Trust Me: Social Games are Better than Social Icebreakers at Building Trust

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ABSTRACT
Interpersonal trust is one of the key components of efficient teamwork. Research suggests two main approaches for trust formation: personal information exchange (e.g., social icebreakers), and creating a context of risk and interdependence (e.g., trust falls). However, because these strategies are difficult to implement in an online setting, trust is more difficult to achieve and preserve in distributed teams. In this paper, we argue that games are an optimal environment for trust formation because they can simulate both risk and interdependence. Results of our online experiment show that a social game can be more effective than a social task at fostering interpersonal trust. Furthermore, trust formation through the game is reliable, but trust depends on several contingencies in the social task. Our work suggests that gameplay interactions do not merely promote impoverished versions of the rich ties formed through conversation; but rather engender genuine social bonds.

Author Keywords
Trust; distributed teams; online game; social play

ACM Classification Keywords
K.8.0 [Personal Computing]: General - Games.

INTRODUCTION
The performance of project teams depends on many factors; one of the key factors is the interpersonal trust – the "willingness to be vulnerable based on positive expectations about the actions of others" [39] – that exists between team members [15,56]. Low interpersonal trust in project teams can lead to collaboration problems, including poor decision making, hampered information exchange, increased risk of misunderstandings, and higher personal conflict [23,15]. Higher trust on the other hand, leads to organizations that work more efficiently, and adapt more quickly to changing circumstances [15,68]. For project teams that work in a face-to-face context, there are multiple established methods of facilitating trust development; team-building activities such as social icebreaker games, ropes courses, and even trust falls – part of the quintessential team-building movie montage – have been shown to be effective at facilitating trust development within collocated project teams [34].

Literature suggests two underlying strategies for facilitating trust development. First, developing the feeling that another team member is trustworthy assists with trust development [69,56], and can be scaffolded through personal information exchange [70] and feelings of similarity [19]. Second, the situational context can assist with trust development – situations that involve interdependence and mutual risk promote trust building [27,56]. In collocated teams, both strategies can be employed to facilitate trust formation among team members. For example, social icebreakers enable information exchange and a feeling of similarity, while the trust fall represents the epitome of risk and interdependence.

However, geographically-distributed project teams are becoming increasingly common, as many knowledge workers are able to telecommute and do not have to live in the city in which they work [47]. The rise of distributed project teams raises the question of how trust development is affected by the online virtual interactions that replace face-to-face communication. Research shows that trust is more difficult to achieve in distributed teams, especially in the initial phases of a project [2,28,29]. Trust develops more slowly in distributed teams [27], and once developed, it is also more fragile and easily damaged [70]. These findings call for effective strategies to facilitate trust development in distributed teams. However, traditional strategies that engender trust formation are difficult to transfer to distributed digital communication. From a purely practical perspective, access to team-building activities is limited when team members are distributed in that the activity itself has to be feasible in an online context. As such, current online trust-building approaches use the strategy of promoting trustworthiness, facilitated through personal information exchange [56]. However, current systems fail to employ the second strategy of promoting risk and interdependence – the online equivalent of ropes courses or trust falls are not available to facilitate trust development in distributed teams.

Considering the various social activities that people already participate in online, we argue that there is potential in multiplayer online games to allow players to experience risk and interdependence in a safe and playful environment, addressing the situational context of trust. While the stakes in a game

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might not have real-world consequences, the vulnerability that is developed, and the need for cooperation with other team members are real. Given their popularity, capacity to help players feel connected [59,66], and ability to simulate risk and interdependence, there is reason to believe that online multiplayer games can be used to facilitate trust building in distributed project teams. Previous literature has already indicated that groups will accept online multiplayer games as a team-building activity [16,36,44], and also provides design guidelines for collaborative games whose purpose is team building [16,44]. However, previous literature has not evaluated the ability of games to enable trust formation.

Previous literature and theoretical frameworks on trust formation suggest that online games can be a viable alternative to current interventions based on personal information exchange. Our goal was to determine whether or not a game could compete with a social task at building trust. First we developed an online puzzle-based multiplayer game that employs interdependence and creates risk, and we then determined whether it could build trust between distributed strangers. We also created a social task that promotes personal information exchange and similarity development to represent the standard in online team-building. We compared the game to the social icebreaker task in an online experiment with 34 pairs of strangers conducted through the web browser using voice chat. Our results showed that:

- Overall, our game is more effective than a social task at building trust between distributed strangers.
- Our game is as effective as a social task at facilitating interpersonal interaction, including the development of relational depth, affect, and interpersonal involvement.
- Trust formation in the game is reliable, whereas the efficacy of the social task is contingent on several factors:
  - Personality–the game works equally well for everyone, whereas the social task works less well for individuals low in propensity to trust or agreeableness.
  - Enjoyment of the experience–the game works equally well for everyone regardless of whether or not they enjoyed it; however, the social task does not work well for people who did not enjoy it.
- The efficacy of our game for building trust is also not affected by age, gender, or gaming experience, suggesting that it is an option with broad demographic appeal.

Our work shows that our game not only worked better for trust development than a social task in general, but that trust development in the game was robust to individual personality characteristics, task enjoyment, and interpersonal experience, whereas trust development in the social task was sensitive to these factors. As such, online social games should be considered as an approach to foster trust-building in distributed project teams. The relationships built through gameplay are sometimes considered as impoverished versions of the rich bonds that are created through conversation. We contribute to a growing body of work suggesting that games can facilitate deep and meaningful social bonds.

RELATED LITERATURE

We propose that games can be used to facilitate trust development in distributed teams. The increasing technological support for telecommuting along with the dearth of skilled workers in certain fields means that more workplace teams are integrating geographically-remote workers or allowing team members to work from home [47]. Ensuring that distributed members of a team are well integrated is essential for the productivity and well-being of the entire team [15,56]. In this section, we present the arguments about the importance of trust development for distributed teamwork, describe how trust is developed, present technologies (including games) that facilitate trust development, and describe how games are used to foster relationship building.

Why Trust is Important

Interpersonal trust is believed to be one of the key factors influencing the performance and efficiency of both face-to-face and distributed teams [1,5,7,12,20,28,29,52,63,64]. Trust is most commonly defined as a "willingness to be vulnerable based on positive expectations about the actions of others" [39]. When trust is low within a work group, collaboration problems may occur. Low trust is associated with poor decision-making [22,23,56], a lack of sharing relevant information with team members [10,56], a tendency to avoid coordination with team members [24,61], increased misunderstandings, and escalating conflicts [22,23, 56]. High trust among team members has been shown to have positive effects on team communication [3,11,14], team identification [40,48,54], negotiations among dyads [58,33], conflict resolution [11,49,68], individual performance [54,53], and team performance [14,15,68].

How Trust is Developed

Russman et al. [56] proposed a model of trust development that can be applied to face-to-face and distributed teams. Following Zolin et al. [69], they distinguish between *trust* and *trustworthiness*. Interpersonal *trust* is conceptualized as a state that determines whether the trustor engages in trusting behavior towards the trustee, whereas trustworthiness is conceptualized as the trustor's perception of how trustworthy the trustee is. Interpersonal trust as a state is determined by the perceived trustworthiness of the trustee [60,69], but also by the characteristics of the trustor (e.g., the inherent propensity to be trusting, mood) [55,39,67,56], and the situational context (e.g., perceived risk) [56,69,37,27].

The trust state determines whether the trustor engages in trusting behavior for each interaction. If the consequences of an interaction were positive, perceived trustworthiness of the trustee increases, which impacts the trust state in future interactions [56]. Trust is therefore built through repeated feedback loops of trust state, trusting behavior, and positive consequences. Because of these self-enhancing properties, researchers stress the importance of initial trust building right at the formation of work groups [56,69,71,28,29].

Trust Development in Distributed Teams

A large body of research has shown that distributed teams face difficulties in building and sustaining trust

[28,29,65,2,70]. These challenges and their effects on interpersonal trust can be summarized in three groups:

First, trust formation works differently when teams are not collocated. Distributed teams tend to have less information about trustworthiness available and fewer chances for personal communication, which leads to assessments of trustworthiness based on stereotypes and generalizations [27,32]. These initial assessments of trustworthiness are harder to change ('sticky'), and heavily impact interpersonal trust, further stressing the importance of initial trust formation in distributed teams [69,70,56]. Second, interpersonal trust that does get built tends to be more fragile and easily damaged in distributed teams than the more robust trust that is based on an extensive history of shared experiences [2,27,65,70,56]. Third, the overall levels of interpersonal trust and trustworthiness appear to be lower in distributed teams, and team members appear to need higher initial trust to engage in collaborative behaviour [56,69].

Current Methods of Building Trust in Distributed Teams

Trustworthiness. In order to engender trust formation in distributed teams, interventions often aim to compensate for the lack of personal and background knowledge in distributed teams [19,56,70,46]. The goal of these interventions is to enhance the initial assessment of trustworthiness. Team members are sometimes encouraged to *exchange personal information* or supply information on trust warranting properties. The sharing of personal information has been shown to increase the perceived trustworthiness of other group members. This in turn facilitates trust formation and allows for a more robust and stable trust in distributed teams [56]. Zolin et al. [70] found a positive impact of personal information exchange on perceived trustworthiness, and Feng et al. [19] argue that helping group members to find similarities amongst each other promotes interpersonal trust.

Characteristics of the trustor. Other factors that will influence interpersonal trust are characteristics of the trustor, such as personality traits. Research has shown that there is an *inherent propensity to trust* that determines how easily someone trusts people in general [55,39,67]. While personality plays a role in trust formation, it is not something that can be changed easily. Therefore, trust-building interventions don't generally address this aspect of trust formation; however, the role of individual characteristics has to be acknowledged in trust-building interventions.

Context. The other factor that strongly affects interpersonal trust formation is situational context. Research on context properties shows that two concepts are important to facilitate trust formation: *risk* and *interdependence* [27,56]. Risk can be described as an uncertainty about the outcome of an interaction [56]. Interpersonal trust is required when the trustor has a potential gain or loss through the interaction with the trustee. The higher the stakes, the more trust is needed to compensate the uncertainty. An ideal context will therefore provide an appropriate risk/trust ratio that encourages the trustor to risk cooperatively engaging with the trustee. Because new teams often have low initial trust [56] toward each other, starting with low risks might be recommendable. Interdependence is the extent to which a trustor is dependent on the actions of the trustee [27]. If the actions of another person are irrelevant for the personal outcome of the trustor, then trust is neither necessary nor will it form through the interaction [27,56]. If a context involves risk and high interdependence, the trustor is vulnerable to the actions of the trustee. According to current models of trust formation, this vulnerability, in combination with positive experiences, should lead to an increase in perceived trustworthiness and in turn interpersonal trust [69,56].

To our knowledge, current approaches for trust building in virtual teams ignore contextual factors. Current approaches of information exchange (e.g., personal profiles, group chats) don't encourage team members to be vulnerable towards their team members. We believe collaborative games can be an ideal setting for team members to experience risk and interdependence in a safe and playful environment. While the stakes in games might not have real world consequences, the feeling of vulnerability and the need for cooperation with other team members are real.

Digital Games as Team Building Exercises

Research has started to investigate whether or not games are a viable form of team building for distributed teams. Research has shown that in-game performance and effort influence how team members feel about their partner [9]. The access to online 3D virtual worlds has inspired studies investigating their potential to support collaborative work. Ellis et al. [16] propose the use of playful group activities in the virtual world *Second Life* to increase cohesion in groups. The study doesn't evaluate the effectiveness of these games to enhance group cohesion or trust, but focuses on the design challenges and frameworks that are relevant when designing games for team building. Lewis, Ellis and Kellogg [36] used a game to investigate leadership behavior. Chat interviews with the groups suggested that games should be considered as a viable team-building intervention. Similar results were shown by Bozanta et al. [4], suggesting that playing a game in a 3D virtual world can have positive effects on group identification and team building.

Nasir et al. [44,45] compared the group interaction of three face-to-face groups that played an icebreaking game before a group exercise to three face-to-face groups that did not interact before the group exercise. Their research indicates that playing an icebreaking game has, for the most part, positive effects on group communication in terms of talking activity, and group member participation. Because of the very low sample size, it is difficult to generalize these results to distributed team building. While these results point to the potential benefits of games as icebreakers in subsequent face-to-face collaborations, it is unclear if their results can be transferred to distributed teams. Furthermore, only the first pilot study [44] compared a game condition with a non-game icebreaker condition. The promising initial results were not verified in the actual study [45].

Requirements for Games as Trusts-Development Activities

Together all of these results seem to indicate that games are potentially suitable team-building activities for distributed teams. The current literature also suggests that groups accept games as a viable team building exercise, even in a business context [4]. Previous work has provided solid design guidelines for collaborative games [44,45,16]. These guidelines have partially been derived from literature on educational games and partially derived from qualitative analysis of collaborative game play. Literature is in agreement that the game should be cooperative in the sense that players should be working towards the same goal, they should be required to come up with communication strategies in order to play successfully, and they should fulfill different roles within the game [16,44]. Keeping theories on trust formation in mind, it becomes evident that these are all game mechanics that enhance the interdependence of the game. Literature also suggests to keep the difficulty low and employ easy to use interfaces. [16,44].

Following these guidelines, a game should be an interdependent task that rewards or even requires coordination and cooperation. Players should also have the chance to take risks with other players within the safe space of a playful interaction. The risk of winning or losing in a game has no real life consequences. We therefore think it is optimal to encourage players to take risks despite low initial trust. The artificial vulnerability that cooperative games create could be ideal for players to *rehearse trust* in a playful environment that encourages trusting behavior. We therefore think that games can be used specifically to foster trust in distributed teams. This approach does not involve information exchange to increase perceived trustworthiness and is therefore quite different from current trust-building interventions. In the next section, we describe a study that tested our assumptions and investigated whether a game can compete with the trust-building properties of a task designed for personal information exchange.

EXPERIMENT

We conducted an online experiment to explore whether games can facilitate trust development in distributed teams. In our experiment, half of the participants played a game to facilitate trust development. To compare our game to a control condition, the remaining participants completed a social icebreaker task used for developing trust.

Labyrinth Game

We created *Labyrinth* (see Figure 1), a networked, cooperative 2-player, asymmetric role puzzle game implemented using the Unity3D game Engine. Labyrinth is played on a tiled board where each tile comprises a piece of a maze (a road through a lake of lava).

Players start on fixed positions within the maze as either the *Pusher* or *Collector*. Moving along the road, the pair's goal is to enable the Collector to collect all of the gems, which appear at fixed locations around the maze. The Pusher can reconfigure the maze by sliding tiles horizontally or vertically, by holding the Shift key and walking towards a wall to "push" the row or column. To foster coordination and communication (over voice chat) between the players, they can only see the other player character's location on the board if they are close to each other; otherwise the other player is invisible. Four rocks are also scattered across the map for players to use as landmarks when communicating locations [62]. The maze's initial configuration was designed such that players would have to work together to effectively move the rows and columns to collect all of the gems. Players completed 4 rounds of 2 minutes, alternating playing as the Pusher or Collector. After each round the participants were given their score with a grade (bronze, silver, gold, or platinum) to give performance feedback.

The mechanics of the game were specifically designed to satisfy the guidelines for developing trust proposed by literature. Players were working together toward the same goal of collecting all of the gems. They were given different but complementary roles. Communication between the players was necessary to coordinate which path to take, to communicate player location, and to strategize. We made the input straightforward, using only arrow keys and shift. The level design was simple enough that most gems could be accessed with a single wall push.

Social Icebreaker Task

For our non-game control condition, we implemented an online version of a social icebreaker task in Construct 2, using WebRTC for the networking. We designed a set of questions that were presented to both participants and that they were encouraged to ask each other over voice chat. In total, the social task included 30 questions. Participants had to talk for at least 15 seconds after the presentation of a question before they could advance to the next question; this feature was included to ensure that participants did not run out of system-presented content during the duration of the social icebreaker task. They could also dwell on questions for as long as they liked and there were no constraints placed on the content of their conversations.

This social task was designed to stimulate conversation and information exchange. As described in the related literature section, social interaction and exchange of personal information about team members is a current method of devel oping trust in distributed teams [56]. We created the questions with specific criteria in mind. We did not want participants to feel uncomfortable providing personal information, so we avoided questions that included age, address, or place of work. We also avoided questions about controversial or divisive topics, such as religion or politics. To support conversational flow, the questions were phrased openly so that participants were encouraged to give longer and more elaborate answers than a simply yes or no answer (e.g., "Where did you grow up?", "If you had a year off with pay, what would you do?", "When you are stressed out, what do you do to relax?"). We tested our icebreaker questions in a pilot study and found that the social task worked well to facilitate communication between distributed strangers online. We also observed reoccurring questions the pilot participants

asked and included them in final version. (e.g., "How long have you been working on Mechanical Turk?", "What kind of hits do you usually do?").

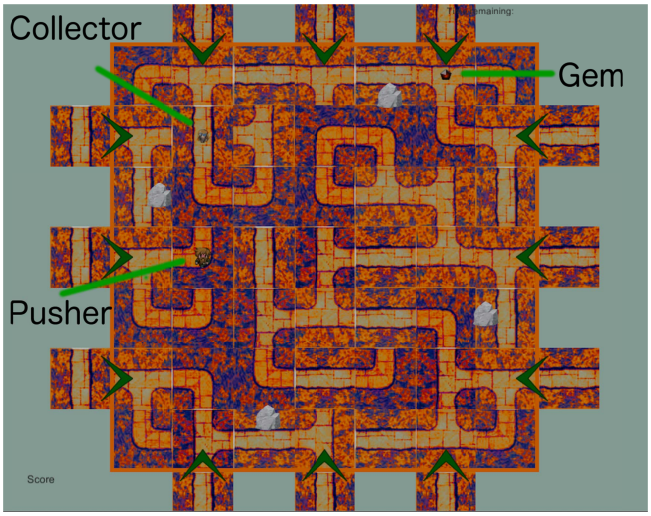

Figure 1: Annotated image of game board

Measures

First, we measured interpersonal trust between the participant and their partner as our main outcome measure. Based on literature on interpersonal trust formation, we expected characteristics of the participants to affect trust formation. Therefore we measured individual propensity to trust and the big five personality dimensions. We were also interested in how the participants perceived the social interaction. We drew from early communication research and distinguished the content of the social interaction from the relational aspects of communication [31,13]: Any given interaction can be analyzed in terms of what it reveals about the relationship between the two participants [13]. Because these are abstract dimensions independent of content, they allow us to compare the two very different tasks in terms of how they impact relational communication. Finally, to understand how trust formation interacts with the experience of the trust development task, we measured how participants experienced the task (game or social task) by including established experience measures from games user research. Unless otherwise mentioned all item responses were measured on a 7-point-Likert scale:

Interpersonal Trust: Most scales for interpersonal trust are designed for close romantic relationships [50,35,30]. We selected 5 items from the Rempel trust scale [50] (e.g., *"I could count on my partner to be concerned about my welfare."*), 4 items from the Dyadic Trust scale [35] (e.g., *"I feel that my partner can be counted on to help me."*) and 2 items from the Specific Interpersonal Trust Scale [30] (e.g., *"I could expect my partner to tell the truth."*) to have enough items appropriate for our setting of loose platonic relationships. Our interpersonal trust scale was an internally consistent measurement of trust (Cronbach's α=.922, M=5.46, SD=.93).

Propensity to Trust: We measure general propensity to trust as proposed by Yamagichi [67]. The 6-item questionnaire (M=4.94, SD=.93) asks participants to rate statements such as "*Most people are basically honest.".*

Ten-Item Personality Inventory (TIPI): We assessed personality using the TIPI [18]. The questionnaire measures the personality dimensions commonly known as the Big Five [26]: extraversion (M=3.87, SD=1.60), agreeableness (M=5.50, SD=1.20), openness to new experiences (M=5.66, SD=1.19), conscientiousness (M=5.79, SD=1.07) and neuroticism (M=2.52, SD=1.31) .

Intrinsic Motivation Inventory (IMI): IMI used a 5-point-Likert scale to measures the interest/enjoyment (M=4.14, SD=.67), effort/importance (M=4.44, SD=.48), pressure/tension (M=2.43, SD= .93), and perceived competence (M=3.42, SD=1.09) felt during a task [41].

Relatedness: We used the relatedness subscale from the Player Experience of Needs Satisfaction (PENS) scale to assess perceived satisfaction of relatedness (M=3.71, SD=.68) on a 5-point-Likert scale [57].

Relational Communication Scale (RCS): We measure relational communication with a selected set of subscales from the RCS [13]. We measure involvement (M=5.13, SD=1.26), affect (M=48, SD=1.08), similarity/depth (M=4.62, SD=1.13), receptivity/trust (M=5.70, SD=.87), and formality (M=3.17, SD=1.12).

Participants and Deployment Platform

The study was deployed on Amazon's Mechanical Turk (MTurk) crowdsourcing platform. MTurk connects paid workers to *Human Intelligence Tasks* (HITs) and has been shown to be a reliable research tool [38]. We had 52 pairs of participants in our study; however, one participant left after the task, resulting in 103 participants completing the full study. Participants completed informed consent and were compensated with $2.50 for the 15-20 minute study.

During the deployment of the study, we encountered client-side networking errors that caused technical difficulties for many of our participants (due likely to low-bandwidth connections). We excluded participants from the study if their voice chat did not work or the experimental platform froze. Some of the remaining participants also experienced minor networking issues – particularly in the game condition because it required real-time networking. The debrief comments and the voice chat recordings indicate that these issues clearly impacted the play experience. We will address these shortcomings in the discussion.

Procedure

Participants began with instructions about the expectation that they have a working microphone, they will be recorded, they should be free to interact with a partner for 10 uninterrupted minutes, and that the Unity Web Player plugin was required. Participants completed the trait questionnaires and then proceeded to a matchmaking page that matched people based on the order they arrived. Once par-

ticipants were matched, the pair was randomly assigned to complete either the icebreaker or labyrinth game task.

The icebreaker started as soon as audio communication was established and both participants pressed a button to indicate they were ready. It lasted 8 minutes. A countdown timer showed for the last 10 seconds of the task before participants were automatically redirected to the remaining questionnaires so that they could say goodbye.

The labyrinth game had a 90-second tutorial video that played before participants were connected to each other. After the video, the audio chat was established and written instructions were also provided. The game began only once it had finished loading for both participants and lasted for 8 minutes. Following the experiment, participants completed the remaining questionnaires and completed a debrief page.

Data Analyses

We excluded participants for being noncompliant in filling out the questionnaires. We identified non-compliance if participants had zero variance in their answers or spent less than one-second per item on average on our main outcome scale (interpersonal trust). In total, we excluded 37 participants due to the previously-mentioned technical issues and non-compliance, leaving 67 participants: 31 male (age: m = 35.18, SD = 9.65, min = 23, max 64).

To test our hypotheses, we used SPSS to perform multivariate analysis of variance (MANOVA) for comparison of means and multivariate regression analysis to investigate moderating effects. We analyzed our data on the individual level and not dependent on pair membership. For all subsequent analyses, we ran a post-hoc power analysis using G-Power. Given our sample size of 67, an set to 0.05, and estimated small effect sizes (f = 0.10), our statistical power was above 0.90 thereby allowing us to assume the null hypothesis when no significant differences were found [17].

RESULTS

Of 67 remaining participants, 35 experienced the social task and 32 the game. The difficulties experienced while playing the game led to some teams performing rather poorly during the game. Over all four rounds, teams collected on average 15.65 gems (SD = 6.97; min = 7, max = 30). Because poor performance could potentially influence trust formation, we median split teams into high and low performing teams and compared their interpersonal trust scores using ANOVA: there was no effect of performance on trust formation ($F=.965$, $p<.334$, $\eta^2=.03$).

Q1. Does the game work better than the social task at building interpersonal trust?

To determine the effects of task on trust development, we conducted a MANOVA with task (social, game) as a between-subjects factor on trust development, on establishing relational communication, and on generating satisfaction of relatedness. The MANOVA revealed an overall significant effect of task ($F_{1,29}=6.76$, $p<.001$, $\eta^2=.45$); we investigate each individual measure in the following sections.

Building Trust

The MANOVA revealed a significant effect of task on trust development ($F_{1,65}=13.5$, $p<.001$, $\eta^2=.17$), showing that the game was significantly better at supporting trust development than the social task (see Figure 2).

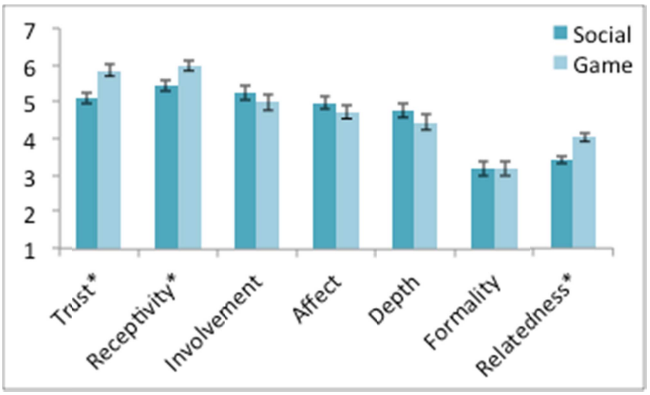

Figure 2. Main effects of condition on interpersonal trust, relational communication, and task experience.

Relational Communication

The MANOVA revealed a significant effect of task on the receptivity and trust subscale of the relational communication scale ($F_{1,65}=7.51$, $p=.008$, $\eta^2=.10$), showing that the game produced greater receptivity than the social task (see Figure 2). The receptivity subscale measures an individual's perception of the sincerity, honesty, openness, and willingness to listen of their partner.

There was no difference between the game and social task on involvement ($F_{1,65}=0.65$, $p=.424$) – which measures an individual's perception of the enthusiasm and interest of their partner, affect ($F_{1,65}=.81$, $p=.371$) – the warmth and closeness of their partner, depth ($F_{1,65}=1.4$, $p=.244$) – the friendliness, similarity, depth of conversation, and desire for further communication of their partner, or formality ($F_{1,65}=.003$, $p=.954$) – how casual/formal they perceived their partner to be (see Figure 2).

Although the social task was comprised of sharing personal information – whereas the game was comprised of enacting cooperative and interdependent game mechanics – there was no advantage of the social task in any aspects of relational communication.

Relatedness and Experience

The MANOVA revealed a significant effect of task on perceived relatedness ($F_{1,65}=15.6$, $p<.001$, $\eta^2=.19$), showing that the game was significantly better at satisfying the psychological need for relatedness than the social task (see Figure 2). There were also significant differences for perceived competence ($F_{1,65}=53.30$, $p<.000$, $\eta^2=.45$), and tension ($F_{1,65}=6.57$, $p<.01$, $\eta^2=.09$). Perceived competence was higher in the social task and perceived tension was higher in the game. We partially attribute these results to the technical difficulties during gameplay, but also to the fact that a conversation in our context is a familiar task with low pressure. The other task experience measures showed no differ-

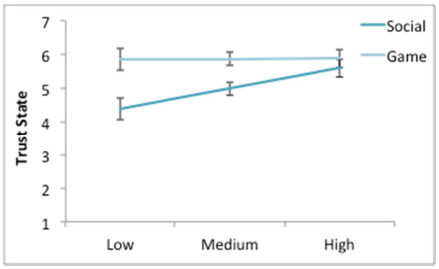

Figure 3: Interaction of propensity to trust (low, medium, high) with condition on interpersonal trust.

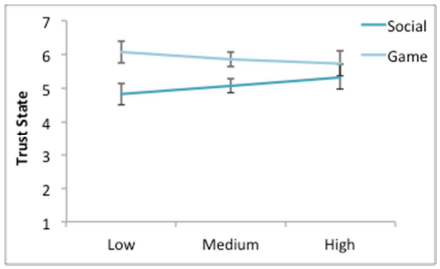

Figure 4: Interaction of agreeableness (low, medium, high) with condition on interpersonal trust.

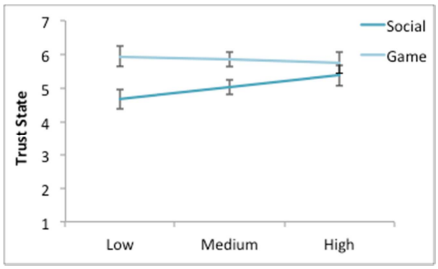

Figure 5: Interaction of condition and enjoyment (low, medium, high) on interpersonal trust.

ences: interest/enjoyment ($F_{1,65}$=2.56, p<.114, η^2=.04), and effort ($F_{1,65}$=2.56, p<.114, η^2=.00).

Q2. Do the trust-building advantages of the game depend on individual characteristics?

We showed that the game works better than the social task overall at building trust amongst distributed strangers (Q1) We further investigated whether the efficacy of games was dependent on demographic variables (e.g., gamers, women) or particular traits (e.g., extroverts, people who are inherently trusting) as is suggested by literature of trust formation [56]. To investigate the role of the continuous demographic factors, we conducted moderated regressions in which we investigated whether the prediction of trust by task (game, social task) was moderated by the demographic or personality factor of interest (see Data Analyses section).

In each of the regressions, task (game or social) significantly predicts trust; however, the role of the moderating factor varies. To investigate the role of the categorical demographic factors (i.e., gender and gaming experience), we conducted univariate analysis of variance.

Age

The moderated regression shows that task (game or social) predicts trust (β=.75, p<.001). However, age does not predict trust (β=.01, p=.284), nor does it moderate the effect of task on trust (p=.265).

Gender

To investigate the effect of gender on trust, we conducted a univariate analysis of variance (ANOVA) with gender (male, female) and task (game, social) as two between-subjects factors; because gender was collected as a categorical and not continuous variable, we could not conduct a moderated regression (note that although we provided other options, participants all answered either male or female). The ANOVA shows a significant main effect of task (game or social) on trust ($F_{1,63}$=11.8, p=.001, η^2=.16). Although we also see a significant main effect of gender on trust ($F_{1,63}$=4.84, p=.031, η^2=.07), it does not interact with task ($F_{1,63}$=0.44, p=.511). The main effect of gender shows that women (N=36, mean =5.70, SD=0.74) develop more trust than men (N=31, mean=5.18, SD = 1.06) in our sample.

Gaming Experience

Gaming experience was collected using an ordinal scale (from not at all through to every day). We divided participants into two groups – those who played multiple times per week or more (N=45) and those who played once per week or less (N=22). We conducted a univariate ANOVA with gaming experience and task as two between-subjects factors. As expected, the ANOVA shows a significant main effect of task (game or social) on trust ($F_{1,63}$=15.8, p<.001, η^2=.20). There was no main effect of gaming experience on trust ($F_{1,63}$=0.99, p=.324); however, there was a marginally significant interaction with task ($F_{1,63}$=3.74, p=.057, η^2=.06). The interaction showed that the game was significantly better than the social task at generating trust for people with less gaming experience (p=.001), but only marginally better for people with more experience (p=.078).

Propensity to Trust

We conducted a moderated regression with task (game, social) as the predictor of trust state, moderated by an individual's propensity to trust (trait). As expected, task significantly predicted trust development (β=.878, p<.001). General propensity to trust also significantly predicted trust development (β=.348, p=.004). In addition, propensity to trust moderated the effect of task on trust development (p=.009). As Figure 3 shows, for people with low (p<.001) or medium (p<.001) propensity to trust, the social task performed significantly worse than the game; however, for people high in propensity to trust, the social task did not perform worse than the game (p=.294). In other words, the game works equally well for people regardless of their general propensity to trust; however, the efficacy of the social task declines with an individual's propensity to trust.

Personality

We conducted five moderated regressions – one for each of the big five personality factors. As expected, in each case, task predicted trust. However, personality was not a significant predictor of trust: Extraversion (β<.001, p=.999), Agreeableness (β=.022, p=.846), Conscientiousness (β=.076, p=.481), Neuroticism (β=-.040, p=.653), and Openness (β=-.076, p=.526). In addition, Extraversion (p=.254), Conscientiousness (p=.433), Neuroticism (p=.653), and Openness (p=.805) did not moderate the prediction of trust. Agreeableness marginally moderated the effect of task on trust development (p=.079). Similar to the effect of propensity to trust, for people with low (p<.001) or medium (p<.001) agreeableness, the social task performed significantly worse than the game; however, for people high

in agreeableness, the social task did not perform significantly worse than the game (p=.426) (see Figure 4).

Q3. Do the trust-building advantages of the game depend on the experience during the task?

In addition to investigating whether the effect of task on trust development was affected by demographic factors, we wondered whether or not trust depended on the participants' experience of the task. To investigate the role of task experience, we conducted moderated regressions in which we investigated whether the prediction of trust by task (game, social task) was moderated by experience as measured by the intrinsic motivation inventory, which measures experienced enjoyment, invested effort, perceived competence, and experienced pressure. In each of the regressions, task (game or social) significantly predicts trust; however, the role of the moderating factor varies.

Enjoyment: We conducted a moderated regression with task (game, social) as the predictor of trust state, moderated by an individual's experienced enjoyment of the task. As expected, task significantly predicted trust development (β=.812, p<.001). Experienced enjoyment did not directly predict trust development (β=.201, p=.207); however, enjoyment did moderate the effect of task on trust development (p=.040). As Figure 5 shows, for people who experienced low (p<.001) or medium (p<.001) enjoyment, the social task performed significantly worse than the game; however, for people with high enjoyment, the social task did not perform significantly worse than the game (p=.233). In other words, the game works equally well for people regardless of their experienced enjoyment of it; however, the efficacy of the social task declines with a decline in experienced enjoyment.

Invested Effort: The moderated regression shows that task predicts trust (β=.76, p<.001), as expected. However, invested effort does not predict trust (β=.243, p=.279), nor does it moderate the effect of task on trust (p=.799). **Perceived competence** does not predict trust (β=.253, p=.076), nor does it moderate the effect of task on trust (p=.187). **Experienced tension** does predict trust (β=-.342, p=.002), showing that increases in experienced tension decrease the development of trust. However, tension does not moderate the effect of task on trust (p=.349).

Q4. Do the trust-building advantages of the game depend on the interpersonal experience?

The efficacy of the social task was sensitive to task experience, whereas the game was not. We were also interested in whether the efficacy of the tasks might be sensitive to the relationship developed. As such, we conducted moderated regressions of task on trust development with experienced relational communication (i.e., receptivity, involvement, affect, depth, and formality) as moderators.

As expected, task predicted trust development in all cases. In addition, all aspects of relational communication except formality (β=.059, p=.628) also predicted trust development (Receptivity: β=.286, p=.003; Involvement: β=.513, p<.001; Affect: β=.276, p=.012; Depth: β=.335, p<.001). This suggests that relational communication is an important factor for interpersonal trust formation. However, none of the interpersonal relationship factors moderated the effect of the task on trust development (Receptivity: p=.739; Involvement: p=548; Affect: p=.958; Depth: p=.286; Formality: p=.778). The effect of task on trust is therefore independent of relational communication.

As mentioned above, relational communication did not change based on our conditions (except for receptivity, which increased as a result of playing the game).

DISCUSSION

We summarize our results, explain why the game works so well at facilitating trust, and discuss the implications of our findings in the broader context of games and interaction.

Summary of Results

The goal of this study was to investigate whether or not games are a legitimate option for fostering interpersonal trust in distributed teams. We compared a multiplayer cooperative game to a social task that was designed to facilitate casual conversation and personal information exchange – a strategy proposed by current literature on trust formation. Although both solutions helped to facilitate trust formation, our game appeared to be more effective than our social task. This was not only true for interpersonal trust but also for how much the task satisfied relational needs and how receptive/trusting the partner was perceived to be.

A closer look at our results gives us an understanding of why a game is overall more effective than a social task. Under ideal conditions, our social task was as effective as our game for facilitating interpersonal trust. However, the effectiveness of our social task was sensitive to characteristics of the trustor as well as to the experience of the task, suggesting that when a team member is inherently less inclined to be trusting or doesn't enjoy social tasks, their ability to foster trust may break down. A similar trend was seen in the personality trait of agreeableness, which measures how socially harmonious people are. The notion that interpersonal trust formation is affected by characteristics of the trustor is coherent with literature on interpersonal trust [67,56,27]. Our results let us conclude that personal information exchange *can* be very effective at fostering trust; however, its effectiveness is fragile and dependent on circumstance. In contrast to this fragility, the game's ability to foster trust was robust to these factors.

The effectiveness of our game was unchanged by any of the measurements we collected in this study. The inherent propensity to trust, enjoyment of the game, or agreeableness did not affect its power to make people feel safe with one another. The effectiveness of the game was also not compromised by age or gender. Although there was a marginally-significant interaction with game play frequency, the results showed that the game was better than the social task for both frequent gamers and less-frequent gamers, but the magnitude of the difference was weaker for game enthusi-

asts, suggesting that games are a viable option for all demographics and levels of experience in games. These results suggest that games such as ours are the more reliable form of fostering trust among team members.

Equally interesting are the constructs that weren't changed by the task. We compared pairs that were talking about each other's preferences and personalities with pairs that talked about where to go on a game board or which tile to push. However we did not observe any differences in involvement, affect, depth, and formality. This is consistent with literature on relational communication, which suggests that the content of a conversation is distinct from its emotional and relational components [31,13]. The results suggest that a game is as effective at fostering a relational connection between two people as a social conversation.

Why Does the Game Work?

The results clearly indicate that a game has the power to facilitate interpersonal trust between players. Considering that the conversations in these games were without any meaning or consequence to the players' lives, these results may seem surprising. One might argue that the interaction that occurs between players in online games might be considered as an impoverished form of communication, and as a result, online games should not be effective at facilitating trust development. Unless games are intentionally designed to promote personal information exchange or similarity development through their mechanics, the limited amount of conversation that does occur will generally be about events in the game. We now explore the idea that a game is in fact a legitimate social interaction that can be optimal for trust formation. In particular, we focus on two components of play: the game's ability to simulate risk and interdependence, and the idea of game moves as conversational turns.

Simulating Risk and Interdependence

As described above, the formation of trust requires an appropriate amount of risk (i.e., consistent with the current level of trust between the individuals) and interdependence between two partners. A game is an artificial environment that can be designed specifically to create interdependence. Following existing frameworks on collaborative game design [16,44], we implemented mechanics like asymmetrical roles and the need for information exchange (e.g., position on the board) to induce interdependence between the players. In terms of risk, poor performance in the game had no real life consequences for the players. Because the stakes were artificial, the risk was relatively low, thereby ideal for initial trust formation between strangers who have no existing interpersonal trust. The conditions we created in our game therefore allow players to *rehearse* or *perform* cooperation and trusting behavior. These activity-based interactions build a relational connection through experiences, rather than through shared knowledge or similarities.

Game Moves as Conversational Turns

Although not explicitly about trust formation, similar patterns of relationship building to ours have been observed in Internet play rooms [42], MUDs [43], and virtual reality games [6]. In these examples, players didn't communicate explicitly about non-game content; however, they still created social bonds. McEwan et al [42] argue that moves within the game "*are legitimate forms of human contact which create a shared experience through an (albeit stylized) form of human interaction*". The notion that players can communicate nonverbally through the game is reflected in our recordings of the game sessions. Players would sometimes suddenly say "Good Idea!" or "Ah, now I get it" without the other player having proposed anything, clearly responding to a nonverbal game move. The game adds richness to computer-mediated communication by allowing for extra channels of communication (i.e., game moves as conversational turns). Our results suggest that these interactions create relational bonds between players that are as strong as those created through explicit verbal conversation.

Fragility of Conversation vs. Robustness of Games

We showed that the effect of social conversation on interpersonal trust is fragile because it is vulnerable to personality and enjoyment of the conversation. Games appear to be robust against these contingencies. We believe the reason for this robustness is due to the activity-based nature of social interaction within games. Based on literature on trust formation, personal information exchange facilitates trust because this information is *trust warranting* and highlights similarities between partners. These effects are however dependent on the content of the interaction. If the information exchanged is not trust warranting or only highlights differences between the partners, the interaction is not likely to facilitate trust formation. Some partners might not want to exchange information because they are generally more private or don't enjoy these kinds of interactions. In contrast, the social interactions in games are independent of content or explicit communication. Relational bonds are formed through action and game-related communication. These activity-based interactions appear to foster relational bonds between partners as well as personal communication, while being free of the contingencies that content-based interactions depend on.

What should be said about the properties of the game

Our game was strongly affected by networking issues, which made the game more frustrating and difficult than we expected. This is reflected in the results. Performance in terms of gems collected was lower than we expected, and participants in the game condition scored low on competence and high on tension. Comments from the debrief as well as the recordings of the game session confirm that many participants experienced a frustrating, 'buggy' game, rather than the playful experience we intended. The results of this study have to be interpreted with this in mind. Nevertheless, our results showed strong effects that support arguments for the effectiveness of our game. Submitted comments and the recorded conversations indicated that dealing with a 'buggy' game made the players bond over how frustrating and challenging the game was. Literature suggests that frustration in games can have positive consequences on player experience [21]. Our results show that

performance, perceived competence, and enjoyment don't impact trust formation directly, supporting at least the assumption that the game doesn't have to be 'fun' or satisfy competence to facilitate trust. Social identity theory suggests that creating an 'out-group', which can be considered the common enemy, strengthens the cohesion of the 'in-group' [60] – in our case, the players can be considered as the in-group and the game system as the out-group. Alternatively, the frustration might have hampered an otherwise even more effective trust building intervention. Based on previous frameworks for team building games [16,44], frustration and poor usability should be avoided. The results support the assumption that increased tension inhibits trust formation. The role of frustration on trust formation in team building games is an interesting area of future research.

Design Implications

Our results suggest that online multiplayer games should be considered as a potential team-building activity to facilitate trust formation in distributed project teams; however, there are implications to other collaborative relationships and to aspects of interpersonal relationships beyond trust.

Games have long been used as a means of supporting social interaction. Family board game nights, tabletop gaming in board game stores, or weekly bridge meet-ups among friends can help us satisfy our psychological need for relatedness [57] and create shared experiences that draw us closer [8,25]. Online multiplayer games have the additional advantage of allowing distributed friends and families to maintain a connection—for example, people enhancing their friendship through play of social network games [66] or seniors playing online poker together to stay connected [59]. Trust is not just important in distributed project teams, but is valuable in many types of relationships. Consider, for example, an online dating site. Users who are matched chat via text to get to know one another before deciding whether or not to meet for a date. Our results suggest that playing an online game together might help potential couples to develop a trusting bond or to develop positive relational communication patterns. Or consider families who are geographically separated from one another. Playing a networked game may help develop that trusting bond between, for example, a grandparent and their grandchild who lives in a different part of the world. Future work is needed to determine whether our results can be applied into contexts beyond distributed project teams.

Limitations and Future Work

Although our results strongly suggest the potential of games as trust-building activities, there are limitations in our study that should be addressed in future work. First we have to acknowledge the already discussed technical problems and the effects on our manipulations. The potential influence of in-game frustration on our results and the question of how well a non-frustrating game could facilitate interpersonal trust should be investigated. Second, we treated participants as individuals, when they were part of a dyad, and therefore not entirely independent. This also prevented us from investigating the effects of matchmaking. An interesting direction for future research would be to investigate the effect of team constellations (e.g., same sex vs. mixed dyads). Third, our method for measuring trust was a modified scale. Even though its metric properties made it a viable measure for trust, future research should try a more multi-methodological approach to measuring trust. Other studies investigating trust have, for example, implemented social dilemmas based on game theory to measure trust behaviorally [2,51]. Using these methods, it is possible to make assumptions about the fragility of trust, which is suggested to be a problem in distributed teams [2,50]. Future research could investigate the effect of games on the 'thickness or fragility' of trust compared to social tasks. Fourth, our results must be generalized with caution. Effects we found in this study might be specific to the mechanics implemented in our labyrinth game. Further research should investigate the effects of other games containing different game mechanics and narrative elements. Fifth, we attribute the results of this study to the game in general. Our findings raise the follow-up question of which mechanics or properties of the game specifically caused our results. Future research should further investigate what properties of the game (e.g., cooperation, interdependence, risk, frustration, playfulness) were the cause of our results. Lastly, we investigated dyads. While using dyads to investigate small group dynamics is a viable research method, future research should aim to investigate the effects of a game in bigger teams.

CONCLUSIONS

Based on current literature on trust development, we proposed that context factors like risk and interdependence could facilitate trust formation in distributed teams. We argued that games are an optimal medium to induce an appropriate amount of risk and a need for interdependent interaction between team members. In this paper, we showed that a game designed with these properties in mind could compete with a social task that was designed to facilitate trust through personal information exchange. In fact, it was better at facilitating trust than the social task. Our game was also as good as the social task in promoting relational communication between the partners in terms how involved or affectionate they perceived one another. These results support the notion that interactions in games, while being focused on the game itself, are as efficient at facilitating social bonds as social conversations. Our findings also suggest an explanation as to why games were better at fostering trust than the social task. Under optimal conditions, the conversations in the social task could effectively bring participants closer together. However, the efficacy of the conversation was vulnerable to a set of contingencies, whereas our game facilitated trust regardless of age, gender, personality, or experience. We conclude that games are simply more robust against factors that threaten the efficacy of social icebreakers.

The relationships built through gameplay are sometimes considered as impoverished versions of the rich bonds that

are created through conversation. We contribute to a growing body of work recognizing the ability of games to shape and foster online social relationships, facilitating the development of deep and meaningful social bonds.

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