrepreneurs on average.

**Group differences in error damage control and rumination about business goal disengagement**

Table 5 shows the results of mean comparisons based on Wald tests. To ease interpretation, we added the results of

appraiser profile and any of the other profiles. However, this result should be interpreted with caution because the size of the high threat profile was very small, thus limiting the interpretability of mean differences between this and other profiles (Spurk et al., 2020). Regarding Research question 2, the level of damage control was not different between entrepreneurs in the high challenge profile compared to those in the high appraiser profile. In line with the argumentation that some relevance needs to be ascribed to the error to elicit coping responses, entrepreneurs in the low appraiser profile scored lower on error damage control than entrepreneurs in the high challenge and high appraiser profiles. Furthermore, high appraisers showed more error damage control than moderate appraisers, while there was no difference between moderate and low appraisers. However, moderate appraisers scored lower on error damage control than those in the high challenge profile.

Entrepreneurs in the high appraiser profile ruminated most about the option to disengage from their entrepreneurial goals, followed by those in the high threat, moderate appraiser, and high challenge profiles. Hypothesis 2 predicted that entrepreneurs who fall into profiles with high threat and low challenge appraisal show higher levels of rumination about business goal disengagement than entrepreneurs who fall into profiles with low threat and high challenge appraisal. Hypothesis 2 was not supported because there was no significant difference between entrepreneurs in those two profiles. Again, analogous to error damage control, there were no differences between entrepreneurs in the threat appraiser profile and any of the other profiles, most likely due to the small profile size (Spurk et al., 2020). Low appraisers and high challenge appraisers scored lower on rumination than high and moderate appraisers. However, there was no difference between the challenge and the low appraiser profiles themselves, indicating that entrepreneurs who appraise an error as a challenge, but not as a threat are to a similar degree protected from ruminative thinking about disengaging from business goals as entrepreneurs who do not ascribe much relevance to the error as indicated by low cognitive appraisal. Finally, there was no difference in rumination between entrepreneurs in the moderate and high appraiser profiles.<sup>1</sup>

## Discussion

### Summary of research findings

Drawing on the TST and error management theory, the current study aimed to examine patterns in entrepreneurs' appraisals of entrepreneurial action errors as challenges or threats and the relationships of these appraisals with error damage control and rumination about business goal disengagement. Like other work-related stressors that have been associated with both challenge and threat appraisal, such as workload and responsibility (Webster et al., 2011), the current study identifies action errors as ambivalent work events that may be appraised as both challenging and threatening at

the same time. The results of a latent profile analysis identified five profiles that varied in the level (low appraiser, moderate appraiser, high appraiser) and shape (high challenge appraisal, high threat appraisal) of challenge and threat appraisal. Most entrepreneurs fell into the moderate appraiser and the high challenge profiles (about 74% of the sample). Only 3% were in the high threat profile, and 6% in the low appraiser profile, indicating that few entrepreneurs interpreted the action error as predominantly threatening or neither threatening nor challenging. We identified differences in error damage control and rumination about business goal disengagement between entrepreneurs in different appraisal profiles. Entrepreneurs in the low appraiser profile showed low levels of error damage control and rumination about business goal disengagement, while entrepreneurs in the high appraiser profile scored relatively high on both coping types. Entrepreneurs in profiles characterized by high challenge appraisal—irrespective of the level of threat appraisal—exhibited relatively high levels of error damage control. Entrepreneurs in the high challenge profile ruminated less about business goal disengagement than entrepreneurs in the moderate and high appraiser profiles.

### Theoretical implications

This is the first study to show that entrepreneurial stressors may be simultaneously appraised as challenges and threats and that different appraisal patterns relate differently to coping reactions. Previous research has predominantly focused on the adverse consequences of entrepreneurial stressors for entrepreneurs' well-being (e.g., Stephan et al., 2022; Wach et al., 2020; Xu & Jin, 2022). The current work resonates with the increasing recognition of the relevance of TST as a theoretical framework relevant for explaining entrepreneurial stress processes (e.g., Bennett et al., 2021; Zhu et al., 2017). As a primary contribution to entrepreneurship research, the study findings show that the appraisal of errors as relevant entrepreneurial stressors adds to the understanding of the entrepreneurial stress process (Bennett et al., 2021; Webster et al., 2011). That is, action errors do not represent work events that may simply be categorized as either challenging or threatening. Instead, they may be appraised as both challenging and threatening at the same time. This finding aligns with the original tenets of the TST and suggests incorporating mixed appraisal forms into research studying entrepreneurial stress (Webster et al., 2011). In addition, the emerging combinations of different levels of challenge and threat appraisals have different consequences for entrepreneurs' coping reactions. Specifically, appraisal profiles were differently associated with error damage control and rumination about business goal disengagement. The findings of the current study highlight the relevance of appraisal (profiles)

<sup>1</sup> We conducted two additional LPAs with three- and four-profile solutions. As can be seen in the Online Appendix ([https://osf.io/z8rek/?view\\_only=69425e6fb4814f038f4eafa31c311e58](https://osf.io/z8rek/?view_only=69425e6fb4814f038f4eafa31c311e58)), the mean comparisons for the three- and four-profile solutions yield similar results as the five-profile solution regarding mean level comparison results for both error damage control and rumination about business goal disengagement. The only notable difference between the selected five-profile solution and alternative three- and four-profile solutions is the omission of the high threat profile in the three- and four-profile solutions. We only report results for the five-profile solution as the one yielding the best fit, the highest interpretability, and appropriate profile sizes.

in explaining the relationship between the occurrence of work-related stressors and stress reactions.

Moreover, previous research has characterized errors as adverse work events because they impede project completion, work goal attainment, and obtaining rewards (King & Beehr, 2017). However, the current findings suggest that entrepreneurs appraise action errors predominantly as challenges. Learning from errors is integral to entrepreneurial success (Cope, 2003). Entrepreneurs may get used to appraising errors as learning opportunities to grow professionally and personally, thus securing business survival. Alternatively, this finding may reflect the self-selection bias of more uncertainty-bearing individuals into entrepreneurial jobs (Schere, 1982).

Because only a small percentage of entrepreneurs fell into the low appraiser profile, it may be concluded that only a few entrepreneurs interpret the action errors they make as somewhat irrelevant (Folkman, 1984). Notably, entrepreneurs in the low appraiser profile were significantly older than entrepreneurs in the high appraiser profile, who were the youngest on average. This finding aligns with life span perspectives on emotion regulation (Scheibe & Zacher, 2013). Older adults appraise events as less severe and show lower affective reactivity to adverse events than younger adults.

Higher levels of coping in the high appraiser profile compared to other profiles align with the argument that only relevant errors elicit coping responses (Folkman, 1984). If appraisal is low, the stressor's impact on success or well-being is likely low, therefore neither demanding direct intervention nor eliciting ruminative thinking. Entrepreneurs in profiles with high challenge appraisals scored high on error damage control. This finding may be due to the empowering effects of challenge appraisal. Specifically, it has been shown that challenging work demands may encourage individuals to believe in their abilities and increase favorable work outcomes (Kim & Beehr, 2018). Our findings show that these positive effects of challenge appraisal on the motivation to solve the adverse situation actively even overrule the potentially hindering effects of simultaneous threat appraisal of action errors. This finding has implications for the applicability of TST and error management theory to the context of entrepreneurial action errors. No matter whether the error is appraised as threatening an entrepreneur's well-being, as long as it also posits a challenge that may be overcome, entrepreneurs tend to actively address negative error consequences. This implies that active coping attempts in the context of dealing with errors depend mainly on the appraisal of the event as a challenge.

The levels of ruminative thinking about business goal disengagement were lower among entrepreneurs with high challenge profiles compared to those with moderate and high appraiser profiles. This finding indicates that the positive emotions associated with high challenge appraisal

prevent entrepreneurs from ruminating about abandoning their entrepreneurial goals only if threat appraisal is low. Threat appraisal has long been identified as a major driver of withdrawal intentions among employees (Biggane et al., 2017; Fugate et al., 2008). Our finding shows that high threat appraisal leads entrepreneurs to ruminate about disengaging from business goals, even if challenge appraisal is also high.

### Limitations and recommendations for future research

The investigation of cognitive appraisal of a work-related event particularly relevant to an entrepreneurial sample (i.e., appraisal of business-related action errors) is one of the strengths of the current study. This study is the first to investigate the occurrence of challenge and threat appraisal profiles of entrepreneurial action errors. The study's exploratory nature warrants additional research to strengthen its theoretical and practical implications. First, while the sample size may be considered sufficiently large for a person-centered analytical approach (Spurk et al., 2020), one profile of very small size was identified (i.e., the high threat profile encompasses only three percent of the sample). A study with a larger sample would have more power to select the correct number of classes and detect significant mean differences in outcome variables (Tein et al., 2013). However, replicating the same profiles across multiple samples would minimize the risk of potential overinterpretation of a spurious profile (Spurk et al., 2020).

Second, error damage control was measured with only one item developed for the study. Although this is not ideal, some literature indicates that the use of single-item measures is adequate when constructs are unidimensional, narrow, and concrete (Allen et al., 2022; Matthews et al., 2022). However, a replication of the findings using multi-item validated scales is recommended. Future research may focus on a broader set of coping responses to action errors, including other problem- and emotion-focused coping forms, to fully understand the relationship between appraisal patterns and coping methods (Carver et al., 1989). Relatedly, replicating the profile structure using another entrepreneurship sample is warranted to provide conclusive evidence for the accuracy of the retained number of profiles and their relationship with coping styles (Spurk et al., 2020).

Third, we did not consider that the context in which an error occurs may influence the cognitive appraisal of that error. Future research may shed light on the predictors and the contextual correlations of action error appraisal. For example, Jumelet et al. (2020) showed that business owners appraise stressors as challenging when they co-occur with other challenging stressors. In contrast, the same stressor represents hindrances/ threats when coinciding with stressors typically appraised as hindrances/ threats (Jumelet et al.,

2020). Similarly, we did not assess whether certain features of the error (e.g., error novelty, disruptiveness, and criticality; Lerman et al., 2020) influence how the error is appraised. Other theoretical frameworks, such as stress events theory (Lerman et al., 2020) or event system theory (Morgeson et al., 2015), may help explain the relationship between specific types of errors and cognitive appraisal patterns.

Fourth, the current research considers error damage control and ruminating about business goal disengagement as positive and negative coping forms, respectively. However, previous research has shown that the entrepreneur's characteristics may influence coping's effects on psychological well-being. For example, avoidance coping has been shown to positively predict immediate well-being for entrepreneurs with more startup experience (Uy et al., 2013). Relatedly, entrepreneurs' emotional intelligence (i.e., their ability to perceive, understand, and manage their emotions) may influence whether errors are perceived as challenging versus threatening in the first place (Pathak & Goltz, 2021). The current study findings may be expanded by investigating boundary conditions that influence the longer-term effects of chosen coping strategies on performance and well-being outcomes.

Finally, all variables were assessed at one point in time. We undertook efforts to reduce common method bias by opting for different numbers of scale points and labels, thus eliminating common scale properties (Podsakoff et al., 2012). The current research aimed to shed light on the unique relationships between appraisal profiles and coping methods without determining the direction of the effects. Although theoretically, cognitive appraisal predicts coping attempts (Folkman et al., 1986), we cannot draw any conclusions regarding the direction of effects due to the concurrent assessment of cognitive appraisal and coping. For example, it may be that ways of coping predicted cognitive appraisal of the error. In addition, it remains to be explored whether profile members exhibit within-person variation in the cognitive appraisal of action errors over time and which factors relate to such variation. To this end, other person-centered approaches, such as latent transition analysis, may be applied to explore transitions between latent profiles over time (Collins & Lanza, 2009). A longitudinal study would also allow for a more rigorous examination of some of the core tenets of error management theory (e.g., learning and development as distal outcomes of positive error handling). Finally, a longitudinal research design may be used to shed light on the dynamics of cognitive appraisal patterns and error occurrence. For example, entrepreneurs who fall into profiles dominated by challenge appraisal may be less prone to avoid making errors. The expected higher frequency with which errors occur may, in turn, positively relate to problem-focused coping. Assessing these variables over time may shed light on the complex relationship between

the occurrence of errors, cognitive appraisal patterns, and ways of coping.

## Practical implications

Research has highlighted the critical role of errors as events that foster entrepreneurial learning (Cope, 2003). According to error management theory, a prerequisite for learning from errors is a positive attitude toward the error and the belief that one can overcome its negative consequences (Frese & Keith, 2015). The current study highlights the relevance of action errors as stressors associated with specific coping responses. While entrepreneurs may not prevent errors from occurring, they can change their attitudes toward them. Entrepreneurs can incorporate error management techniques to love the fear of making errors, thus enhancing the chance of falling into high challenge or high appraiser profiles (Frese & Keith, 2015). As has been noted by Bennett et al. (2021), understanding entrepreneurs' appraisal of stressors and the resulting reactions may be particularly relevant for small business owners because these individuals make the decisions that determine the firm's success and have a significant impact on the atmosphere within the team.

## Conclusion

The current study offers opportunities for integrating TST and error management theory with entrepreneurial stress and well-being theories. The study shows that entrepreneurs may experience action errors as challenging, threatening, and both challenging and threatening to varying degrees. Most entrepreneurs experienced errors as predominantly challenging or as both challenging and threatening. Entrepreneurs in the high challenge profile appeared the most resilient as they adopted active coping strategies and showed relatively low levels of rumination about business goal disengagement. Only a small percentage of entrepreneurs was assigned to the high threat profile, highlighting entrepreneurs' generally positive attitude towards making errors.

**Acknowledgements** The authors thank Safal Batra for his feedback on an earlier version of this manuscript.

**Data availability** The dataset the current study analyzed is available in the open science framework (OSF) repository and is accessible via the following link: [https://osf.io/de6qf/?view\\_only=62ce03dcf3dd4053aa4b5c79acd02a5f](https://osf.io/de6qf/?view_only=62ce03dcf3dd4053aa4b5c79acd02a5f)

## Declarations

The study was approved by the local university's ethical committee (University of Groningen, PSY-1920-S-0162). All study participants provided their informed consent to participate in the study before filling in the questionnaire.

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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