

Fostering psychological safety in global virtual teams: The role of digital reminder nudges and team-based interventions

Carolin Fleischmann
Technische Hochschule Rosenheim
carolin.fleischmann@th-rosenheim.de

Isabella Seeber
Grenoble Ecole de Management
isabella.seeber@grenoble-em.com

Peter Cardon, Jolanta Aritz
USC Marshall
cardon@marshall.usc.edu,
aritz@marshall.usc.edu

Abstract

Psychological safety, the feeling of being comfortable to express one's ideas or opinions in teams, is a key determinant of successful global virtual teams. Even though there exists considerable knowledge about its antecedents, it is unknown how team-based (e.g., clarification of deliverables and deadlines) and technology-based (e.g., digital reminder nudges/ DRN) interventions foster psychological safety given cultural variations of team members. Based on a survey involving 148 participants, our data shows that both team-based interventions (TBI) and digital nudges foster psychological safety in global virtual teams. TBI are even more effective for high-context, indirect communicators than for low-context, direct communicators. However, digital nudges were equally effective across cultures for building psychological safety. These findings contribute to the literature on psychological safety as we show that not all antecedents hold equally across cultures and to the literature of digital nudges as we show the effectiveness of technology-based interventions in a team context.

Keywords: collaboration, digital nudging, psychological safety, team intervention, global virtual teams.

1. Introduction

Global virtual teams (GVT) are defined by two characteristics: team members are geographically dispersed across several countries and teams interact in a technology-mediated communication environment (C. B. Gibson & Cohen, 2003). The Covid-19 pandemic is a testament to the challenges of virtual teamwork. Pressed into virtual team environments, interaction among team members became more asynchronous, static and siloed, and less synchronous (Yang et al., 2021). Asynchronous communication, which is common for virtual teams, can foster anxiety and a loss of trust as there exist periods of silence and delayed

communication (Powell et al., 2004). Without active interventions to foster team exchanges and feedback, virtual teams lose their capability to perform well and drive team learning (Peñarroja et al., 2015). Psychological safety, which describes a team climate in which team members feel comfortable to express themselves and overcome interpersonal fear (A. C. Edmondson, 2018), is a key ingredient of successful high-performing teams and a driver of individual and team learning (Newman et al., 2017). It is thus not surprising that psychological safety has received much attention in recent years (see for example the meta-analysis of Frazier et al., 2017) as it is particularly important to GVT performance (Glikson & Erez, 2020).

Psychological safety is less explored on the cross-cultural level. We know that building psychological safety in GVT is complex due to cultural differences and reliance on technology-mediated communication (Cristina B. Gibson & Gibbs, 2006). Yet, little work has explored how different cultures react to various types of interventions and how it affects psychological safety.

Prior research has explored antecedents of psychological safety. On the team level, significant antecedents include interpersonal relationships and group dynamics (Kahn, 1990a). But in the context of GVT, it is unclear if these antecedents hold across cultures. Frazier et al. (2017) present some initial findings that culture moderates the relationship between psychological safety and its antecedents. However, they do not hone in on GVT and focus solely on uncertainty avoidance, one single dimension of culture. Kirkman et al. (2013) research GVT, but they focus on the outcomes of psychological safety and culture rather than the antecedents.

Moreover, even though collaboration technology is an enabler of GVTs (Griffith et al., 2003), it is unclear how technology features in a digital environment can serve as a facilitator and antecedent for building psychological safety in a team.

In this research, we consider on the one hand the quality of team-based interventions TBI, which we refer to the perceived quality of guidance by team members in terms of interpersonal information sharing and peer

support, which enables primarily relationship-oriented and indirect communication. On the other hand, we explore the quality of DRNs, which refer to the perceived quality of deliberate notice interventions provided by a digital choice environment to guide behavior (Schneider et al., 2018) and facilitate primarily task-oriented, direct, and non-equivocal communication. To reflect these attributes of interventions, we build on Hall's (1989) theory of context cultures, where cultures with low-context orientation lean towards task-oriented communication and cultures with high-context orientation lean towards relationship-oriented communication (Hall, 1989).

Moreover, we specifically explore the role of (digital) nudging (Sunstein, 2014; Thaler & Sunstein, 2009) in teams. Nudging has been researched on the individual level, but there exists limited understanding if and to what extent nudging can also guide behavior and decision-making on a team level (Gupta et al., 2019; Vinella et al., 2022). We designed a study to understand whether digital reminder nudges facilitate collaboration and improve psychological safety. Also, we wanted to understand the degree to which context orientation (i.e., high-context versus low-context cultures) influences how team members respond to digital nudges. Thus, we state the following research questions: *What effects do TBI and DRNs have on psychological safety? How do high- and low-context culture affect these relationships?*

To answer these research questions, we collected responses from 142 team members that virtually collaborated in teams in a controlled setting. Our research contributes to the fields of (1) digital nudging, (2) cross-cultural team collaboration, and (3) psychological safety. First, we expand the knowledge on digital nudging to include insights on nudging in a team environment. Second, we contribute to research on how technology impacts team processes and outcomes across cultures. Finally, we provide additional nuances to the body of knowledge on psychological safety by including a cross-cultural perspective on digital nudges.

2. Theoretical Foundation

2.1 Psychological safety in GVT

Psychological safety is defined as a “shared belief held by members of a team that the team is safe for interpersonal risk taking” (A. Edmondson, 1999, p. 354). It includes an assessment of the team environment as to how others will react to seeking feedback, pointing out mistakes, or pitching ideas (A. Edmondson, 1999). If the team environment is perceived as non-threatening and no negative consequences are expected when expressing oneself, a person will feel psychologically

safe (Zhang et al., 2010). Consequently, it facilitates the contribution of ideas and actions in a team.

Psychological safety has received widespread attention because it has been found to be one of the top predictors of team performance (P. Cardon et al., 2022; Newman et al., 2017). The concept has become even more relevant during the Covid-19 pandemic when all teams transitioned to collaborate virtually and emotional states of team members shifted as a result of a global health crisis (Lee, 2021). By fostering feedback and a culture of reflecting collaboratively on mistakes, psychological safety has been associated with learning and knowledge sharing (A. Edmondson, 1999). For virtual teams, Gibson & Gibbs (2006) found that virtuality of collaboration has negative effects on team performance, but this negative effect can be mitigated by psychological safety. Psychological safety can increase knowledge sharing in virtual teams (Zhang et al., 2010) and team performance, particularly for teams with high national diversity (Kirkman et al., 2013). These results indicate that psychological safety is of particular relevance for GVT.

Antecedents of psychological safety include interpersonal relationships and group dynamics, leadership style, organizational norms, work design and personality (A. Edmondson, 1999; Kahn, 1990b; Newman et al., 2017). A meta-analysis of Frazier et al. (2017) has confirmed certain personality traits (proactive personality, learning orientation, emotional stability), positive leader relations (trust, LMX, inclusive leadership, transformational leadership), work design characteristics (autonomy, interdependence, role clarity), and supportive work context (peer support, TBI) as the most defining antecedents of psychological safety. Frazier et al. (2017) included culture in their work on antecedents but focused only on one cultural dimension. It remains to be explored further how these antecedents play out in a cross-cultural, technology-mediated context. In this study, we research work design characteristics, specifically DRNs, and supportive work context, specifically TBI, to better understand technology and team dynamics in GVT. We do not focus on individual level personality and leaders relations since they fall outside the scope of this study.

2.2 Digital reminder nudges and teams

A nudge describes any deliberate change in a choice environment by a choice architect with the aim to influence a decision maker's behavior without forbidding any decision options (Thaler & Sunstein, 2009). When nudges occur in an online environment, for example with user interface elements like buttons, pictures, or different font sizes and colors, they are

referred to as digital nudges (Weinmann et al., 2016). A (digital) nudge focuses the attention of decision makers in a particular direction with the aim to a beneficial outcome (Kosters & Van der Heijden, 2015; Thaler & Sunstein, 2009). Nudges influence individuals' information processing to make use of heuristics and biases as decision makers have bounded rationality (Hansen, 2016; Thaler & Sunstein, 2009). Several types of nudges exist comprising default rules, simplification, disclosure, warnings, reminders, and many others (Sunstein, 2014).

This work focuses on reminder nudges, which is a notification tactic to not only provide relevant information but also make certain information salient again to a decision maker (Hansen, 2016). Several studies have investigated reminder nudges across different application areas: Smith et al. (2018) investigated homework reminder nudges in the context of higher education and found that simple e-mail reminders about homework deadlines can increase grades. Zavaleta Bernuy et al. (2022) studied the effects of email-based reminder nudges to reduce students' tendency to procrastinate and showed that students that received reminders start their homework earlier in the week and also perform better. In the context of charity giving, Sonntag and Zizzo (2015) found that participants donate more when they receive monthly reminders than none. Kroll and Stieglitz (2021) showed that privacy-related nudges showed no significant effects on perceived privacy, trust in provider, and perceived control in social media environments. Consequently, nudging individuals to adopt a certain behavior (e.g., less procrastination, higher security, more donations) with simple reminders in the form of e-mails has shown to be effective. However, their effect sizes differ so that in some studies and contexts, the reminder nudge showed little or no effect (Hummel & Maedche, 2019).

While the nudging theory has only been established in the early 2000s (Thaler & Sunstein, 2009), the technology-based interventions into teams with email reminders have existed before. For example, the group support systems literature considers automatic reminders as means to trigger users' actions for better coordination (Ellis et al., 1991). Reminders were theorized to function as an external storage for memory and thus an aid to remember (Wegner, 1987). However, in past research, reminders were usually treated as contextual enablers hidden in the study environment rather than in the focus of the study. The consequences of DRNs have not yet been studied in team-based settings, such as global virtual teams. However, related research on moral nudges shows that nudges are effective on the team level (Dunaiev & Khadjavi, 2021). Moreover, nudges usually do not occur in isolation from

other types of interventions and may be influenced by interventions from other team members. Finally, not all individuals react the same way to nudges and therefore, their perceived quality might differ and render DRNs ineffective.

2.3 Culture and context orientation

While culture has been studied for many decades (Kroeber & Kluckhohn (1952) already collected 150 definitions of culture) and by many disciplines (e.g., anthropology, psychology, and business), we still do not have agreement on a common definition. The most famous intercultural business researcher Geert Hofstede describes culture as the "collective programming of the mind" (Hofstede, 2001); Edward Hall hones in on communication: "culture is communication and communication is culture" (Hall, 1989). Communication is also key in a much used, more recent definition "Culture is information transmitted between individuals or groups, where this information flows through and brings about the reproduction of, and a lasting change in, the behavioral trait" (Ramsey 2013: 466). Culture can refer to nationality or other social groups, such as organizations, generations, or regions (Hofstede, 2001). We focus our attention on nationality because we research cross-national teams, and national culture has been found to significantly influence work outcomes (Taras, Kirkman, & Steel, 2010). At the same time, we acknowledge that nationality is only one aspect of culture.

In GVT, team members from multiple cultural backgrounds communicate and collaborate in order to accomplish a specific task. This cultural diversity offers opportunities for synergy, but also causes process losses due to miscommunication, misunderstanding, and elevated cognitive load (Adler & Gundersen, 2001).

Multiple models of cultural value dimensions exist with Hofstede's (2001) dimensions being the most prominent. Hall's (1989) cultural dimensions hone in on different communication styles, and are therefore well suited for an analysis of communication and collaboration in teams (P. W. Cardon, 2008).

Specifically, Hall's dimension of context orientation has shown to have a significant impact on collaboration in cross-cultural teams. Context orientation is defined as the extent to which team members communicate implicitly and indirectly (Hall, 1989). Nationality or country of origin has been used as a proxy for context orientation, while undoubtedly intra-national variations exist (Van Everdingen & Waarts, 2003). Low context communicators prefer explicit and direct communication where the focus is on what is being said. Information is clearly coded and transmitted in a message. It is also known as a very task-oriented

communication style, that is low context communicators value efficient information transmission which is centered around task accomplishment. Being assertive and candid are highly valued in low context cultures (Hall, 1989).

On the other side of the continuum, high context communicators put emphasis on the context of the communication situation – the surroundings of the interaction, such as the relationship, the tone, non-verbals, and other nuances. In high context communication, building and preserving a relationship and saving face are important communication goals. High context communication is often prevalent in cultures where honor and respect are highly valued (Hall, 1989; Warner-Söderholm, 2013).

3. Hypotheses Development

This research investigates the role of TBI and digital nudges for the emergence of psychological safety in culturally diverse global virtual teams. The research model is depicted in Figure 1. Team ID is every team's identifier. It is included as a control variable to assess whether team-specific differences are present in the data.

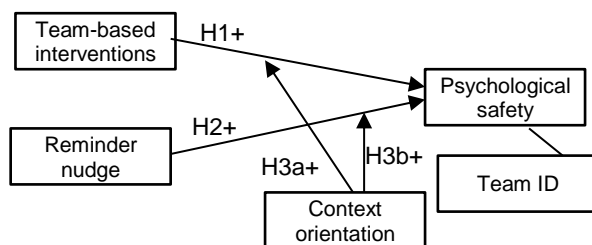


Figure 1: Research model

In teams, clarification of deadlines, deliverables, and expectations are often handled among team members rather than relying on external sources of information. Team members discuss, remind each other proactively, and ask each other questions to clarify expectations. We conceptualize TBI as being part of a supportive work context as defined by Frazier et al. (2017). They exert social influence in the team by providing peer support. TBI are rooted in bi-lateral interpersonal relationships within the team and in group dynamics, such as coordination, team caring, and trust in team members. All of these have been established as antecedents of psychological safety (Frazier et al., 2017). With TBI being part of a supportive work context, we hypothesize that we will find similar effects as the ones that have been established in the past. Yet, in the context of GVT, teams often suffer from process losses due to cultural miscommunication and virtuality

(Adler & Gundersen, 2001). It is therefore more difficult to establish psychological safety. In these environments, high quality TBI are expected to be even more relevant for establishing psychological safety because they will mitigate process losses.

Hypothesis 1: Higher-quality TBI result in higher psychological safety.

Nudges and particularly digital nudges guide the attention and focus of decision makers (Thaler & Sunstein, 2009) towards decision attributes. In the context of GVT, such attributes could concern the expectations that exist around team outcomes, such as team deliverables. For example, Zavaleta Bernuy et al. (2022) varied over the course of 4 weeks some of the attributes of a reminder message, such as the sender information (instructor vs. teaching assistant), provision of rationale information, level of detail of the subject line, recommendation, or advice to foster motivation, self-regulation, time management, and engagement. Their study showed that students started their homework approximately 10 hours earlier when receiving reminders with sender signature, information and recommendation compared to students that did not receive reminders (Zavaleta Bernuy et al., 2022).

DRNs make information, such as a team's deadlines and task expectations, salient. In GVTs planning and coordination could be particularly challenging due to time zone and cultural differences (Martins et al., 2004). E-mail reminders push deadlines and task details to the attention of the team members and serve as a common artefact that functions as external memory to decrease ambiguity and mitigate task related misunderstandings. The encoded information within reminder emails allows team members to revisit the team goals, expected deliverables, and deadlines so that it should become easier to build shared understanding of the goals and plan accordingly. Team members should have more clarity about their task goals, which should facilitate their taskwork. Reminder nudges that make task expectations transparent also help team members to clarify their roles and what others can expect from their work. At the same time, reminder nudges preserve the freedom of choice (Thaler & Sunstein, 2009), and team members have the autonomy to decide for themselves whether to accept the guidance how to achieve the task goal or not.

Literature on psychological safety has established that task design characteristics, such as autonomy and role clarity, facilitate the emergence of psychological safety (Frazier et al., 2017). As established above, reminder nudges that make transparent expectations towards the task goal do so by making transparent what tasks need to be accomplished while leaving the

decision-making power with the individual team members. However, even if reminder nudges make expectations transparent, they are not necessarily perceived as such. Team members may still perceive reminders as unclear and ambiguous and may still feel unsure how to engage in the team and contribute effectively. In such cases, DRNs are perceived to be of low-quality, which should result in lower psychological safety. Thus, we hypothesize

Hypothesis 2: Higher-quality DRNs result in higher psychological safety.

Research has established that diverse teams have an even higher need for psychological safety to perform well than homogeneous teams (A. C. Edmondson, 2018; Gerpott et al., 2021; Cristina B. Gibson & Gibbs, 2006). Yet, antecedents of psychological safety are not the same across cultures. This has been tested for some cultural dimensions, such as uncertainty avoidance (Frazier et al., 2017). Context orientation has not been considered in the context of psychological safety, while it may be an indicator for how susceptible a cultural group is to provide open feedback, share opinions, or freely disagree with others (Edmondson & Lei, 2014). In this study, we explore context orientation as a potential cultural factor for whether a certain type of reminder is considered useful by team members.

TBI are a relationship-oriented way of reminding and clarifying expectations for teammates. For TBI to be successful, they rely on the relationship between teammates and the context of the communication. Hence, TBI reflect a working style that high context communicators are familiar and comfortable with. For high context communicators, higher quality TBI are therefore more important to feel psychologically safe than for their low context teammates. On the contrary, team members with low context orientation may perceive reminders and discussions around expectations within the team as ambiguous, unclear, and inefficient, thus placing less emphasis on TBI for establishing psychological safety. Therefore, we hypothesize:

Hypothesis 3a: The positive effect of higher quality TBI on psychological safety is higher for team members with high context orientation than for team members with low context orientation.

DRNs, on the other hand, are a task-oriented way of communicating deadlines, reminders, and expectations. They transmit information explicitly and directly and are therefore a low context way of communicating. Low context team members likely

value the low level of ambiguity in DRNs. Low context and task-oriented DRNs correspond to the preferred working style of low context communicators. Feeling familiar and comfortable with direct and efficient transmission of communication, DRNs will likely have a larger positive impact on psychological safety for low context communicators than for high context communicators. Therefore, we hypothesize:

Hypothesis 3b: The positive effect of higher quality DRNs on psychological safety is higher for team members with low context orientation than for team members with high context orientation.

4. Methods

4.1. Sample and data collection. We surveyed global virtual teams, in which participants interacted in a real-world setting; yet, the study environment was controlled in the sense that teams had similar tasks and identical instructions and project conditions. Also, they were of similar diversity and demographic structures.

Teams completed a consulting project for a large multinational organization in the technology industry. Teammates were dispersed around the globe, never met in person during their 7-week project and did not know each other nor had worked together before the project. Teams produced a report of their analysis, findings, and recommendations for a client. Instructions for the project, including goals, tasks, deliverables, and deadlines were communicated at the beginning of the project. Additionally, weekly email reminders were sent to participants each Monday morning. These DRNs included a recap of the previous week, a reminder of upcoming tasks and deliverables, as well as a recommendation and the sender's signature (in accordance with Zavaleta Bernuy et al., 2022).

Project participants were mostly Gen Zers (from birth year 1997) with some Millennials (born between 1981 and 1996) that were enrolled in an undergraduate or an MBA program at one of 13 participating institutions in 7 countries on 3 continents. In total, participants in the study come from 23 different countries originally.

A total of 341 individuals in 56 teams participated in the project. All teams had 6 or 7 team members and were composed to reflect similar levels of diversity. Each team consisted of 2 or 3 US-based team members and team members from at least two other countries. The three most represented countries in the sample are USA, China, and Germany.

Data was collected via quantitative surveys before the teams began working together, in February 2022, and after the project had ended in April 2022. Pre- and post-project survey responses were matched using

person-specific identifiers. The response rate was high at 78% for the pre-project survey and 56% for the post-project survey. Of the 341 participants in the project, 148 participants completed both the pre- and the post-survey. 55.5 % of participants identified as women; 43.2 % identified as men; 0.7 % identified as non-binary; and 0.8% preferred not to state. Most participants are from the Gen Z age range (born after 1996). Therefore, this subset of participants was used for the analysis.

Psychological safety was measured using the established 10-item-scale of Edmondson (1999). Items included “I felt emotionally invested in my team” and “I was afraid of making mistakes” (reverse-coded). The answer scale ranged from 1 (strongly disagree) to 7 (strongly agree). Quality of TBI was measured by asking “Teammates helped me stay aware of deadlines for deliverables.”. Similarly, quality of DRNs was assessed with the item “Weekly VBP email reminders helped me stay aware of deadlines for deliverables.”. Nationality served as a proxy for context orientation. Every nationality was assigned a rating on a continuum from 1 (low context) to 16 (high context) according to the classification of van Everdingen & Waarts (2003). In this classification Switzerland, Austria, and Germany are positioned as the low context communicators (rating 1), while Japan represents the other end of the continuum (rating 16).

4.2 Testing model assumptions and validity.

Regression analysis builds on several statistical assumptions. We tested multi-variate normality by visually inspecting QQ-Plots and the distribution of Studentized Residuals. Both plots showed that residuals appear to follow a normal distribution with the exception of one statistical outlier, which we dropped from further analysis. We tested homoscedasticity of residuals with the Breusch-Pagan test, which was insignificant ($p > 0.05$) suggesting homoscedasticity can be assumed. Finally, we tested auto-correlation of error terms with the Durbin-Watson, which was negative ($p > 0.05$). Overall, the assumption tests were deemed satisfactory so that we proceeded with the analysis.

Table 1: Correlation table (N=148)

Variable	<i>M</i>	<i>SD</i>	1	2	3	4
1. PSY	4.99	1.03				
2. TID	30.24	17.61	.25**			
3. DRN	5.74	1.29	.45**	.13		
4. TBI	5.26	1.69	.75**	.18*	.47**	

5. CO 7.07 5.50 .11 -.25** .13 .24**

Note: PSY – psychological safety, TID – team ID, DRN – digital reminder nudges, TBI – Team-based interventions, CO – context orientation

We tested reliability, discriminant validity, and convergent validity for the multi-item construct item psychological safety. Reliability was tested with Cronbach’s alpha ($\alpha > 0.7$), discriminant validity was tested with Variance Inflation Factor ($VIF < 4$) and correlation analysis (see Table 1), convergent validity was tested with exploratory factor analysis to see if all items load on the same factor and have a factor loading higher than 0.6. All tests exceeded the conventional thresholds. Only the correlation coefficient between team-based intervention and team ID was high, which shows that TBI differ across teams.

5. Results

The hypotheses were tested using multiple linear regression analysis, which was performed in R (version 1.3.073). Table 2 shows the results of three regression models: Model (1) includes only the control variable Team ID to account for nested data. We considered to run a mixed-effects model with Team ID as a random factor. However, according to the ANOVA analysis the results did not warrant to use Team ID as a random factor, i.e. inter-team variances did not vary significantly. Therefore, we decided to keep it as a fixed factor in a linear regression model. Model (2) includes the predictors TBI and DRN. The adjusted R² shows that the model explains a large amount of the variance in psychological safety (58.5%). Model (3) includes in addition the moderation terms. The adjusted R² increased to 59.2%, which suggests that the moderation effect has additional explanatory power.

Hypothesis 1 suggested that higher-quality TBI will foster more psychological safety. The β -estimates of Model (2) show that TBI had a positive and significant effect on psychological safety ($\beta = .409$, $p < 0.001$), which supports H1.

Hypothesis 2 put forward that higher-quality DRNs will lead to higher psychological safety. Also here, the analysis shows a positive and significant effect on psychological safety ($\beta = .098$, $p < 0.05$). Looking at local effect sizes, Cohen’s f^2 for TBI is 0.808 and interpreted as a large effect size, whereas Cohen’s f^2 for RN is 0.029, which is considered a small effect size (Cohen, 1988).

Hypothesis 3a and 3b suggested that context orientation (low vs. high) will positively moderate the effects of quality of TBI and DRNs on psychological safety. The analysis revealed a positive and significant moderation effect for TBI and context orientation ($\beta =$

.020, $p < 0.01$) but not for DRNs ($\beta = -.012$, $p > 0.05$). Thus, H3a is accepted and H3b is rejected.

Figure 2: Moderation plot

6. Discussion and Implications

This research investigated whether team-based intervention and DRNs facilitate the development of psychological safety in global virtual teams. Additionally, we addressed the question whether the effectiveness of TBI and digital nudges differs across cultures.

Our contribution is three-fold. First, these findings contribute to (digital) nudging theory (Hummel & Maedche, 2019; Schneider et al., 2018; Thaler & Sunstein, 2009; Weinmann et al., 2016) as we provide novel evidence that DRNs can be effective in the team context. Digital nudging facilitates the development of psychological safety in GVT. Second, we provide additional insights that not all antecedents of psychological safety work equally across cultures. While TBI are preferred by high-context communicators, digital nudges are equally effective across cultures. Finally, we provide additional nuances to the body of knowledge on psychological safety (A. Edmondson, 1999; Frazier et al., 2017; Kahn, 1990b; Newman et al., 2017) by including a cross-cultural perspective on TBI and DRNs.

All hypotheses except H3b (DRN x context orientation) found support in our data. Results confirm previous studies that have established interpersonal relationships, team dynamics and peer support as antecedents of psychological safety (e.g. Kahn, 1990b; Edmondson, 1999). High quality TBI, where team members remind each other of deadlines and deliverables and clarify expectations with their teammates rather than outsiders or management, are highly relevant for establishing psychological safety. This finding confirms the groundwork of Kahn (1990b) and Edmondson (1999) and subsequent empirical studies, some even in the context of virtual or diverse teams (Gerpott et al., 2021; Cristina B. Gibson & Gibbs, 2006), on the antecedents of psychological safety.

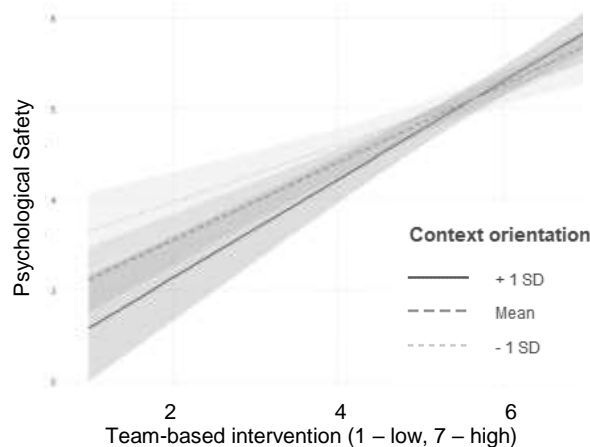
While researchers agree that psychological safety is particularly difficult to establish and at the same time of utmost importance for GVT, few have investigated whether psychological safety is built equally across cultures. Our results suggest that this is not the case. For team members with a high context cultural background, TBI are more relevant for building psychological safety than for team members with a low context cultural background. As long as TBI is of high quality in GVT, psychological safety is not an issue (see Figure 3). But GVTs are prone to process losses, miscommunication, and misunderstandings. In these cases, TBI is perceived

Table 2: Results of regression analysis

	DV: Psychological Safety		
	(1) Model: Control	(2) Model: Main	(3) Model: Moderation
TID	0.014**	0.037*	0.006*
TBI		0.409***	0.294***
DRN		0.098*	0.176*
CO ¹			-0.046
TBI x CO			0.020**
DRN x CO			-0.012
Constant	4.554***	2.074***	2.261***
Observations	148	148	148
R ²	0.062	0.585	0.609
Adjusted R ²	0.056	0.576	0.592
F Statistic	9.67**	67.72***	36.54***
	(df= 1; 146)	(df= 3; 144)	(df= 6; 141)

Note: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$; TID – team ID, DRN – digital reminder nudges, TBI – Team-based interventions, CO – context orientation; ¹context orientation: 1 = high context orientation, 0 = low context orientation

To better understand the moderation effect of TBI and context information on psychological safety, we created a moderation plot (see Figure 3). The plot shows that when team members perceived their TBI to be of higher quality, their psychological safety was also high independent whether team members were from low or high context cultures. However, when TBI were of lower quality, particularly team members from high context cultures suffered resulting in lower levels of psychological safety.



as low quality, and we observe that it becomes difficult for high context communicators to feel psychologically safe. Relying on TBI for communication deadlines, reminders and clarifying expectations does not seem to suffice in GVT. These teams need a reminder system that works for all team members regardless of cultural background.

Our study is one of the first to demonstrate that DRNs can be effective in a cross-cultural team environment. Related studies have investigated DRNs exclusively at the individual level (Kroll & Stieglitz, 2021; e.g., Smith et al., 2018; Sonntag & Zizzo, 2015; Zavaleta Bernuy et al., 2022) and it was thus far unknown if they can ‘survive’ in a team context. Our findings show that team members that perceived reminder emails as high-quality decision aids had higher psychological safety. Team members most likely considered digital reminders nudges as an aid to keep overview of deadlines and deliverables as well as an aid to carefully process expectations towards the team deliverables. Thus, those DRNs supported them in (re)focusing their attention to the task and enabling planning and coordination. Even though the DRN fostered psychological safety, its effect size is small. This is in line with previous research that showed that compared to default nudges, DRNs were found to have a comparably low effect size (Hummel & Maedche, 2019).

When considering culture-specific interventions, we find that DRNs work equally for high and low context communicators in fostering psychological safety. Low context communicators value the direct and unambiguous form of communication. While high context cultures generally prefer indirect, relationship-oriented communication, they may perceive a team-based intervention as criticism. In contrast, a digital nudge seems to be face-saving and not perceived as threatening to an interpersonal relationship. The DRN may therefore be fostering psychological safety for high context cultures even though it is directly communicated not by a teammate but from a machine. Additionally, the sender of a DRN is an authority, the project management office. In high context cultures, the status and relationship of the communication partners carries additional meaning. Therefore, high context communicators may highly value information that is sent by an authority. Thus, digital nudges can be a universally useful system for GVT across cultures.

This offers new opportunities for theorizing on nudges. Most nudging literature builds on the decision maker’s information processing capacity including

one’s heuristics and cognitive biases. However, this leaves aside additional influences that could occur through information processing on the group level and affect, in turn, group outcomes (Bartelt et al., 2013).

Our findings have also implications for the management of GVTs. Even though the effect of DRNs were rather small in this study, they represent a low cost and easy to implement intervention tool for teams. We could show that independent of high or low context communicators, the DRN was effective in fostering psychological safety, which is a key ingredient of team success.

7. Limitations and Future Research

Due to its exploratory nature, our research can serve as a basis for multiple further studies. The interaction of TBI and digital nudges, for example, needs exploration. Possibly, one form of intervention can compensate for the lack of another.

One limitation of our study is that it was conducted in a controlled environment in a university setting. Teams were part of a simulated class project, and it would be interesting to see if the same findings would hold in a real-world scenario with GVT operating in a real work setting. Future research on real workplace GVTs is needed to test our results that higher-quality TBI and nudging improve collaboration and foster more psychological safety.

For culture, context orientation has been assessed on the basis of nationality. Undoubtedly, this measure is a mere proxy for a person’s true context orientation. While context orientation is an accepted cultural characteristic in intercultural studies, it has not been operationalized by Hall, and Hall has not provided a specific ranking of countries along the continuum of context orientation (P. W. Cardon, 2008; Kittler et al., 2011; Warner-Søderholm, 2013). Future research can mitigate this shortcoming of our study by assessing context orientation using the scale that Warner-Søderholm (2013) has developed.

Our study is one of the first to investigate psychological safety based on cultural orientations. We find high effects of both TBI and DRNs on psychological safety. Future research will need to assess whether TBI and DRNs serve as proxies for larger constructs, such as team coordination or team work quality.

More research on the perception of psychological safety across cultures is needed to identify additional factors that contribute to psychological safety in GVTs and the implications they may have on designing how digital nudges are used in GVTs.

8. Conclusion

This study examined whether different forms of influence in GVT contribute to psychological safety. We assessed the influence of TBI and DRNs on psychological safety. In a second step, we tested how culture, and specifically context orientation, influences the relationship between team-based or digital reminders and psychological safety.

Our data shows that both TBI and digital nudges foster psychological safety in GVT. While having a significant influence on psychological safety for all team members, TBI are even more effective for high-context, indirect communicators than for low-context, direct communicators. However, digital nudges were equally and universally effective across cultures for building psychological safety.

These findings hold important implications for theory and practice. Our research contributes to the literature on digital nudging by expanding it to team contexts. For psychological safety, we confirm insights that not all antecedents hold equally across cultures, but digital nudges can serve as universally useful mechanisms of influence across cultures.

Particularly this last aspect offers a valuable insight for management. Cross-cultural teams should be offered DRNs to ensure that all team members, independent of their culture, are equally supported in building psychological safety. Managers can add DRNs to their repertoire of work design characteristics when trying to facilitate the development of psychological safety in a team.

Acknowledgements. This research is supported by the chair Digital Organizations & Society of Grenoble Ecole de Management.

9. References

- Adler, N., & Gundersen, A. (2001). *International dimensions of organizational behavior*. South-Western.
- Bartelt, V. L., Dennis, A. R., Yuan, L., & Barlow, J. B. (2013). Individual Priming in Virtual Team Decision-Making. *Group Decision and Negotiation*, 22(5), 873–896. <https://doi.org/10.1007/s10726-012-9333-3>
- Cardon, P., Fleischmann, C., Aritz, J., Ma, H., Springer, A., & Springer, S. (2022). The Influence of Psychological Safety and Personality on Technology Acceptance of Team-Based Technology in Global Virtual Teams. *Proceedings of the 55th Hawaii International Conference on System Sciences*, 7, 634–643. <https://doi.org/10.24251/hicss.2022.076>
- Cardon, P. W. (2008). A critique of Hall's contextualizing model: A meta-analysis of literature on intercultural business and technical communication. *Journal of Business and Technical Communication*, 22(4), 399–428. <https://doi.org/10.1177/1050651908320361>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Lawrence Erlbaum Associates.
- Dunaiev, Y., & Khadjavi, M. (2021). Collective Honesty? Experimental Evidence on the Effectiveness of Honesty Nudging for Teams. *Frontiers in Psychology*, 12(July), 1–8. <https://doi.org/10.3389/fpsyg.2021.684755>
- Edmondson, A. (1999). Psychological Safety and Learning Behavior in Work Teams. *Administrative Science Quarterly*, 44(2), 350. <https://doi.org/10.2307/2666999>
- Edmondson AC, Lei Z. (2014). Psychological safety: The history, renaissance, and future of an interpersonal construct. *Annual Review of Organizational Psychology and Organizational Behavior*, 1, 23–43. <http://dx.doi.org/10.1146/annurev-orgpsych-031413-091305>
- Edmondson, A. C. (2018). *The fearless organization: Creating psychological safety in the workplace for learning, innovation, and growth*. John Wiley & Son.
- Ellis, C. A., Gibbs, S. J., & Rein, G. L. (1991). Groupware: Some Issues and experiences. *Communications of the ACM*, 34(1).
- Frazier, M. L., Fainshmidt, S., Klinger, R. L., Pezeshkan, A., & Vacheva, V. (2017). Psychological Safety: A Meta-Analytic Review and Extension. *Personnel Psychology*, 70(1), 113–165. <https://doi.org/10.1111/PEPS.12183>
- Gerpott, F. H., Lehmann-Willenbrock, N., Wenzel, R., & Voelpel, S. C. (2021). Age diversity and learning outcomes in organizational training groups: the role of knowledge sharing and psychological safety. *International Journal of Human Resource Management*, 32(18), 3777–3804. <https://doi.org/10.1080/09585192.2019.1640763>
- Gibson, C. B., & Cohen, S. G. (2003). *Virtual Teams That Work: Creating Conditions for Virtual Team Effectiveness*. John Wiley & Sons.
- Gibson, Cristina B., & Gibbs, J. L. (2006). Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly*, 51(3), 451–495. <https://doi.org/10.2189/asqu.51.3.451>
- Glikson, E., & Erez, M. (2020). The emergence of a communication climate in global virtual teams. *Journal of World Business*, 55(6), 101001. <https://doi.org/10.1016/j.jwb.2019.101001>
- Griffith, T. L., Sawyer, J. E., & Neale, M. A. (2003). Virtualness and Knowledge in Teams: Managing the Love Triangle of Organizations, Individuals, and Information Technology. *Management Information Systems*, 27(2), 265–287.
- Gupta, P., Kim, Y. J., Glikson, E., & Woolley, A. W. (2019). Digitally Nudging Team Processes to Enhance Collective Intelligence. *ACM Collective Intelligence*, 1–5.
- Hall, E. T. (1989). *Beyond culture*. Doubleday.
- Hansen, P. G. (2016). The definition of nudge and libertarian paternalism: Does the hand fit the glove? *European Journal of Risk Regulation*, 7(1), 155–174. <https://doi.org/10.1017/S1867299X00005468>
- Hofstede, G. (2001). *Culture's consequences : comparing values, behaviors, institutions, and organizations across nations*. 596.
- Hummel, D., & Maedche, A. (2019). How effective is nudging? A quantitative review on the effect sizes and limits of empirical nudging studies. *Journal of Behavioral*

- and *Experimental Economics*, 80(February), 47–58.
<https://doi.org/10.1016/j.socec.2019.03.005>
- Kahn, W. A. (1990a). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*, 33(4), 692–724.
<https://doi.org/10.5465/256287>
- Kahn, W. A. (1990b). Psychological Conditions of Personal Engagement and Disengagement at Work. *Academy of Management Journal*, 33(4), 692–724.
- Kirkman, B. L., Cordery, J. L., Mathieu, J., Rosen, B., & Kukenberger, M. (2013). Global organizational communities of practice: The effects of nationality diversity, psychological safety, and media richness on community performance. *Human Relations*, 66(3), 333–362. <https://doi.org/10.1177/0018726712464076>
- Kittler, M. G., Rygl, D., & MacKinnon, A. (2011). Beyond culture or beyond control? Reviewing the use of hall's high-/low-context concept. *International Journal of Cross Cultural Management*, 11(1), 63–82.
<https://doi.org/10.1177/1470595811398797>
- Kosters, M., & Van der Heijden, J. (2015). From mechanism to virtue: Evaluating Nudge theory. *Evaluation*, 21(3), 276–291. <https://doi.org/10.1177/1356389015590218>
- Kroeber, A. L. and Clyde Kluckhohn, 1952, "Culture: A Critical Review of Concepts and Definitions". Papers of the Peabody Museum of Archaeology and Ethnology, Harvard University, 47.1, Cambridge, MA: Peabody Museum Press.
- Kroll, T., & Stieglitz, S. (2021). Digital nudging and privacy: improving decisions about self-disclosure in social networks. *Behaviour and Information Technology*, 40(1), 1–19. <https://doi.org/10.1080/0144929X.2019.1584644>
- Lee, H. (2021). Changes in workplace practices during the COVID-19 pandemic: the roles of emotion, psychological safety and organisation support. *Journal of Organizational Effectiveness*, 8(1), 97–128.
<https://doi.org/10.1108/JOEPP-06-2020-0104>
- Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual Teams: What Do We Know and Where Do We Go From Here? *Journal of Management*, 30(6), 805–835.
<https://doi.org/10.1016/j.jm.2004.05.002>
- Newman, A., Donohue, R., & Eva, N. (2017). Psychological safety: A systematic review of the literature. *Human Resource Management Review*, 27(3), 521–535.
<https://doi.org/10.1016/j.hrmr.2017.01.001>
- Peñarroja, V., Orengo, V., Zornoza, A., Sánchez, J., & Ripoll, P. (2015). How team feedback and team trust influence information processing and learning in virtual teams: A moderated mediation model. *Computers in Human Behavior*, 48, 9–16.
<https://doi.org/10.1016/j.chb.2015.01.034>
- Powell, A., Piccoli, G., & Ives, B. (2004). Virtual Teams : A Review of Current Literature and Directions for Future. *Data Base For Advances In Information Systems*, 35(1).
- Ramsey, Grant, 2013, "Culture in Humans and Other Animals", *Biology & Philosophy*, 28(3): 457–479.
doi:10.1007/s10539-012-9347-x
- Schneider, C., Weinmann, M., & vom Brocke, J. (2018). Digital nudging: Guiding online user choices through interface design. *Communications of the ACM*, 61(7), 67–73. <https://doi.org/10.1145/3213765>
- Smith, B. O., White, D. R., Kuzyk, P. C., & Tierney, J. E. (2018). Improved grade outcomes with an e-mailed “grade nudge.” *Journal of Economic Education*, 49(1), 1–7.
<https://doi.org/10.1080/00220485.2017.1397570>
- Sonntag, A., & Zizzo, D. J. (2015). On reminder effects, drop-outs and dominance: Evidence from an online experiment on charitable giving. *PLoS ONE*, 10(8), 1–17.
<https://doi.org/10.1371/journal.pone.0134705>
- Sunstein, C. R. (2014). Nudging: A Very Short Guide. *Journal of Consumer Policy*, 37(4), 583–588.
<https://doi.org/10.1007/s10603-014-9273-1>
- Taras V, Kirkman BL, Steel P. (2010). Examining the impact of Culture's consequences: A three-decade, multilevel, meta-analytic review of Hofstede's value dimensions. *Journal of Applied Psychology*, 95, 405–439. doi: 10.1037/a0018938
- Thaler, R. H., & Sunstein, C. R. (2009). *Nudge: Improving Decisions About Health, Wealth, and Happiness*. Yale University Press.
- Van Everdingen, Y. M., & Waarts, E. (2003). The effect of national culture on the adoption of innovations. *Marketing Letters*, 14(3), 217–232.
<https://doi.org/10.1023/A:1027452919403>
- Vinella, F. L., Lykourantzou, I., Mosch, R., & Masthoff, J. (2022). The Impact of Digital Nudging Techniques on the Formation of Self-Assembled Crowd Project Teams. *Proceedings of the 30th ACM Conference on User Modeling, Adaptation and Personalization*.
<https://doi.org/10.1145/3503252.3531298>
- Warner-Søderholm, G. (2013). Beyond a Literature Review of Hall's Context Dimension: Scale Development, Validation & Empirical Findings within a Norwegian Study. *International Journal of Business and Management*, 8(10), 27–40. <https://doi.org/10.5539/ijbm.v8n10p27>
- Wegner, D. (1987). Transactive memory: A contemporary analysis of the group mind. In B. Mullen & G. R. Goethals (Eds.), *Theories of group behavior* (pp. 185–208). Springer-Verlag.
- Weinmann, M., Schneider, C., & Brocke, J. vom. (2016). Digital Nudging. *Business and Information Systems Engineering*, 58(6), 433–436.
<https://doi.org/10.1007/s12599-016-0453-1>
- Yang, L., Holtz, D., Jaffe, S., Suri, S., Sinha, S., Weston, J., Joyce, C., Shah, N., Sherman, K., Hecht, B., & Teevan, J. (2021). The effects of remote work on collaboration among information workers. *Nature Human Behaviour*.
<https://doi.org/10.1038/s41562-021-01196-4>
- Zavaleta Bernuy, A., Han, Z., Shaikh, H., Zheng, Q. Y., Lim, L. A., Rafferty, A., Petersen, A., & Williams, J. J. (2022). How can Email Interventions Increase Students' Completion of Online Homework? A Case Study Using A/B Comparisons. *ACM International Conference Proceeding Series*, 107–118.
<https://doi.org/10.1145/3506860.3506874>
- Zhang, Y., Fang, Y., Wei, K. K., & Chen, H. (2010). Exploring the role of psychological safety in promoting the intention to continue sharing knowledge in virtual communities. *International Journal of Information Management*, 30(5), 425–436.
<https://doi.org/10.1016/j.ijinfomgt.2010.02.003>