Are all errors created equal?

Horvath, Dorothee; Klamar, Alexander; Keith, Nina; Frese, Michael

Published in:
European Journal of Work and Organizational Psychology

DOI:
10.1080/1359432X.2020.1839420

Publication date:
2021

Document Version
Publisher's PDF, also known as Version of record

Routledge
Taylor & Francis Group

European Journal of Work and Organizational Psychology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/pewo20

Are all errors created equal? Testing the effect of error characteristics on learning from errors in three countries

Dorothee Horvath, Alexander Klamar, Nina Keith & Michael Frese

To cite this article: Dorothee Horvath, Alexander Klamar, Nina Keith & Michael Frese (2021) Are all errors created equal? Testing the effect of error characteristics on learning from errors in three countries, European Journal of Work and Organizational Psychology, 30:1, 110-124, DOI: 10.1080/1359432X.2020.1839420

To link to this article: https://doi.org/10.1080/1359432X.2020.1839420

Published online: 02 Nov 2020.

EUROPEAN JOURNAL OF WORK AND ORGANIZATIONAL PSYCHOLOGY
2021, VOL. 30, NO. 1, 110–124
https://doi.org/10.1080/1359432X.2020.1839420

Are all errors created equal? Testing the effect of error characteristics on learning from errors in three countries

Dorothee Horvath [a]†, Alexander Klamar [b,c]†, Nina Keith [a] and Michael Frese [b,d,e]

[a]Department of Psychology, Technical University of Darmstadt, Darmstadt, Germany; [b]Institute for Management and Organisation, Leuphana Universität Lüneburg, Lüneburg, Germany; [c]Helmut-Schmidt-Universität/Universität der Bundeswehr Hamburg, Hamburg, Germany; [d]Department of Management & Organisation, National University of Singapore, Singapore; [e]Asia School of Business (in collaboration with MIT Sloan Management), Kuala Lumpur, Malaysia

ABSTRACT

Errors can be a source of learning. However, little is known to what extent learning from errors depends on error characteristics and the context in which the error was made. We tested the assumption that more learning occurs from errors with severe consequences and when the error was made by oneself. We further investigated if and how learning from errors and organizational error culture differs between countries. In two vignette studies (Study 1, $N = 118$ from the United States; Study 2, $N = 588$ from the United States, Hungary, and Germany), participants responded to error scenarios that happened to employees at work. As expected, people learned more from errors in terms of affective error learning (Studies 1 and 2) and cognitive error learning (Study 1) if consequences were severe and if the error was made by themselves. Furthermore, we found differences between countries (Study 2) in that participants from the United States learned more from errors and reported more error management culture than participants from Hungary or Germany. Furthermore, the relationship of country and learning was mediated by error management culture. With our studies, we aim to contribute to a better exploitation of the learning potential inherent in errors.

ARTICLE HISTORY
Received 13 June 2019
Accepted 15 October 2020

KEYWORDS
Errors; learning from errors; country differences; error management

The topic of learning from errors at work is increasingly gaining attention in applied psychology and management research. Errors are a rich source of information, as they unveil that something went wrong. Scholars agree that errors can foster learning (e.g., Dormann & Frese, 1994; Edmondson, 1996; Ellis et al., 2014; Frese & Keith, 2015; Heimbeck et al., 2003; Ivancic & Hesketh, 1995/1996; Keith & Frese, 2008; Madsen & Desai, 2010; Zakay et al., 2004). It also seems intuitive that errors vary in the amount of learning they foster (Cannon & Edmondson, 2005; Sitkin, 1992). However, research investigating error characteristics that influence learning from errors is scarce. Understanding the error characteristics that influence learning from errors enables individuals taking advantage of errors.

In the present study, we systematically test the effects of error characteristics that influence learning from errors by means of vignette experiments. We investigate two error characteristics, namely (a) severity of error consequences (mild vs. severe) and (b) agent (i.e., the person who makes the error; error made by oneself vs. error made by someone else). More specifically, we propose that (a) severe error consequences lead to more learning than mild consequences and that (b) people learn more from an error if they are the ones who made the error (as opposed to someone else). We further investigate whether there are country differences in (c) learning from errors and (d) organizational error culture (i.e., shared norms and beliefs about errors; error management culture). We also explore whether (e) potential country differences in learning from errors may be due to differences in error management culture. For this purpose, we study samples of three different countries, namely the United States, Hungary, and Germany, and assess error management culture. We selected the United States, Hungary, and Germany, as these countries differ in regard to the way people deal with uncertainty (De Luque & Javidan, 2004). Specifically, the way people deal with uncertainty may influence how people consider and deal with errors (i.e., error management culture), as error occurrence is always unexpected and also there is much ambiguity involved in identifying root causes of errors. Therefore, how people handle uncertainty can influence the extent to which learning from errors occurs.

With our research, we aim to contribute to the existing literature in the following ways. First, we aim to provide a more systematic understanding of error characteristics that may exert a stronger influence on learning from errors. Second, it seems intuitive that there may be country differences in how errors are considered and dealt with. While theory suggests differences (Gelfand et al., 2011), empirical studies on country differences in how errors are considered and dealt with are scarce. The question of whether and how countries differ in organizational error culture and learning from errors has important implications for both theory and practice. We aim to shed light on why country differences may be observed in learning from errors. From a practical perspective, a better understanding of error characteristics and how the cultural context determines learning from errors can help organizations to develop appropriate interventions to improve learning from errors. In

CONTACT Dorothee Horvath horvath@psychologie.tu-darmstadt.de
†These authors contributed equally to this work and share first authorship.

the following section, we define relevant concepts and develop our hypotheses in more detail.

Theory and hypotheses

Errors are unintentional deviations from a goal, rule, or standard (Frese & Keith, 2015; Frese & Zapf, 1994; Hofmann & Frese, 2011; Reason et al., 1990). For example, when an employee uses an outdated file to order goods without knowing better, s/he has made an error. Errors can be distinguished from *violations*. A violation is an intentional, deliberate deviation from a norm, goal, rule, policy, or standard (Frese & Keith, 2015). It has to be noted that errors do not inevitably lead to negative error consequences (Frese & Keith, 2015). Errors can even lead to positive consequences, such as learning (e.g., checking for the latest version of the files before placing an order).

Learning can be defined as "changes in the knowledge, skills, or attitudes" (Kraiger et al., 2015, p. 4) and behaviour (Baldwin & Ford, 1988; Bell et al., 2017). Learning from errors does not only encompass avoiding the same, specific error in the future (Frese & Keith, 2015), it can actually be conceptualized in different ways. In a review of training and development research and how learning has been conceptualized in the *Journal of Applied Psychology* over the past 100 years, Bell et al. (2017) identified affective, cognitive, and skill (behavioural) outcomes of learning (Kraiger et al., 1993). Affective outcomes describe increased motivation or changes in attitudes. Cognitive outcomes describe acquired knowledge, such as the ease of retrieval in terms of memorizing and recollecting knowledge (Metcalfe, 2017). Skill outcomes describe mastery of tasks (Bell et al., 2017). Learning does not necessarily require a change in behaviours (Argote & Miron-Spektor, 2011). As described in more detail later, the present research focused on affective error learning in terms of attitudes towards errors and on cognitive error learning in terms of recall of error situations.

How much learning from errors occurs may depend on the amount of attention an error receives. Errors signify that something is wrong (Sitkin, 1992) and that some (re)action is required. In most cases, errors occur unexpectedly – errors are "negative surprises" (Cannon & Edmondson, 2005, p. 300) that catch attention. The amount of attention devoted to errors may evoke a deeper cognitive processing of the errors. Thereby, errors foster learning. Different error characteristics may determine the amount of attention a person devotes to an error, and thus the amount of learning from errors that can occur. Severity of error consequences and the agent of the error are two such error characteristics. In the following, we will develop hypotheses on how error characteristics may affect these learning outcomes.

Error characteristics that influence learning from errors

Severity of error consequences

Learning from errors may depend on the severity of error consequences. We propose that severity of error consequences positively affects learning from errors. As errors are unexpected events, they instigate increased attention (Wilson & Gilbert, 2008). Attention is a prerequisite for encoding and later retrieval of information, thus learning (Anderson et al., 1998; Craik et al., 1996). Increased attention leads to greater affective reactions (attention principle; Wilson & Gilbert, 2008). Affective reactions have been shown to stimulate learning by increasing motivation to learn (e.g., Tyng et al., 2017; Um et al., 2012), for example, to avoid the negative affective reaction to the error (e.g., shame or guilt) in the future. Furthermore, increased attention evokes a "greater cognitive effort to determine the meaning and import of an event" (Wilson & Gilbert, 2008, p. 373), such as the thinking about the cause of the error, or how it may be corrected.

In general, humans devote more attention to negative than to positive information (Vaish et al., 2008; Zakay et al., 2004). As greater attention should be paid to errors with more severe consequences, greater affective reactions and deeper cognitive processing and thus more affective and cognitive learning should follow. Errors with mild consequences are considered to be of less importance (Cannon & Edmondson, 2005). Furthermore, errors with mild consequences are more easily overlooked or ignored (Baumard & Starbuck, 2005). Error consequences thus need to be severe enough to attract attention (e.g., Homsma et al., 2009; Madsen & Desai, 2010). We propose:

Hypothesis 1: Severity of error consequences increases learning from errors; the more severe the consequences, the more learning from errors will occur.

Agent of the error

Who made the error can also influence learning from error. Who made the error may influence the attention given to an error and, thus, how much learning occurs: People may learn more from errors made by themselves as opposed to errors made by someone else. An error that was made by oneself should have high personal relevance, which attracts a higher degree of attention (e.g., Petty et al., 1981). Affective reactions (e.g., shame, guilt) to errors made by oneself should be greater than affective reactions to errors made by someone else. Affective reactions to errors made by oneself should lead to a greater motivation to learn in order to avoid negative affective reactions (e.g., shame, guilt) in the future (Tyng et al., 2017). Similarly, errors made by oneself should evoke deeper cognitive processing, for example, one may strive to analyse the causes of an error and to think of solutions to correct the error. The increased affective and cognitive reactions to errors made by oneself should make learning more likely than from errors made by others. Nevertheless, learning is likely to occur also from errors made by others. According to social learning theory (Bandura, 1986), people also learn from observing others. However, errors made by others may not necessarily be considered personally relevant, as the errors may be ascribed to the other person's incompetence or negligence (Frese & Keith, 2015). Consequently, errors made by others may receive less attention and be more easily overlooked or ignored than errors made by oneself. In turn, learning is less likely to occur. We thus assume less learning to occur from errors made by someone else than from errors made by oneself:

Hypothesis 2: Learning from errors depends on the agent (i.e., the person who made the error): More learning from errors occurs when the error is made by oneself as opposed to by someone else.

Country differences in learning from errors mediated by organizational error management culture

Learning from errors may differ from one country to another. Both theoretical (e.g., Gelfand et al., 2011) and empirical (e.g., Davis et al., 2005; Helmreich & Merritt, 1998) evidence suggest that the way people deal with errors, that is, error management culture (van Dyck et al., 2005), varies across countries. Learning from errors may thus differ as well.

Whether errors are considered negatively or as chances to learn varies between countries. Typically, errors are regarded as negative events. In this case, errors thus evoke negative reactions such as anxiety, anger, shame, and guilt (Carmeli & Gittell, 2009; Edmondson, 1999; Ivancic & Hesketh, 1995/1996; Keith & Frese, 2005, 2008; Zhao, 2011). Negative reactions may reduce learning. When errors are framed as indicators of failure and lack of competence, they set off "negative self-evaluative reaction cycles" of self-doubt and dissatisfaction (Wood et al., 2000, p. 267). These may have negative effects on learning. On the contrary, when errors are considered as chances to learn, that is, within an error management culture, learning should be fostered.

Country differences can be described using cultural dimensions (e.g., Hofstede, 1980; House et al., 2004). In light of the ambiguous nature of errors, we suggest the GLOBE (House et al., 2004) dimension of uncertainty avoidance to be particularly important for the way people deal with errors, that is, error management culture, consequently for learning from errors.

Uncertainty avoidance refers to "the extent to which ambiguous situations are threatening to individuals, to which rules and order are preferred, and to which uncertainty is tolerated in society" (De Luque & Javidan, 2004, p. 602). In other words, uncertainty avoidance denotes "the extent to which members of collectives seek orderliness, consistency, structure, and formalized procedures, and laws to cover situations in their daily lives" (De Luque & Javidan, 2004, p. 603). In countries high in uncertainty avoidance, errors may be evaluated more negatively (Gelfand et al., 2011). A negative evaluation of errors may, in turn, make error management culture and learning less likely. For the purpose of our study, we use the GLOBE societal practices scores, because we are interested in actual practices that are typical for a country, rather than in people's attitudes (values) on how things should be in their respective country.[1]

Country differences in uncertainty avoidance may be particularly important for learning from errors. Many decisions are made under uncertainty. These decisions bear specific potential of errors (Shimizu & Hitt, 2011). Oftentimes, it is hard to identify the root causes of errors, because they may be caused by multiple agents and/or multiple actions (i.e., factors) (Zhao & Olivera, 2006). This makes learning more difficult: When the causes for an error remain ambiguous, there is ambiguity in the solution to the error. Several reactions to an error may eliminate the problem or prevent its re-occurrence. This implies an ambiguity of the appropriate reaction to an error, and consequently to the lessons to be learned from an error. The way people approach ambiguity, as circumscribed by uncertainty avoidance, may thus have particular influence on learning from errors. People in countries high in uncertainty avoidance will feel particularly threatened by errors and will react particularly distressed when an error occurs (Gelfand et al., 2011). This increased threat and highly negative affective reactions to the error may lead to maladaptive responses, such as rigidity and defensiveness (Vaes & Wicklund, 2002). These maladaptive responses, in turn, impede motivation to avoid the same error in the future (affective error learning), or even to think about how to correct or avoid the error in the future (cognitive error learning) (Holmer, 2014; Staw et al., 1981). In concrete terms, the ambiguity associated with an error may leave persons making the error in the dark about what can be learned to prevent the same or similar errors in the future, or how to react to the error.

Countries high in uncertainty avoidance are less comfortable with ambiguity and more likely to establish structures to control or predict uncertain situations (Gelfand et al., 2011). We thus argue uncertainty avoidance may particularly influence error management culture. Country practices may shape work processes in organizations, as well as the way people in organizations interpret and deal with occurring phenomena (Noort et al., 2016), such as errors. The context, such as the location, time, or physical environment, in which an organization operates, has an impact on organizational behaviour, thus on organizational culture (Johns, 2006). This is in line with empirical evidence, for example of GLOBE that suggest that societal practices of uncertainty avoidance affect organizational practices of uncertainty avoidance (De Luque & Javidan, 2004). Noort et al. (2016) also found the cultural dimension uncertainty avoidance to be associated with organizational culture, in particular with organizational safety climate.

One specific form of organizational culture that encompasses how organizations consider and deal with errors is error management culture. Error management culture entails "practices related to communicating about errors, to sharing error knowledge, to helping in error situations, and to quickly detecting and handling errors" (van Dyck et al., 2005, p. 1229). Error management culture influences whether and how much learning from errors occurs (Keith & Frese, 2011). When the error management culture is high, it is acknowledged that despite best efforts to prevent errors, it is impossible to be completely error free (Reason, 1997). The acknowledgement that errors can happen at all times, and to everyone, leads to a culture in which the occurrence of errors is not a taboo that has to be avoided at all cost – error strain will be low. Consequently, when the error management culture is high, negative emotions are kept at bay (Bell & Kozlowski, 2008; Keith & Frese, 2005). The positive framing of errors may help learners to accept errors. Accepting the occurrence of errors can help in controlling negative emotions in response to errors (Heimbeck et al., 2003), which benefits learning (van Dyck et al., 2005). A mindset of acceptance of errors may even increase motivation to learn, as mastery and task interest may be strengthened (Bell & Kozlowski, 2008).

For the present study, we chose three countries that score very differently on the societal practices in uncertainty

avoidance in the GLOBE project: while Hungary is low on uncertainty avoidance (M = 3.12; rank 60 of 62), the United States ranges in the middle (M = 4.15; rank 30), and Germany scores high (M = 5.22; rank 5; De Luque & Javidan, 2004). Following the argument that error management culture and learning from errors is higher in countries low on uncertainty avoidance, we would predict error management culture and learning from errors to be highest in Hungary, followed by the United States, and lastly Germany.

There is ongoing debate about whether country rankings can be used to predict individual behaviour (e.g., Bond, 2002; Brewer & Venaik, 2012, 2014; Kirkman et al., 2006). While some argue that phenomena that are observable on a societal level "do not exist on individual level" (Brewer & Venaik, 2012, p. 674), others argue that the perception of practices in a country may indeed shape individual-level variables (e.g., Adler & Gundersen, 2008; Maccoby, 2000; Singelis & Brown, 1995; Triandis & Suh, 2002). We acknowledge both sides of the debate, and therefore exercise caution in regard to how country rankings of any cultural dimension would predict error management culture and individual learning from errors. We thus decided to put forth open research questions regarding country differences rather than concrete hypotheses:

Open research question 1: Are there country differences in learning from errors?

Open research question 2: Are there country differences in error management culture?

Following our reasoning above, country differences in uncertainty avoidance may affect the way people deal with errors (i.e., error management culture) (Gelfand et al., 2011). Error management culture, in turn, may influence the amount of learning from errors (Frese & Keith, 2015). Therefore, we assume that country differences in learning from errors can be explained with differences in error management culture.

Open research question 3: If there are country differences in learning from errors (Open research question 1), does error management culture mediate the relationship between country and learning from errors?

Overview of studies

We tested our two hypotheses, namely, the effect of severity of error consequences and agent on learning from errors in two studies. In Study 1 (conducted in the United States), we assessed learning from errors with two indicators: *affective error learning* and *cognitive error learning* (in terms of recall of error situations). In Study 2, we only used one indicator for learning from errors, namely, affective error learning. The focus of Study 2 was to replicate the pattern of results from Study 1 and to extend them by assessing country differences in error management culture and learning from errors by collecting data in three different countries, that is, the United States, Hungary, and Germany.

Study 1

Method

Sample

Participants of Study 1 were 118 working adults from the United States, recruited via eLancing websites.[2] Research has demonstrated that data gathered via eLancing websites are of satisfactory quality (e.g., Buhrmester et al., 2011). The quality can be augmented by taking certain steps, including incorporating attention check items and fair compensation of the participants (e.g., Aguinis & Lawal, 2012; Cheung et al., 2017). We carefully followed these recommendations. Mean age of our participants was 35.76 years (SD = 10.54) and 35% were female. Participants' average work experience was 14.31 years (SD = 10.48), and 39% reported to hold a leadership position. Participants came from different industries, the most frequent were Information and Communication (14.4%), Manufacturing (12.7%), and Financial and Insurance activities (12.7%). Participants received USD 4.50 for participation (which corresponds to an hourly wage of approximately USD 9.00 and was thus in line with the United States federal minimum wage). The criteria for inclusion of respondents in the survey were age (>18 years), place of residence (the United States), and employment status (at least part-time employed).

Experimental design and procedure

We used an experimental vignette methodology in a 2 × 2 within-participants design with severity of error consequences (mild vs. severe) and agent (self vs. other) as experimental factors.

Participants read eight scenarios in which we described error situations that varied with regard to severity of error consequences and agent. To avoid sequence, practice, and boredom effects, we counterbalanced the order of presentation and scenario-factor combinations (Girden, 1992). Participants were randomly assigned to one of four permutations of material versions. For later statistical analyses, we used material version as control variable.

In the online experiment, participants were first welcomed and briefly introduced to the study's purpose and procedure. Participants then filled out a questionnaire on demographics. Subsequently, participants were presented with the first experimentally manipulated error scenario. Participants were asked to read the error scenario carefully and to imagine themselves in the described situation. Subsequently, items were presented that constituted the manipulation checks and the first dependent variable (affective error learning). This procedure was repeated for each successive error scenario. Participants then worked on a filler task which lasted about 10 minutes. Afterwards, participants were asked to recall as many of the previously presented error scenarios (cognitive error learning) in as much detail as possible (this constituted our second dependent variable). Up to this point, participants had been unaware that they will be asked to recall the scenarios. Finally, participants were thanked, debriefed, and provided with a code for compensation on the eLancing website.

Experimental material

The vignettes (i.e., error scenarios) in Study 1 described typical errors at work. The vignettes were developed based on actual errors as reported by managers in interviews unrelated to the present studies (the interviews were about errors and error management in organizations). All scenarios were developed and pilot tested with the two goals to arrive at (a) a scenario as realistic as possible and (b) at a distinction as clear as possible between degrees of the experimental factor severity of error consequences (i.e., mild or severe). The manipulation of the experimental factor severity of error consequences was implemented by systematically varying the endings of error scenarios. More specifically, the baseline vignette that described the error and the situation in which the error occurred was identical across experimental conditions, but the consequences that developed from the same error varied. For example, one scenario described an employee having placed an incorrect order of materials based on an outdated project plan. In the condition representing mild error consequences, the employee can return the surplus materials and receive reimbursement. In the condition representing severe error consequences, the supplier does not accept a return of the goods. The employee causes significant economic damage, as the surplus material cannot be used elsewhere in the company. The manipulation of the experimental factor agent was implemented by varying the person who made the error (self or colleague), for example, as "you made the mistake to use the wrong, outdated project plan as a basis for ordering" versus "your colleague made the mistake to use the wrong, outdated project plan as a basis for ordering."

Measures

Manipulation checks. After reading the vignettes and before the first dependent variable was assessed, participants responded to manipulation checks that probed whether participants perceived the severity of the error consequences in the intended way. After reading each vignette, participants were asked to indicate how severe they think the situation is and how negatively they evaluate the situation. We asked participants two questions (e.g., "How negative do you evaluate the described situation?") to which they responded on a 5-point Likert scale. In addition, we asked them to indicate, on a 5- point Kunin face scale, how they would feel in the described situation (Kunin, 1955). As expected, we found large effects both for the two questions, $F(1,117) = 297.96$, $p < .001$, $\eta_p^2 = .72$, and for the Kunin item, $F(1,117) = 276.19$, $p < .001$, $\eta_p^2 = .70$, indicating that our manipulations had worked well.

Dependent variables. Following the multidimensional perspective on learning (e.g., Bell et al., 2017; Kraiger et al., 1993), we address two aspects by which learning can be conceptualized: we assessed affective error learning by using a self-report measure and cognitive error learning in terms of recall of error situations. We assessed *affective error learning* with 3 of the 4 items of the subscale "learning from errors" of the Error Orientation Questionnaire (EOQ; Rybowiak et al., 1999).[3] The EOQ is designed to measure "attitudes to and coping with errors at work" (Rybowiak et al., 1999, p. 527) of individuals or groups. We slightly modified item wordings to fit the presently used vignettes. For example, the original item "My mistakes help me to improve my work" was changed to "This mistake helps me to improve my work." Participants responded on a 5-point Likert scale. In the present study, median Cronbach's alpha was .91 across experimental conditions. For *cognitive error learning* (i.e., *recall of error situations*), participants were asked to recall as many of the previously presented error scenarios in as much detail as possible. In order to facilitate recall, we asked for the agent who made the error, the error situation, as well as the error consequences. Two raters independently assigned the values 0 (incorrect), 1 (partially correct), or 2 (fully correct) to the recall of the error situation and to the error consequences, respectively. Additionally, the two raters coded with 0 (incorrect) or 1 (correct) whether participants correctly recalled the agent who made the error, resulting in a maximum score of 5. Inter-rater agreement was high, with a median ICC (3,2) of .99 (range: .95 to 1.00) across the scenarios.

Filler task (cognitive ability test). As a filler task (after presentation of error scenarios and before the recall of error scenarios), we used a subscale of a freely available cognitive ability test (Satow, 2017) that measures numerical skills (22 items; Cronbach's alpha = .86). Our primary goal was to use this test as a filler task, as it is common to use unrelated filler tasks in experiments that use recall tests. Our second goal was to use the cognitive ability test as a potential control variable for the recall task, because we suspected that performance on the recall task may be influenced by participants' cognitive ability.

Results

Means, standard deviations, and correlations of variables used in Study 1 are depicted in Tables 1 and 2. Descriptive analyses showed that our two learning measures, affective error learning and cognitive error learning, were correlated by $r = .19$ ($p < .05$). This significant, but small correlation indicates that our two variables measure the same construct, namely, learning from errors, but cover somewhat different aspects of the criterion space. Furthermore, as we expected, cognitive ability was positively related to cognitive error learning, but not related to affective error learning, indicating that our two dependent variables differ in the extent of cognitive loading. Hence, we included cognitive ability as a between-participants covariate and reran all analyses, but the pattern and magnitude of effects were unaltered. In the following, we therefore report results without this additional covariate.

Severity of error consequences and agent

Hypothesis 1 predicted that severity of error consequences increases learning from errors in that learning is higher for errors with severe consequences. Hypothesis 2 predicted that learning from errors depends on the agent in that learning is higher when the error is made by oneself as opposed to when the error is made by someone else. The hypothesized effects were tested simultaneously in a repeated-measures MANOVA with the two learning measures affective error learning and cognitive error learning as dependent variables. We included material version (i.e., vignette-factor combination) as a between-participants control factor (Judd et al., 2001).

As we expected, the multivariate test results showed a main effect of severity of error consequences on learning from errors,

Table 1. Means, standard deviations, and intercorrelations of Study 1 variables.

	M	*SD*	*1*	*2*	*3*	*4*	*5*
1. Age	35.76	10.54	-				
2. Gender	-	-	−.33**	-			
3. Cognitive ability	15.44	4.34	.09	.00	(.86)		
4. Affective error learning (self-reports)	4.11	0.57	.16	−.23*	.01	(.91)	
5. Cognitive error learning (recall of error situations)	1.74	0.95	.13	.08	.31**	.19*	(.99)

Note. $N = 118$. Cronbach's alpha coefficients are shown in parentheses along the diagonal. For the variable "cognitive error learning," median ICC (inter-rater agreement) is shown in parentheses along the diagonal. Gender was coded 0 for female and 1 for male.
* $p < .05$. ** $p < .01$.

Table 2. Means and standard deviations of dependent variables in Study 1 by factor levels[a].

	Affective error learning (self-reports)		Cognitive error learning (recall of error situations)	
Severity	*M*	*SD*	*M*	*SD*
Mild error consequences	4.04	0.66	1.62	1.11
Severe error consequences	4.19	0.60	1.86	1.12
Agent				
Self	4.31	0.56	1.73	1.19
Colleague	3.91	0.74	1.74	1.14

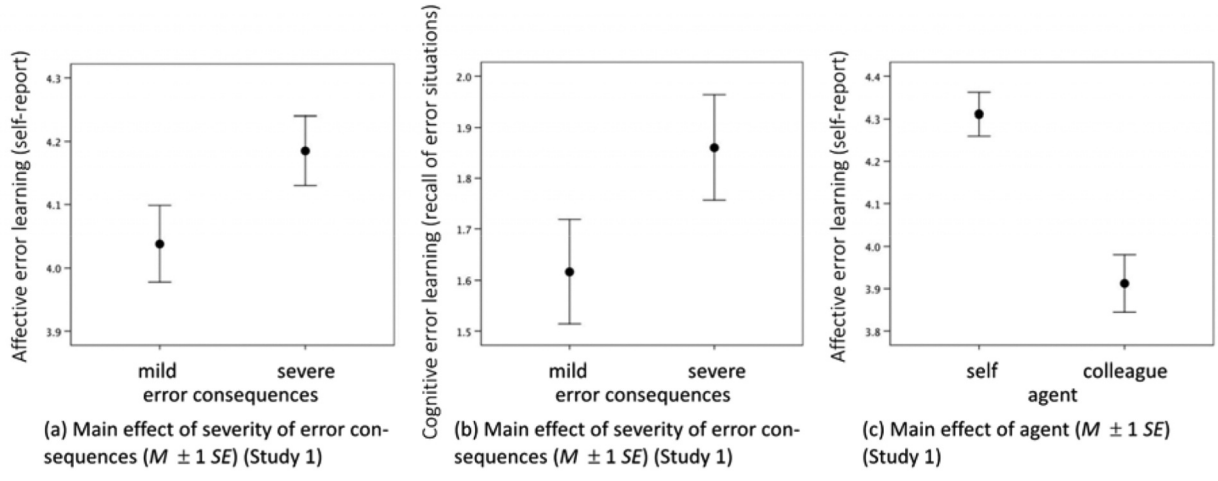
Note. $N = 118$.
[a]Factor 1: severity of error consequences (mild, severe); Factor 2: agent (self, colleague).

$F(2,113) = 7.88$, $p < .001$, $\eta_p^2 = .12$, and a main effect of agent, $F(2,113) = 23.07$, $p < .001$, $\eta_p^2 = .29$. Thus, both hypotheses were supported.

Additional post-hoc univariate analyses showed the expected main effect of severity of error consequences for both learning measures: affective error learning, $F(1,114) = 10.51$, $p < .01$, $\eta_p^2 = .08$, and cognitive error learning, $F(1,114) = 6.20$, $p < .05$, $\eta_p^2 = .05$ (see Figure 1, Panels a and b). Regarding the agent, we found the expected main effect for affective error learning, $F(1,114) = 44.17$, $p < .001$, $\eta_p^2 = .28$ (see Figure 1, Panel c), but not for cognitive error learning, $F(1,114) = 0.15$, $p = .70$, $\eta_p^2 = .00$.[4]

Study 2

There are four notable differences between Study 1 and Study 2. First, as Study 1 provided evidence that the affective error learning measure is an adequate proxy for learning from errors, in Study 2 we only used the affective error learning measure. Second, Study 2 was conducted in three different countries that score differently on the GLOBE uncertainty avoidance societal practices dimension, namely, the United States, Hungary, and Germany. Third, in Study 1, we had only distinguished the experimental factor agent between "self" and "other." However, according to social identity theory (Tajfel & Turner, 2004), there is a "tendency to favor the in-group over the out-group in evaluations and behavior" (p. 281). This would imply that more personal relevance could be attributed to errors made by someone from an in-group (e.g., a close colleague) than to errors made by someone from an out-group (e.g., someone from a competing company). This would have implications for learning from errors: More learning should occur from errors made by an in-group member than from errors made by an out-group member. To account for this possibility, Study 2 further subdivides the experimental factor agent. Fourth, we explore country differences in error management



(a) Main effect of severity of error consequences ($M \pm 1\ SE$) (Study 1)

(b) Main effect of severity of error consequences ($M \pm 1\ SE$) (Study 1)

(c) Main effect of agent ($M \pm 1\ SE$) (Study 1)

Figure 1. Main effect of severity of error consequences and agent on learning from errors in Study 1.

culture, and whether potential differences in error management culture may explain differences in learning from errors.

Method

Sample

Participants of Study 2 were 588 working adults from the United States, Hungary, and Germany, recruited via eLancing websites. Mean age was 37.02 years (*SD* = 10.76), and 50% were female. Participants average work experience was 15.11 years (*SD* = 11.02), and 10.7% reported to hold a leadership position. Participants came from different industries, the most frequent were Information and Communication (13.6%), Human Health and Social work activities (11.4%), and Education (9.7%). Participants received USD 2.40 (or its equivalent in Hungarian Forint or Euro) for participation (which corresponds to an hourly wage of approximately USD 9.00 and is thus above the minimum wage in all three countries). The criteria for inclusion of respondents in the survey were age (>18 years), place of residence (the United States, Hungary, or Germany), and employment status (at least part-time employed).

Experimental design and procedure

Design and procedure of Study 2 were similar to those of Study 1, with the following differences. First, we included country (in which the sample was collected in) as a between-participants factor. Second, Study 2 only employs the affective error learning measure. Third, Study 2 used three levels of the experimental factor agent (self, close colleague [i.e., from the same company], and distant colleague [i.e., from a competing company]). The degree of learning that occurs might not only depend on whether the error was committed by oneself or someone else, but whether the other person is an in-group or out-group member. This resulted in a 3x(2x3) mixed factorial design with country as between-participants factor (the United States, Hungary, or Germany) and severity of error consequences (mild vs. severe) and agent (self vs. close colleague vs. distant colleague) as within-participants factors.

Experimental material

In Study 2, we used 6 of the 8 vignettes (i.e., error scenarios) from Study 1.

Measures

Manipulation checks. We used the same two questions as in Study 1 to test whether participants perceived the severity of the error consequences in the intended way. As expected, we found a large effect, $F(1,582) = 1117.01$, $p < .001$, $\eta_p^2 = .66$, indicating that our manipulations of severity of error consequences had worked as intended.

Dependent variable. Affective error learning was assessed with the same three items as in Study 1, adapted from the subscale "learning from errors" of the Error Orientation Questionnaire (EOQ; Rybowiak et al., 1999). Cronbach's alpha was .95.

Error management culture. We assessed error management culture using the 17-item Error Management Culture Questionnaire (van Dyck et al., 2005). The Error Management Culture Questionnaire (van Dyck et al., 2005) is based on the Error Orientation Questionnaire (Rybowiak et al., 1999) and is commonly used as a measure of error management culture in organizations (Frese & Keith, 2015). The Error Management Culture Questionnaire assesses aspects of error competence, learning from errors, analysing errors, and error communication. Sample items are "When people make an error, they can ask others for advice on how to continue" or "After an error, people think through how to correct it." Participants had to indicate, on a 5-point Likert scale, how much the statements apply to their workplace. Cronbach's alpha was .93.

Results

Means, standard deviations, and correlations of variables used in Study 2 are presented in Tables 3 and 4. Results indicated that error management culture was positively related to affective error learning. Error management culture was also related to country.

Severity of error consequences and agent

Hypothesis 1 predicted that severity of error consequences increases learning from errors in that learning is higher for errors with severe consequences. Hypothesis 2 predicted that learning from errors depends on the agent in that learning is higher when the error was made by oneself as opposed to by someone else. We tested the hypothesized effects simultaneously in a repeated measures ANOVA in which we included material version (i.e., vignette–factor combination) as between-participants control factor (Judd et al., 2001). In support of our hypotheses, we found a main effect of severity of error consequences on affective error learning, $F(1,582) = 27.54$, $p < .001$, $\eta_p^2 = .05$ (see Figure 2, Panel a), and a main effect of agent, $F(2,1164) = 71.75$, $p < .001$, $\eta_p^2 = .11$ (see Figure 2, Panel b).[5,6] Learning from errors was

Table 3. Means, standard deviations, and intercorrelations of Study 2 variables.

	M	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1. Age	37.02	10.76	-						
2. Gender	-	-	−.08						
3. Error management culture	4.00	0.67	.05	.00	(.93)				
Country									
4. United States vs. Hungary and Germany	-	-	.00	.00	.29**	-			
5. Germany vs. United States and Hungary	-	-	.01	.00	−.09*	−.49**	-		
6. Hungary vs. United States and Germany	-	-	−.01	.00	−.20**	−.52**	−.49**	-	
7. Affective error learning (self-reports)	4.07	0.67	.13**	−.13**	.38**	.17**	−.06	−.11*	(.93)

Note. $N = 588$. Cronbach's alpha coefficients are shown in parentheses along the diagonal. Gender was coded 0 for female and 1 for male.
* $p < .05$. ** $p < .01$.

Table 4. Means and standard deviations of the dependent variable in Study 2 by factor levels[a].

	Affective error learning (self-reports)	
Severity	*M*	*SD*
Mild error consequences	4.01	0.73
Severe error consequences	4.12	0.72
Agent		
Self	4.26	0.71
Close colleague	3.97	0.82
Distant colleague	3.96	0.82
Country		
United States	4.23	0.64
Hungary	3.97	0.76
Germany	4.00	0.57

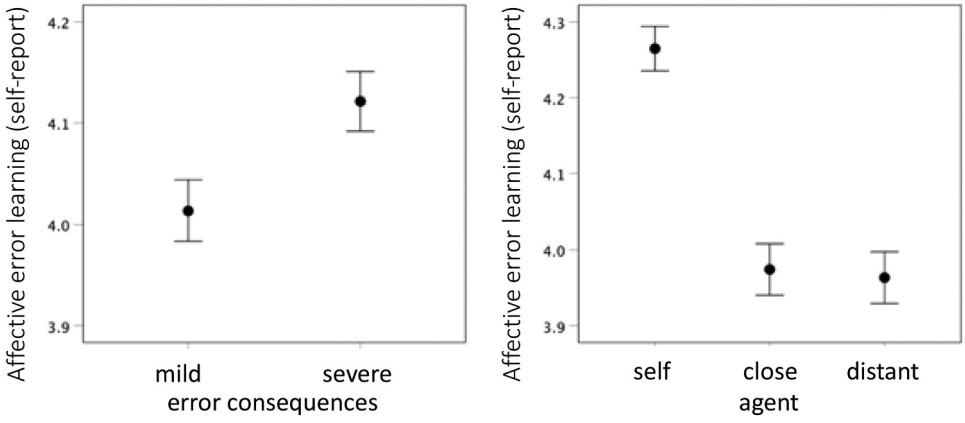
Note. $N = 588$.
[a]Factor 1: severity of error consequences (mild, severe); Factor 2: agent (self, close colleague, distant colleague); Factor 3: country (United States, Hungary, Germany).

higher if the error was made by oneself ($M = 4.23$, $SD = 0.03$) than made by a close colleague ($M = 3.93$, $SD = 0.03$), $t(587) = 9.67$, $p < .001$, or distant colleague ($M = 3.92$, $SD = 0.03$), $t(587) = 10.52$, $p < .001$. Learning from errors did not differ for errors made by a close colleague or distant colleague, $t(587) = 0.56$, $p = .57$.

Country differences in learning from errors

Our first open research question addressed whether there are country differences in learning from errors. We tested our first open research question in a repeated measures ANOVA in which we included a multicategorical independent variable for country (the United States vs. Hungary vs. Germany) and the material version (i.e., vignette–factor combination) as between-participants control factor (Judd et al., 2001). We found a significant relationship between country and affective error learning, $F(2,570) = 9.00$, $p < .001$, $\eta_p^2 = .03$, indicating that learning differs between the United States, Hungary, and Germany (see Figure 3, Panel a). However, contrary to our assumption, learning from errors was significantly higher in the United States ($M = 4.23$, $SD = 0.64$) than in Hungary ($M = 3.97$, $SD = 0.76$), $t(399) = 3.94$, $p < .001$, and also than in Germany ($M = 4.00$, $SD = 0.57$), $t(386) = 3.31$, $p < .01$. Hungary and Germany did not differ significantly, $t(385) = 0.56$, $p = .57$.

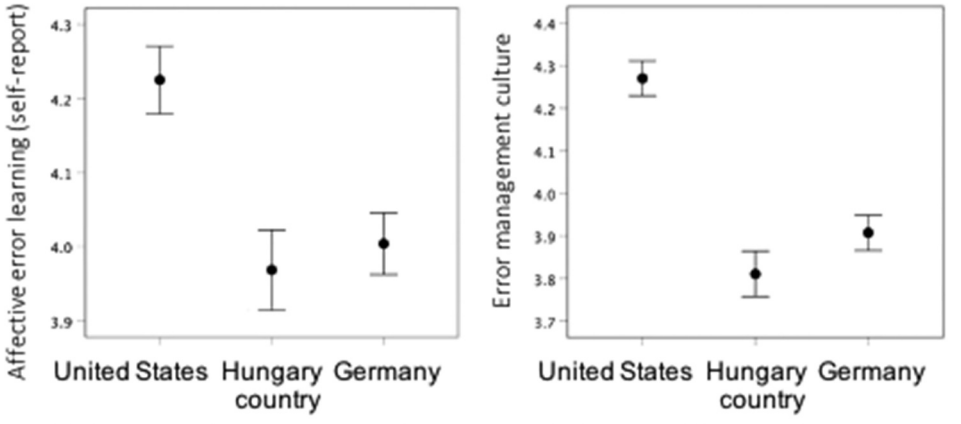
The other results in the repeated measures ANOVA (not pertinent to the hypothesis) were as follows. No interaction of country and severity, $F(2,570) = 2.09$, $p = .13$, $\eta_p^2 = .01$,



(a) Main effect of severity of error consequences ($M \pm 1\ SE$) (Study 2)

(b) Main effect of agent ($M \pm 1\ SE$) (Study 2)

Figure 2. Main effect of severity of error consequences and agent on learning from errors in Study 2.



(a) Country differences in learning from errors ($M \pm 1\ SE$) (Study 2)

(b) Country differences in error management culture ($M \pm 1\ SE$) (Study 2)

Figure 3. Country differences in learning from errors and error management culture in Study 2.

and no interaction of country and agent, $F(4,1140) = 2.16$, $p = .07$, $\eta_p^2 = .01$.[7]

Country differences in error management culture

Our second open research question asked whether there are differences in error management culture between countries. To test our second open research question, we conducted a univariate ANOVA. We found a significant main effect of country on error management culture, $F(2,585) = 28.37$, $p < .001$, $\eta_p^2 = .09$ (see Figure 3, Panel b). Participants in the United States ($M = 4.27$, $SD = 0.56$) reported significantly more error management culture than did participants in Germany ($M = 3.91$, $SD = 0.57$), $t(386) = 6.21$, $p < .001$, or Hungary ($M = 3.81$, $SD = 0.76$), $t(399) = 6.84$, $p < .001$. Hungary and Germany did not differ significantly, $t(385) = 1.41$, $p = .16$.

Potential mediation of error management culture

Our third open research question asked whether error management culture mediates the relationship between country and learning from errors. To test this open research question, we conducted mediation analysis (using 5,000 bootstrap samples) with our multicategorical independent variable, country, as predictor (Hayes & Preacher, 2014; Preacher & Hayes, 2004), error management culture as mediator, and learning from errors (affective error learning) as criterion variable. Based on our previous results that learning and error management culture is highest in the United States, and that Hungary and Germany did not differ in learning or error management culture, we only created one dummy variable ("United States vs. Hungary and Germany") for the multicategorical independent variable, country, with codes of (⅔, -⅓, -⅓) for the United States, Hungary, and Germany, respectively. (We reran the mediation analysis with two Helmert-coded dummy variables with codes of [⅔, -⅓, -⅓] and [0, -½, ½] for the United States, Hungary, and Germany, respectively. The pattern and magnitude of results remained unaltered.) Again, we controlled for material version (i.e., vignette–factor combination). We found a significant positive relationship between our dummy variable "United States vs. Hungary and Germany" and error management culture (Figure 4, Path *a*). We also found a significant positive relationship between error management culture and affective error learning (Figure 4, Path *b*).[8] The 95% bias corrected confidence interval for the indirect effect excluded zero, indicating a significant indirect relationship for our dummy variable "United States vs. Hungary and Germany", $B = 0.15$, CI [0.09, 0.20] (Figure 4, Path *a*b*). In other words, the results are consistent with the idea that error management culture mediates the relationship between country and learning from errors.

General discussion

It is well-established that individuals can learn from errors (e.g., Frese & Keith, 2015). However, we know surprisingly little about whether and how errors differ in the extent to which they foster learning. In the present research, we demonstrated that otherwise identical errors differ in the extent to which they stimulate learning, dependent on error characteristics such as severity of error consequences or the agent who made the error, as well as on the cultural context in which the error occurred. More specifically, in two vignette experiments, we demonstrated that learning was more likely when (a) the consequences of the errors were severe as opposed to mild and when (b) the error was made by oneself as opposed to by someone else. We did not find differences in learning from errors made by someone from an in-group or an out-group. We also demonstrated that participants in the United States (c) reported higher levels of error management culture and (d) learned more than participants in Hungary or Germany. We showed that (e) the differences in learning were due to differences in error management culture.

Theoretical contributions

First, our research adds to the controversial debate of whether more learning occurs from errors with mild or severe consequences. One line of research argues that more learning occurs from errors with mild or moderate consequences (e.g., Hayward, 2002; Khanna et al., 2016; Sitkin, 1992). This follows the proposition that severe error consequences may pose a threat to humans. The perceived threat may lead to defensiveness and denial, which impedes learning. This line of argumentation has received some supportive and some less supportive results (Hayward, 2002; Homsma et al., 2009; Khanna et al., 2016; Madsen & Desai, 2010; Zakay et al., 2004). The other line of research argues that more learning occurs from errors with severe consequences (e.g., Baumard & Starbuck, 2005; Homsma et al., 2009; Joung et al., 2006; Madsen & Desai, 2010; Zakay et al., 2004). In contrast to errors

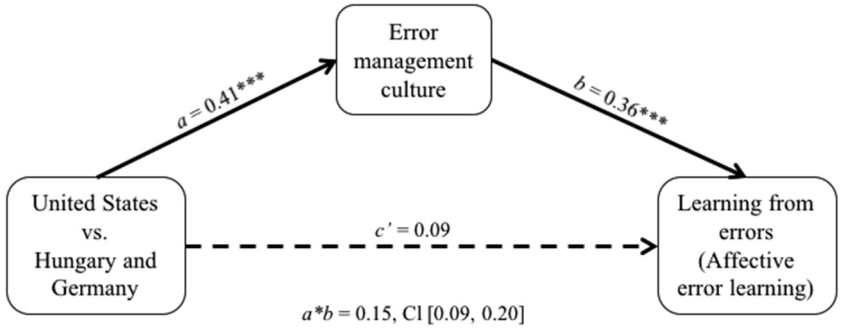


Figure 4. The relationship between country and learning from errors (affective error learning) mediated by error management culture in Study 2. Unstandardized values and confidence intervals (CI). The dashed arrow indicates the non-significant direct path from country to learning from errors. * $p < .05$. ** $p < .01$ *** $p < .001$.

with severe consequences, errors with mild consequences are more easily overlooked or ignored (Cannon & Edmondson, 2005). To attract attention, error consequences need to be severe enough (e.g., Homsma et al., 2009; Madsen & Desai, 2010). Attention is a prerequisite for learning (Anderson et al., 1998; Craik et al., 1996) and our results provide further evidence for this line of argumentation.

One potential alternative explanation for this attentional account is that the mechanism is not the severity but the noticeability of errors with severe consequences. In other words, severe error consequences led to more learning because they were more visible, not because they attracted more attention. However, we think that this explanation does not contradict our argumentation based on attention: Greater visibility and greater attention do not need to be mutually exclusive. Visibility and attention may be closely related, as greater visibility of error consequences may attract more attention. Future research may seek to disentangle these presumably interrelated processes more systematically.

Second, we contribute to research on vicarious learning compared to direct learning. It is well documented that observational learning does occur (e.g., Bandura, 1986). Yet we assumed that errors made by oneself are of greater personal relevance and that this greater personal relevance increases attention to and learning from errors. The same mechanism should apply for errors made by in-group members versus out-group members, as presumably errors by in-group members are of greater personal relevance than errors by out-group members. However, we found no differences in learning from errors made by in- and out-group members. One potential explanation for this is that participants might not have identified with the described person as an in-group member. Another explanation might be that negative affective reactions to an error may make differences to the in-group member more salient, thereby reducing in-group favouritism. In-group favouritism might indeed depend on whether the group outcome is success or failure. For example, in-group favouritism disappeared when the in-group received the feedback that their group did not succeed (Brewer, 1979; Ryen & Kahn, 1975).

Third, we add to the scarce body of cross-cultural research on error management culture. In order to do so, we selected three countries that differ in regard to the practices of uncertainty avoidance (House et al., 2004): the United States, Hungary, and Germany. Uncertainty avoidance may have a particular influence on how people deal with errors (i.e., error management culture) and thus whether they learn from errors (Gelfand et al., 2011). Specifically, we had speculated about a potential linear effect of uncertainty avoidance on error management culture and learning from errors, predicting learning from errors to be highest in Hungary, to be moderate in United States, and to be lowest in Germany.

Yet we did not find such a linear effect of uncertainty avoidance on error management culture and learning from errors, but instead found an inverted u-shaped relationship: error management culture and learning was highest in the United States (which, according to the GLOBE project, scores moderately on practices of uncertainty avoidance; De Luque & Javidan, 2004) and lower in Hungary (low on practices of uncertainty avoidance) and Germany (high on practices of uncertainty avoidance; De Luque & Javidan, 2004). An explanation for these results could be that in countries low in uncertainty avoidance, errors may not be taken seriously enough, which inhibits their learning potential. However, when uncertainty avoidance is high, errors may be considered to be too threatening. This could lead to defensive reactions, which may also reduce the learning potential of the errors. The optimum would thus lie in the middle, at moderate levels of practices of uncertainty avoidance.

There are at least two additional potential alternative explanations for our results regarding country differences in error management culture and learning from errors. First, it could be that another cultural dimension, namely, humane orientation, influences how people deal with and learn from errors. *Humane orientation* refers to the extent to which a society "encourages and rewards individuals for being fair, altruistic, friendly, generous, caring, and kind to others" (House & Javidan, 2004, p. 13). Humane orientation may influence error management culture and learning from errors, because it "is related to increased compassion and acceptance and thus acceptance of mistakes" (Gelfand et al., 2011, p. 260). Countries high on humane orientation can thus be described as more error-tolerant. In the GLOBE study, one item examines how error-tolerant people are in the respective country. This item on error tolerance is part of the humane orientation scale (Kabasakal & Bodur, 2004). While tolerating errors may seem like a contradiction to our hypothesis that errors need to be severe enough to stimulate learning, it is important to note that error tolerance does not mean that errors are not taken seriously. Error tolerance means that it is accepted that errors may happen, despite best efforts to prevent them. Moreover, when errors are more tolerated and expected to happen, emotions associated with errors should be less negative (Frese & Keith, 2015). This positivity may stem from the assumption that errors can be corrected. This may foster an environment in which learning from errors could be more likely.

According to the GLOBE study, Germany ($M = 3.18$; rank 61 of 62) and Hungary ($M = 3.35$; rank 58) are lower on humane orientation practices than the United States ($M = 4.17$; rank 26; Kabasakal & Bodur, 2004). Following the reasoning that error management culture and learning from errors is higher in countries high on humane orientation, error management culture and learning from errors should be highest in the United States, followed by Hungary and Germany. This is the pattern of results that we found in our study.

It has to be noted that the concept of humane orientation as defined by GLOBE is a subject of debate. For example, Schlösser et al. (2013) point out that humane orientation is an ambivalent, multidimensional construct. In conclusion, the GLOBE humane orientation scale as such has rather poor psychometric properties and validation evidence.

Second, another alternative explanation for our results regarding country differences in learning from errors could lie in the litigious nature of the United States. The United States is considered to be a more litigious country than Germany or Hungary. In litigious countries, seemingly small incidents can *develop* severe consequences, such as a tort case with high compensation payments as a potential outcome. When each error may develop severe consequences, each error may be taken seriously. Thus, we would assume more learning from errors to occur in the United States than in Germany or

Hungary. This may explain why participants in our United States sample learned most from errors, regardless of the *manipulated* severity of the consequences.

Strengths, limitations, and directions for future research

In the present study, we used vignette experiments to test our assumptions that severity of error consequences and the person who made the error influence learning from errors. Learning from errors is a critical topic that may be difficult to study in non-experimental field settings for the following reasons. First, while errors occur quite often (e.g., Frese, 1991), many people are reluctant to report errors. This may be because in many companies, errors are stigmatized so that employees might fear negative consequences when reporting errors. Second, in natural field settings, it is hardly possible to isolate error characteristics in a similar manner as we did in our study. While conducting a study in natural field settings as opposed to employing a vignette methodology would produce findings of high ecological validity, it would be difficult to clearly identify which error characteristics influenced learning – which was the aim of the present study. In that way, we were able to hold all error characteristics except for our independent variables constant.

In regard to ecological validity, we see the prior concern of our study in the way we assessed learning from errors. In Studies 1 and 2, we assessed affective error learning using three self-report items of the "learning from errors" subscale of the Error Orientation Questionnaire (Rybowiak et al., 1999). As a self-report measure, responses on our affective error learning scale may be affected by response biases. Participants may have indicated more affective error learning than we could observe using a different way of assessment. In order to address this issue, in Study 1, we additionally assessed cognitive error learning in terms of recall of error situations by asking participants to describe the error situation and the error consequences we had previously presented to them. Even though we cannot be sure that the pattern we found in our results will also be reflected in actual behaviour, we propose that our measures are valid proxies for actual learning from errors for mainly four reasons. First, our affective error learning measure was a validated measure of learning from errors (Rybowiak et al., 1999). Second, affective learning from errors can be considered as a readiness and intention to learn from that particular error. Social psychological research demonstrates substantial correlations between intentions and behaviour (Ajzen & Fishbein, 1977). Third, our findings regarding severity of error consequences are in line with those of previous correlational research using non-experimental field data (Homsma et al., 2009). Fourth, in Study 1, we were able to demonstrate that the cognitive error learning variable correlated with the affective error learning variable that we employed in both studies. While we acknowledge that recalling error scenarios and actual learning from error are not the same, recalling the error and the consequences caused by the error are necessary prerequisites and intrinsically tied to actual learning from errors.

The aim of our study was to systematically assess how varying the factors agent and severity influence learning from errors. We chose an experimental setting to study variations of these factors under standardized conditions – by means of vignette experiments. This allowed us to identify a cause–effect relationship for affective and cognitive error learning. At the same time, it came at the expense of a behavioural learning measure, as it did not allow participants to actually demonstrate what they had learned from the errors. We acknowledge the importance of studying actual behavioural reactions to the errors and strongly encourage future studies in this area. Future studies on learning from errors could aim at developing a learning measure that on the one hand can be employed in standardized settings such as experiments, but on the other hand has higher ecological validity than the measures we employed in the present studies.

A first step could be to replicate our vignette experiment, but supplemented by additionally asking participants to describe what they would have done differently if they were asked to do the same task again. Subsequently, two independent raters could rate participants' answers in terms of the extent of learning from errors. This would allow for a systematic variation of the factors we had investigated, while at the same time giving participants the opportunity to articulate what they had learned. Another possibility could be to invite participants into a laboratory to work on standardized tasks. For these standardized tasks, the possible errors participants could make would be limited to a certain pool of errors. These errors could be categorized, and the learning that results from them could be assessed. One way of assessing actual learning from these errors could be to see whether participants repeated the errors they had previously made. Another possible future study could be a field study in one specific department of an organization, which could be considered as a balance between a standardized setting while at the same time allowing researchers to observe behavioural outcomes in response to errors. It has to be noted, however, that not all errors must lead to behavioural outcomes, or that the time lag between the error and the adapted behaviour may be too long to observe it during a field study.

Notably, however, is that fact that the use of country rankings as predictors of individual behaviour has been criticized for long (e.g., Bond, 2002; Brewer & Venaik, 2012, 2014). According to Brewer and Venaik (2012), societal level phenomena "do not exist on individual level" (p. 674). In a similar manner, Schwartz (2009) argues that "cultural value orientations are properties of societies, not of individuals" (p. 146). Furthermore, Minkov and Hofstede (2011) argue that dimensions of national culture "are meaningless as descriptors of individuals or as predictors of individual differences because the variables that define them do not correlate meaningfully across individuals" (p. 12). The assumption that similar characteristics and relationships exist at the cultural and individual level has been labelled ecological fallacy (e.g., Brewer & Venaik, 2012, 2014; House & Hanges, 2004). Brewer and Venaik (2012) further argue that one may not associate societal level phenomena, such as practices of uncertainty avoidance, with phenomena on an individual level, such as individual behaviour. Instead, one may only investigate relationships of societal level phenomena with societal level variables, such as the Gross Domestic Product. In that sense, the scores from GLOBE's uncertainty avoidance practices measure

are not an indicator or predictive of individual behaviour, but represent how participants perceive the practices in their society.

However, several researchers argue that there may well be an influence of country level variables on individual behaviour. For example, how the practices in a country are perceived can influence socialization patterns (Maccoby, 2000), personality (Triandis & Suh, 2002), and behaviour (Adler & Gundersen, 2008; Singelis & Brown, 1995). This may be because the perceptions of what is prevailing, what is considered to be right or wrong, may shape "the knowledge about and attitudes towards life" (Geertz, 1973, p. 89), and the norm of how people feel one expects them to behave.

We acknowledge the caveats as noted above (e.g., Brewer & Venaik, 2012, 2014). However, we also acknowledge the line of reasoning that perception of the practices in a country may influence individual behaviour. It has to be noted that, of course, not every individual in a country must behave accordingly, but we assume that the practice scores of a cultural dimension may adequately pinpoint a general behavioural tendency of individuals in the respective country. De Mooij (2013) argues that "scores on national dimensions cannot be used to predict the behaviour of a particular individual, but as long as authors are clear about reporting frequencies or averages, using the word individuals is not problematic. (…) Individuals in a national society are like the pieces in a jigsaw puzzle; while each being unique, they fit together and produce a meaningful national picture. In describing the national culture, it is perfectly okay to refer to characteristics of individuals that in such a culture are relatively more frequent or more likely." (p. 254). Taken together, we decided to exercise caution regarding potential country differences in learning from errors and chose to postulate open research questions rather than concrete hypotheses.

Another potential limitation is that we collected data on error management culture and learning from errors from the same persons. Due to the common source bias, the results might be inflated. We therefore encourage further studies that use data from different sources in order to further assess the relationship between error management culture and learning from errors.

In the ongoing replication crisis in psychology and other fields (Open Science Collaboration, 2015), replication of results is important to minimize the possibility of false positive findings. In this regard, one of the strengths of the present paper is that we were able to find the suggested pattern across four independent samples from three countries.

Practical implications

Luckily, most errors that happen every day do not end in catastrophes – their consequences are mild. As our results indicate, the learning potential inherent in errors with mild consequences may not be fully exploited. Therefore, it is important that organizations put errors with mild consequences in the focus of attention, so that their learning potential can unfold. Similarly, while errors made by others may be a rich source of learning, their learning potential is not fully exploited. Managers might establish regular meetings in which errors with mild consequences or errors made by others are particularly discussed. At the same time, it is important not to blame the person who made the error. Discussion of errors with mild consequences might be more open, as fear and negative emotions should be reduced: for instance, "nothing happened, anyway, so why not talk about it!" should be the prevailing attitude instead of "nothing happened anyway, so why bother sharing what went wrong?".

Furthermore, these meetings could tackle our finding that learning from errors also occurs when someone else has made the error. Open communication about errors and exchanging experiences with errors turns other people's attention to sources and consequences of errors. This way, the team or the organization as a whole can learn from these errors. "You don't need to make an error yourself in order to learn from it!" could be a motto that encourages sharing the error, as one is doing something that benefits the group as a whole. Thereby, managers foster an error management culture, which is beneficial for learning from errors.

While we showed that participants in all three countries that we investigated learned from errors, most learning occurred in the United States. Therefore, we particularly encourage organizations in Germany and Hungary to foster an error management culture, which is beneficial for learning from errors.

Disclosure statement

The authors report no conflict of interest.

Funding

This research was supported by grants from the German Research Foundation (Deutsche Forschungsgemeinschaft) [grants no. KE 1377/4-1, FR 638/38-1].

ORCID

Dorothee Horvath http://orcid.org/0000-0003-3954-1720
Alexander Klamar http://orcid.org/0000-0002-5983-3707
Nina Keith http://orcid.org/0000-0003-3024-1297
Michael Frese http://orcid.org/0000-0002-6462-4395

Notes

1. It should be noted that uncertainty avoidance in the GLOBE project and by Hofstede capture different constructs (De Luque & Javidan, 2004; Venaik & Brewer, 2010). According to Venaik and Brewer (2010), uncertainty avoidance by GLOBE is unidimensional and captures the importance of orderliness, consistency, structure, as well as rules and laws. On the contrary, uncertainty avoidance by Hofstede is multifaceted and captures three different aspects: feelings of nervousness and tension, employment stability, and rule orientation. Furthermore, Hofstede's conceptualization of uncertainty avoidance entails mainly values. We follow Gelfand et al. (2011) and adhere to the unidimensional conceptualization of practices of uncertainty avoidance by GLOBE.
2. Of the 120 participants originally recruited, two participants had to be excluded from further analyses.
3. We did not include the fourth item of the scale "Mistakes provide useful information for me to carry out my work" in our study. In the German version of the scale, this item includes a hypothetical construction or "if clause" ("If an error happens to me … "). We found

this item to be too complex and unsuitable for our purposes, and barely equivalent to the English translation. In order to minimize differences in different language versions of the questionnaire, we decided not to include this item in our study.

4. The other effects in the repeated measures MANOVA (not pertinent to the hypothesis) were as follows. For the first learning measure (affective error learning): no main effect of material version, $F(3,114) = 1.05$, $p = .38$, $\eta_p^2 = .03$, no interaction effect of material version with severity of error consequences, $F(3,114) = 2.15$, $p = .10$, $\eta_p^2 = .05$, or agent, $F(3,114) = 1.13$, $p = .34$, $\eta_p^2 = .03$. For the second learning measure (cognitive error learning): no main effect of material version, $F(3,114) = 0.21$, $p = .89$, $\eta_p^2 = .01$, but an interaction effect of material version with severity of error consequences, $F(3,114) = 15.95$, $p < .001$, $\eta_p^2 = .30$, and agent, $F(3,114) = 3.40$, $p < .05$, $\eta_p^2 = .08$. Such interaction effects are common in experiments that include multiple naturalistic materials and they underscore the appropriateness of systematically varying and statistically controlling for experimental material.
5. Due to the violation of the sphericity assumption in case of agent, a Huynh-Feldt corrected *F*-value (as the ε estimates of sphericity were greater than 0.75) was applied (Girden, 1992).
6. The other effects in the repeated measures ANOVA (not pertinent to the hypothesis) were as follows: no main effect of material version, $F(5,582) = 0.63$, $p = .68$, $\eta_p^2 = .01$, but an interaction effect of material version with severity of error consequences, $F(5,582) = 12.79$, $p < .001$, $\eta_p^2 = .10$, and with agent, $F(10,1164) = 4.16$, $p < .001$, $\eta_p^2 = .03$.
7. Due to the violation of the sphericity assumption in case of agent, a Huynh-Feldt corrected *F*-value (as the ε estimates of sphericity were greater than 0.75) was applied (Girden, 1992).
8. Likewise, in Study 1, error management culture was significantly associated with learning from errors, $F(2,112) = 12.75$, $p < .001$, $\eta_p^2 = .19$. Error management culture was significantly associated with both learning measures, affective error learning, $F(1,113) = 23.80$, $p < .001$, $\eta_p^2 = .17$, and cognitive error learning, $F(1,113) = 4.04$, $p < .05$, $\eta_p^2 = .03$.

Data availability statement

Data can be obtained from the authors upon reasonable request.

Geolocation information

The studies were conducted in the United States, Hungary, and Germany.

References

Adler, N. J., & Gundersen, A. (2008). *International dimensions of organizational behavior* (5th ed.). Thomson South-Western.

Aguinis, H., & Lawal, S. O. (2012). Conducting field experiments using eLancing's natural environment. *Journal of Business Venturing*, *27*(4), 493–505. https://doi.org/10.1016/j.jbusvent.2012.01.002

Ajzen, I., & Fishbein, M. (1977). Attitude-behavior relations: A theoretical analysis and review of empirical research. *Psychological Bulletin*, *84*(5), 888–918. https://doi.org/10.1037/0033-2909.84.5.888

Anderson, N. D., Craik, F. I., & Naveh-Benjamin, M. (1998). The attentional demands of encoding and retrieval in younger and older adults: I. Evidence from divided attention costs. *Psychology and Aging*, *13*(3), 405–423. https://doi.org/10.1037/0882-7974.13.3.405

Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science*, *22*(5), 1123–1137. https://doi.org/10.1287/orsc.1100.0621

Baldwin, T. T., & Ford, J. K. (1988). Transfer of training: A review and directions for future research. *Personnel Psychology*, *41*(1), 63–105. https://doi.org/10.1111/j.1744-6570.1988.tb00632.x

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive perspective*. Princeton-Hall.

Baumard, P., & Starbuck, W. H. (2005). Learning from failures: Why it may not happen. *Long Range Planning*, *38*(3), 281–298. https://doi.org/10.1016/j.lrp.2005.03.004

Bell, B. S., & Kozlowski, S. W. J. (2008). Active learning: Effects of core training design elements on self-regulatory processes, learning, and adaptability. *Journal of Applied Psychology*, *93*(2), 296–316. https://doi.org/10.1037/0021-9010.93.2.296

Bell, B. S., Tannenbaum, S. I., Ford, J. K., Noe, R. A., & Kraiger, K. (2017). 100 years of training and development research: What we know and where we should go. *Journal of Applied Psychology*, *102*(3), 305–323. https://doi.org/10.1037/apl0000142

Bond, M. H. (2002). Reclaiming the individual from Hofstede's ecological analysis – A 20-year odyssey: Comment on Oyserman et al. (2002). *Psychological Bulletin*, *128*(1), 73–77. https://doi.org/10.1037/0033-2909.128.1.73

Brewer, M. B. (1979). In-group bias in the minimal intergroup situation: A cognitive-motivational analysis. *Psychological Bulletin*, *86*(2), 307–324. https://doi.org/10.1037/0033-2909.86.2.307

Brewer, P., & Venaik, S. (2012). On the misuse of national culture dimensions. *International Marketing Review*, *29*(6), 673–683. https://doi.org/10.1108/02651331211277991

Brewer, P., & Venaik, S. (2014). The ecological fallacy in national culture research. *Organization Studies*, *35*(7), 1063–1086. https://doi.org/10.1177/0170840613517602

Buhrmester, T. K., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality data? *Perspectives on Psychological Science*, *6*(1), 3–5. https://doi.org/10.1177/1745691610393980

Cannon, M. D., & Edmondson, A. C. (2005). Failing to learn and learning to fail (intelligently): How great organizations put failure to work to innovate and improve. *Long Range Planning*, *38*(3), 299–319. https://doi.org/10.1016/j.lrp.2005.04.005

Carmeli, A., & Gittell, J. (2009). High-quality relationships, psychological safety, and learning from failures in work organizations. *Journal of Organizational Behavior*, *30*(6), 709–729. https://doi.org/10.1002/job.565

Cheung, J. H., Burns, D. K., Sinclair, R. R., & Sliter, M. (2017). Amazon Mechanical Turk in organizational psychology: An evaluation and practical recommendations. *Journal of Business and Psychology*, *32*(4), 347–361. https://doi.org/10.1007/s10869-016-9458-5

Craik, F. I., Govoni, R., Naveh-Benjamin, M., & Anderson, N. D. (1996). The effects of divided attention on encoding and retrieval processes in human memory. *Journal of Experimental Psychology: General*, *125*(2), 159–180. https://doi.org/10.1037/0096-3445.125.2.159

Davis, D. D., Bryant, J. L., Tedrow, L., Liu, Y., Selgrade, K. A., & Downey, H. J. (2005). *Team performance and error management in Chinese and American simulated flight crews: The role of cultural and individual differences* (Report). National Aeronautics and Space Administration-Langley Research Center.

De Luque, M. S., & Javidan, M. (2004). Uncertainty avoidance. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership, and organizations: The GLOBE study of 62 societies* (pp. 602–653). Sage.

De Mooij, M. (2013). On the misuse and misinterpretation of dimensions of national culture. *International Marketing Review*, *30*(3), 253–261. https://doi.org/10.1108/02651331311321990

Dormann, T., & Frese, M. (1994). Error training: Replication and the function of exploratory behavior. *International Journal of Human-Computer Interaction*, *6*(4), 365–372. https://doi.org/10.1080/10447319409526101

Edmondson, A. (1996). Learning from mistakes is easier said than done: Group and organizational influences on the detection and correction of human error. *Journal of Applied Behavioral Science*, *32*(2), 5–28. https://doi.org/10.1177/0021886396321001

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, *44*(2), 350–383. https://doi.org/10.2307/2666999

Ellis, S., Carette, B., Anseel, F., & Lievens, F. (2014). Systematic reflection: Implications for learning from failures and successes. *Current Directions in Psychological Science*, *23*(1), 67–72. https://doi.org/10.1177/0963721413504106

Frese, M. (1991). Error management or error prevention: Two strategies to deal with errors in software design. In H.-J. Bullinger (Ed.), *Human aspects in computing: Design and use of interactive systems and work with terminals* (pp. 776–782). Elsevier.

Frese, M., & Zapf, D. (1994). Action as the core of work psychology: A German approach. In H. C. Triandis, M. D. Dunette, & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (Vol. 4, pp. 271–340). Consulting Psychologists Press.

Frese, M., & Keith, N. (2015). Action errors, error management, and learning in organizations. *Annual Review of Psychology*, *66*(1), 661–687. https://doi.org/10.1146/annurev-psych-010814-015205

Geertz, C. (1973). *The interpretation of cultures*. Basic Books.

Gelfand, M. J., Frese, M., & Salmon, E. (2011). Cultural influences on errors: Planning, detection, and management. In D. A. Hofmann & M. Frese (Eds.), *Errors in organizations* (pp. 1–43). Taylor & Francis.

Girden, E. R. (1992). *Sage university papers. Quantitative applications in the social sciences, Vol. 84. ANOVA: Repeated measures*. Sage Publications, Inc.

Hayes, A. F., & Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology*, *67*(3), 451–470. https://doi.org/10.1111/bmsp.12028

Hayward, M. L. (2002). When do firms learn from their acquisition experience? Evidence from 1990 to 1995. *Strategic Management Journal*, *23*(1), 21–39. https://doi.org/10.1002/smj.207

Heimbeck, D., Frese, M., Sonnentag, S., & Keith, N. (2003). Integrating errors into the training process: The function of error management instructions and the role of goal orientation. *Personnel Psychology*, *56*(2), 333–362. https://doi.org/10.1111/j.1744-6570.2003.tb00153.x

Helmreich, R. L., & Merritt, A. C. (1998). *Culture at work in aviation and medicine: National, organizational, and professional influences*. Ashgate.

Hofmann, D. A., & Frese, M. (2011). Errors, error taxonomies, error prevention, and error management: Laying the groundwork for discussing errors in organizations. In D. A. Hofmann & M. Frese (Eds.), *Errors in organizations* (pp. 1–43). Taylor & Francis.

Hofstede, G. (1980). *Culture's consequences*. Sage.

Holmer, L. L. (2014). Understanding and reducing the impact of defensiveness on management learning: Some lessons from neuroscience. *Journal of Management Education*, *38*(5), 618–641. https://doi.org/10.1177/1052562913505568

Homsma, G. J., van Dyck, C., De Gilder, D., Koopman, P. L., & Elfring, T. (2009). Learning from error: The influence of error incident characteristics. *Journal of Business Research*, *62*(1), 115–122. https://doi.org/10.1016/j.jbusres.2007.12.003

House, R. J., & Javidan, M. (2004). Overview of GLOBE. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership, and organizations: The GLOBE study of 62 societies* (pp. 9–28). Sage.

House, R. J., & Hanges, P. J. (2004). Research design. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership, and organizations: The GLOBE study of 62 societies* (pp. 95–101). Sage.

House, R. J., Hanges, P. J., Javidan, M., Dorfman, P. W., & Gupta, V. (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. Sage.

Ivancic, K., & Hesketh, B. (1995/1996). Making the best of errors during training. *Training Research Journal*, *1*, 103–125.

Johns, G. (2006). The essential impact of context on organizational behavior. *Academy of Management Review*, *31*(2), 368–408. https://doi.org/10.5465/amr.2006.20208687

Joung, W., Hesketh, B., & Neal, A. (2006). Using "war stories" to train for adaptive performance: Is it better to learn from error or success? *Applied Psychology: An International Review*, *55*(2), 282–302. https://doi.org/10.1111/j.1464-0597.2006.00244.x

Judd, C. M., Kenny, D. A., & McClelland, G. H. (2001). Estimating and testing mediation and moderation in within-subject designs. *Psychological Methods*, *6*(2), 115–134. https://doi.org/10.1037/1082-989X.6.2.115

Kabasakal, H., & Bodur, M. (2004). Humane orientation in societies, organizations, and leader attributes. In R. J. House, P. J. Hanges, M. Javidan, P. W. Dorfman, & V. Gupta (Eds.), *Culture, leadership, and organizations: The GLOBE study of 62 societies* (pp. 564–601). Sage.

Keith, N., & Frese, M. (2011). Enhancing firm performance and innovativeness through error management culture. In N. M. Ashkanasy, C. P. M. Wilderom, & M. F. Peterson (Eds.), *Handbook of organizational culture and climate* (2nd ed., pp. 137–157). Sage.

Keith, N., & Frese, M. (2005). Self-regulation in error management training: Emotion control and metacognition as mediators of performance effects. *Journal of Applied Psychology*, *90*(4), 677–691. https://doi.org/10.1037/0021-9010.90.4.677

Keith, N., & Frese, M. (2008). Effectiveness of error management training: A meta-analysis. *Journal of Applied Psychology*, *93*(1), 59–69. https://doi.org/10.1037/0021-9010.93.1.59

Khanna, R., Guler, I., & Nerkar, A. (2016). Fail often, fail big, and fail fast? Learning from small failures and R&D performance in the pharmaceutical industry. *Academy of Management Journal*, *59*(2), 436–459. https://doi.org/10.5465/amj.2013.1109

Kirkman, B. L., Lowe, K. B., & Gibson, C. B. (2006). A quarter century of culture's consequences: A review of empirical research incorporating Hofstede's cultural values framework. *Journal of International Business Studies*, *37*(3), 285. https://doi.org/10.1057/palgrave.jibs.840020

Kraiger, K., Passmore, J., Dos Santos, N. R., & Malvezzi, S. (2015). The psychology of training development, and performance improvement. In K. Kraiger, J. Passmore, N. R. Dos Santos, & S. Malvezzi (Eds.), *The Wiley Blackwell handbook of the psychology of training development and performance improvement* (pp. 1–9). John Wiley & Sons.

Kraiger, K., Ford, J. K., & Salas, E. (1993). Application of cognitive, skill-based, and affective theories of learning outcomes to new methods of training evaluation. *Journal of Applied Psychology*, *78*(2), 311–328. https://doi.org/10.1037/0021-9010.78.2.311

Kunin, T. (1955). The construction of a new type of attitude measure. *Personnel Psychology*, *8*(1), 65–77. https://doi.org/10.1111/j.1744-6570.1955.tb01189.x

Maccoby, E. E. (2000). Parenting and its effects on children: On reading and misreading behavior genetics. *Annual Review of Psychology*, *51*(1), 1–27. https://doi.org/10.1146/annurev.psych.51.1.1

Madsen, P. M., & Desai, V. (2010). Failing to learn? The effects of failure and success on organizational learning in the global orbital launch vehicle industry. *Academy of Management Journal*, *53*(3), 451–476. https://doi.org/10.5465/amj.2010.51467631

Metcalfe, J. (2017). Learning from errors. *Annual Review of Psychology*, *68*(1), 465–489. https://doi.org/10.1146/annurev-psych-010416-044022

Minkov, M., & Hofstede, G. (2011). The evolution of Hofstede's doctrine. *Cross Cultural Management: An International Journal*, *13*(1), 10–20. https://doi.org/10.1108/13527601111104269

Noort, M. C., Reader, T. W., Shorrock, S., & Kirwan, B. (2016). The relationship between national culture and safety culture: Implications for international safety culture assessments. *Journal of Occupational and Organizational Psychology*, *89*(3), 515–538. https://doi.org/10.1111/joop.12139

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, *349*(6251), 253–267. https://doi.org/10.1126/science.aac4716

Petty, R. E., Cacioppo, J. T., & Goldman, R. (1981). Personal involvement as a determinant of argument-based persuasion. *Journal of Personality and Social Psychology*, *41*(5), 847–855. https://doi.org/10.1037/0022-3514.41.5.847

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, *36*(4), 717–731. https://doi.org/10.3758/BF03206553

Reason, J. (1997). *Managing the risks of organizational accidents*. Ashgate Publishing.

Reason, J., Manstead, A., Stradling, S., Baxter, J., & Campbell, K. (1990). Errors and violations on the roads: A real distinction? *Ergonomics*, *33*(10–11), 1315–1332. https://doi.org/10.1080/00140139008925335

Rybowiak, V., Garst, H., Frese, M., & Batinic, B. (1999). Error Orientation Questionnaire (EOQ): Reliability, validity, and different language equivalence. *Journal of Organizational Behavior*, *20*(4), 527–547. https://doi.org/10.1002/(SICI)1099-1379(199907)20:4<527::AID-JOB886>3.0.CO;2-G

Ryen, A. H., & Kahn, A. (1975). Effects of intergroup orientation on group attitudes and proxemic behavior. *Journal of Personality and Social Psychology*, *31*(2), 302–310. https://doi.org/10.1037/h0076283

Satow, L. (2017). Allgemeiner Intelligenz-Test (AIT): Testmanual und Normen [General intelligence test (AIT): Test manual and norms] [Unpublished instrument]. https://www.drsatow.de/

Schlösser, O., Frese, M., Heintze, A.-M., Al-Najjar, M., Arciszewski, T., Besevegis, E., Bishop, G. D., Bonnes, M., Clegg, C. W., Drozda-Senkowska, E., Gaborit, M., Garzon, D., Hansen, T. G. B., Heszen, I., Juhasz, M., Keating, M. A., Mangundjaya, W., Mansor, N., Mitchelson, J. K., Pandey, J., … Zhang, K. (2013). Humane orientation as a new cultural dimension of the GLOBE Project: A validation study of the GLOBE scale and out-group humane orientation in 25 countries. *Journal of Cross-Cultural Psychology*, *44*(4), 535–551. https://doi.org/10.1177/0022022112465671

Schwartz, S. H. (2009). Culture matters: National value cultures, sources, and consequences. In C.-Y. Chiu, Y. Y. Hong, S. Shavitt, & R. S. Wyer Jr. (Eds.), *Understanding culture: Theory, research, and application* (pp. 127–150). Psychology Press.

Shimizu, K., & Hitt, M. A. (2011). Errors at the top of hierarchy. In D. A. Hofmann & M. Frese (Eds.), *Errors in organizations* (pp. 199–224). Taylor & Francis.

Singelis, T. M., & Brown, W. K. (1995). Culture, self, and collectivist communication: Linking culture to individual behavior. *Human Communication Research*, *21*(3), 354–389. https://doi.org/10.1111/j.1468-2958.1995.tb00351.x

Sitkin, S. B. (1992). Learning through failure. *Research in Organizational Behavior*, *14*, 231–266.

Staw, B. M., Sandelands, L. E., & Dutton, J. E. (1981). Threat rigidity effects in organizational behavior: A multilevel analysis. *Administrative Science Quarterly*, *26*(4), 501–524. https://doi.org/10.2307/2392337

Tajfel, H., & Turner, J. C. (2004). The social identity theory of intergroup behavior. In J. T. Jost & J. Sidanius (Eds.), *Key readings in social psychology. Political psychology: Key readings* (pp. 276–293). Psychology Press.

Triandis, H. C., & Suh, E. M. (2002). Cultural influences on personality. *Annual Review of Psychology*, *53*(1), 133–160. https://doi.org/10.1146/annurev.psych.53.100901.135200

Tyng, C. M., Amin, H. U., Saad, M. N. M., & Malik, A. S. (2017). The influences of emotion on learning and memory. *Frontiers in Psychology*, *8*, Article 1454. https://doi.org/10.3389/fpsyg.2017.01454

Um, E. R., Plass, J. L., Hayward, E. O., & Homer, B. D. (2012). Emotional design in multimedia learning. *Journal of Educational Psychology*, *104*(2), 485–498. https://doi.org/10.1037/a0026609

Vaes, J., & Wicklund, R. A. (2002). General threat leading to defensive reactions: A field experiment on linguistic features. *British Journal of Social Psychology*, *41*(2), 271–280. https://doi.org/10.1348/014466602760060246

Vaish, A., Grossmann, T., & Woodward, A. (2008). Not all emotions are created equal: The negativity bias in social-emotional development. *Psychological Bulletin*, *134*(3), 383–403. https://doi.org/10.1037/0033-2909.134.3.383

van Dyck, C., Frese, M., Baer, M., & Sonnentag, S. (2005). Organizational error management culture and its impact on performance: A two-study replication. *Journal of Applied Psychology*, *90*(6), 1228–1240. https://doi.org/10.1037/0021-9010.90.6.1228

Venaik, S., & Brewer, P. (2010). Avoiding uncertainty in Hofstede and GLOBE. *Journal of International Business Studies*, *41*(8), 1294–1315. https://doi.org/10.1057/jibs.2009.96

Wilson, T. D., & Gilbert, D. T. (2008). Explaining away a model of affective adaptation. *Perspectives on Psychological Science*, *3*(5), 370-–86. https://doi.org/10.1111/j.1745-6924.2008.00085.x

Wood, R. E., Kakebeeke, B. M., Debowski, S., & Frese, M. (2000). The impact of enactive exploration on intrinsic motivation, strategy, and performance in electronic search. *Applied Psychology: An International Review*, *49*(2), 263–283. https://doi.org/10.1111/1464-0597.00014

Zakay, D., Ellis, S., & Shevalsky, M. (2004). Outcome value and early warning indications as determinants of willingness to learn from experience. *Experimental Psychology*, *51*(2), 150–157. https://doi.org/10.1027/1618-3169.51.2.150

Zhao, B. (2011). Learning from errors: The role of context, emotion, and personality. *Journal of Organizational Behavior*, *32*(3), 435–463. https://doi.org/10.1002/job.696

Zhao, B., & Olivera, F. (2006). Error reporting in organizations. *Academy of Management Review*, *31*(4), 1012–1030. https://doi.org/10.5465/amr.2006.22528167

APPENDIX

An example of a vignette (error situation) that was presented to participants

You/A close colleague of yours/An employee of a competing company have/has to hold a presentation in front of a customer. Depending on the outcome of the talk, you/he/she can count on an acquisition. You/he/she make/makes the following mistake. Despite your/his/her preparation, you/he/she cannot answer the customer's questions adequately. The customer is thus very dissatisfied with the performance of the company.

Mild error consequence

However, the customer gives you/your close colleague/the employee of the competing company some time and you/he/she can submit the answers within the next few days.

Severe error consequence

The customer is so dissatisfied with you/your close colleague/the employee of the competing company that the acquisition does not happen.