

# Making Decisions From a Distance: The Impact of Technological Mediation on Riskiness and Dehumanization

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## ABSTRACT

Telepresence means business people can make deals in other countries, doctors can give remote medical advice, and soldiers can rescue someone from thousands of miles away. When interaction is mediated, people are removed from and lack context about the person they are making decisions about. In this paper, we explore the impact of technological mediation on risk and dehumanization in decision-making. We conducted a laboratory experiment involving medical treatment decisions. The results suggest that technological mediation influences decision making, but its influence depends on an individual's self-construal: participants who saw themselves as defined through their relationships (interdependent self-construal) recommended riskier and more painful treatments in video conferencing than when face-to-face. We discuss implications of our results for theory and future research.

## Author Keywords

Computer-mediated decision making; Teledecision; Risk-taking; Risk-preference; Dehumanization; Telemedicine; Telepresence; Decontextualized decision making.

## ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation]: User Interfaces - Interaction styles.

## General Terms

Human Factors; Design.

## INTRODUCTION

In many domains, people now use technology to work with remote others and make decisions about remote people or events. Physicians use telepresence systems to diagnose patients 3,000 miles away from their office [36]; soldiers use drones to rescue victims [67]; managers oversee remote workplaces using mobile telepresence robots [44]; surgeons use robotic surgical tools to operate on remote patients [36]; and a suite of experts provide advice to their clients over video [33]. How does technological mediation influence perceptions of, and decision-making about a remote target?

Are people risk-seeking and more dehumanizing at a distance? Are certain people more risk seeking and dehumanizing at a distance than others?

While telepresence technologies support sharing and collaboration across geographical and temporal boundaries, decision makers are now decontextualized from their decision targets. Research in social psychology and decision science suggests that this mediation and decontextualization could create distance in how decision makers construe, feel toward, and engage with remote people and events [45]. This perceived distance may be exacerbated by intrinsic differences among cultural dimensions, such as styles of self-construal [10] as previous work has shown that culture changes the nature of mediated communication [68, 77]. The change in perceived distance should ultimately impact the quality of the decision outcomes, yet their impacts are largely unknown.

Some researchers have begun to raise such concerns about the effects of mediation in areas as diverse as humanitarian work [21], medicine [30], and drone warfare [65]. Despite this attention, mediated and decontextualized decision-making on a remote decision target has not been a focus of previous studies in computer-supported collaborative work (CSCW), computer-mediated communication (CMC), and telepresence.

Research on CSCW and CMC has investigated the impact of mediating technologies on collaboration: interpersonal communication [40], impression formation [23, 72, 55], collaborative group decision-making [39, 49], collaborative work [52], knowledge sharing [15], distributed team collaboration [56] and awareness [18, 29], physical collaboration [24], and trust [8]. Research on telepresence has explored ways to measure [79] and improve [51] social presence of a remote person or situation, and improve teleoperators' navigation and control of the telepresence systems [61]. However, to our knowledge, little research has looked at how the quality of decisions about a remote person or event change through mediating technologies, with the exception of a study on job interviews and the hiring decision [70].

Our research takes a first step towards systematically understanding the impact of mediating technology on decision-making about remote decision targets. Although

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there is a wide range of possible remote decision tasks and there are many types of decisions that can be made through mediating technology, we first focus on risk and dehumanization in medical decision-making. The area of medical decision-making is especially relevant as it is one of the most prominent areas where mediating technologies are starting to be implemented and used widely [36]. Additionally, medical decision tasks are often used to test the decision-making behaviors of both everyday people and medical experts [62]. We conducted a laboratory experiment where a participant made treatment recommendations to another participant (a confederate), either face-to-face or through video conferencing. We examined the influence of mediation on risk and dehumanization in the decisions made.

In this paper, we make three contributions. First, we offer a theoretical framework explaining how technological mediation may influence decision-making. Our framework draws from the social psychology, decision science, CSCW, and CMC literature. Second, we experimentally demonstrate that technological mediation can significantly influence important decision-making outcomes, and that this influence is dependent on one's cultural self-construal. Finally, we consider implications of our results and research insights to help frame future work in this critical, yet unexplored area.

### **MEDIATION, DISTANCE & DECISION-MAKING**

We investigate the following research question about the impact of technological mediation on decision-making:

- How does technological mediation influence different types of distances and decisions?

Drawing from the literature in social psychology, decision science, CSCW and CMC, we elucidate three interconnected ways that mediating technologies increase distance between decision-makers and decision targets. We explain how this distance can influence the riskiness and dehumanization inherent in a decision context (Figure 1). We then consider how an individual's self-construal could moderate technology's influence on decision-making.

Among different qualities of decision outcomes, we first focus on risk preferences and the dehumanizing tendencies of decision-making. Risk preference, or a decision maker's willingness to accept risk for a certain decision outcome, is a classic concept in decision science with relevance to many tasks and lines of work [46]. Dehumanization, the perception or representation of others as "animal-like" or "less human", is a similarly important concept in the realm of social psychology. Dehumanization occurs when out-group members are perceived as fundamentally different and even inferior to a perceiver's in-group [31].

#### **Construal Level Distance**

An event, person, or object is said to be psychologically distant when it is not present in one's direct experience [45]. A framework grounded in psychological distance,

construal-level theory suggests a decision maker's distance from a decision target – whether it is spatial, temporal, or social – leads to a higher, more abstract construal level representation of the decision target (for a review, see [73]). Psychological distance research has shown that greater distance can influence many different facets of decision-making such as self-control, willpower, negotiation behavior, and ethical decision-making.

We posit that mediating technologies could increase the psychological distance of decision makers from remote decision targets. Geographical distance, inherent in working through technology with someone in a different place, can influence decision-makers to construe another person more abstractly. In fact, a study by Bradner and Mark demonstrated that increasing perceived distance of a collaborator decreased cooperation and trust [9]. In addition, mediating technologies reduce contextual information and social cues about the remote decision target [15], which in turn may lead to less concrete mental representations of a decision target.

#### **Promotion Focus and Risk-Taking**

If mediating technologies increase decision makers' psychological distance from a remote decision target, they can influence decision-makers to make riskier decisions. Research has shown that psychological distance – either temporal [58] or social [59] – influences regulatory focus: a promotion focus that involves sensitivity to *positive* outcomes (i.e., a half-filled glass) or a prevention focus that involves sensitivity to *negative* outcomes (i.e., a half-empty glass).

Greater psychological distance elicits abstract representations of an event (such as a goal or desirability) whereas lesser distance elicits more concrete, task-specific representations (such as a method or feasibility). For example, in a study by Sagristano et al., people made riskier gambling decisions when gameplay was to take place two months later instead of at the time of the choice [66]. They explain that with greater temporal distance, the "desirability" (higher payoff) of the choice is highlighted over the "feasibility" (low probability) of the choice. According to construal-level theory, which suggests that temporal and spatial distance could work interchangeably, we posit that decision-makers may make a riskier treatment decision about the remote decision target when video conferencing, as compared to face-to-face.

#### **Psychological Distance and Dehumanization**

Increased psychological distance may also lead to dehumanized decision-making. Previous research suggests that people tend to dehumanize others when they have greater social distance, such as out-group members [32]. For example, Lammers demonstrated that people who imagined themselves in more powerful positions (e.g., senior surgeon) became less sensitive to others' pain and recommended more painful and effective treatments, compared to those who imagined themselves in less

powerful positions (e.g., nurse) [42]. This research suggests that decision-makers may make a more dehumanizing decision via video conferencing, compared to face-to-face.

**Experiential Level Distance**

In addition to their influence on mental representations of the decision target, mediating technologies could also create experiential distance from a remote decision target – that is, how immersed and engaged decision makers are in the experience of communicating with another person. Previous research suggests that mediated communication is inherently less engaging, physically, cognitively, and emotionally than face-to-face communication [57]. The previous work in the following sections suggests that this increased experiential distance can elicit both more or less risky and dehumanizing decisions.

*Saliency Change of Decision Attributes*

Mediating technologies can impact what attributes of a remote decision target become salient to decision-makers. In mediated communication, information that conveys social presence – social cues and non-verbal gestures – is significantly limited whereas the delivery of factual information is less impacted [12, 56]. This difference in information quality might make factual information more salient than social presence in mediated communication. Along with increased saliency of factual information, reduced social presence may influence people to make riskier and more dehumanizing decisions for others.

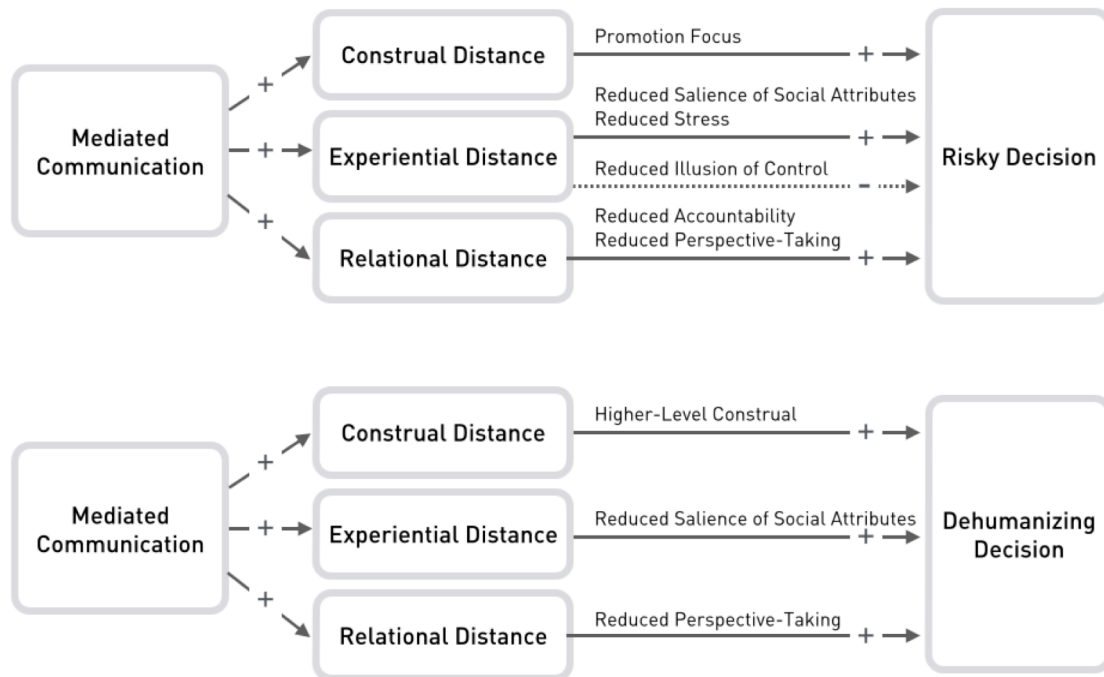
Research on the role of affect in decision-making (e.g., Lowenstein’s “risk as feelings” [46]) suggests that risk

preferences and tendencies towards loss aversion can depend on individual perceptions of risk. The relative saliency of factual information in mediated communication may reduce the vividness of the decision target’s feeling toward the risk, thus eliciting a riskier decision. In the same way, people may put more weight on factual, quantitative information and put less weight on social considerations (such as pain that the decision target would experience) in mediated communication. In fact, it has been shown that people make more rational choices when making a decision for others as, when thinking about others, perceived risk can be less vivid than the feelings of risk evoked when making decisions for one’s self [37, 81].

We posit that in mediated communication, people will put more weight on factual, probability-based information and put less weight on social consideration, whereas when face-to-face, they will put similar weight on both risk neutrality and how their decision target would feel about the risk.

**Stress**

According to Porcelli [60], when people are under stress, they make more conservative betting choices for gains. Stress interferes with people’s rational, deliberate thought processes resulting in more intuitive and automatic thought processes that are susceptible to loss-aversion biases [38]. Previous research suggests that face-to-face communication can be more cognitively taxing [57], thereby increasing stress and leading people to minimize risk in their decisions.



**Figure 1. A conceptual model that shows how mediated communication may influence three types of distances, and in turn yield different types of risky and dehumanizing decisions.**

### *Reduced Illusion of Control*

On the other hand, mediating technologies may lead to a less risky decision. Previous research suggests that people feel “the illusion of control” [43] over objects or events when they are co-located. Similarly, being co-located with another person is correlated with greater interpersonal control (e.g., greater persuasion and cooperation) compared to talking via voice or another medium [50]. This suggests that people may make a riskier choice when talking face-to-face than when video conferencing, as they feel that they have greater control over the co-located person or situation, and perceive the risky choice’s chance of success as higher. In fact, Goh et al.’s study shows that people gave higher bets on a physical roulette wheel when in the room with it compared to when they saw the wheel over video conference [25].

### **Relational Level Distance**

The reduced bandwidth of mediating technologies may also decrease the relational connection that decision-makers feel towards the remote decision target. Previous research on CMC suggests that during their first encounter, people communicating face-to-face form more positive impressions about their conversational partners than those video conferencing [55, 23]. This reduced relational closeness could also influence the decision-maker to make a riskier and dehumanized decision about the decision target.

### *Reduced Accountability*

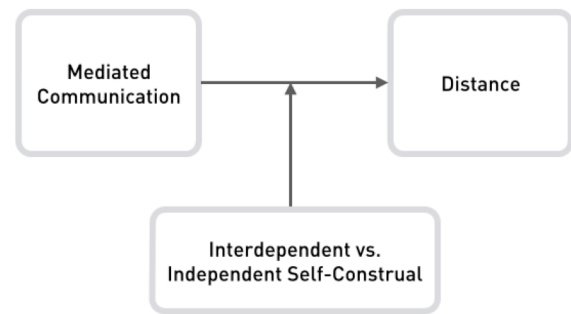
Reduced closeness may influence decision makers to feel less accountable about their decisions. Previous research investigating decision making differences in a self-other paradigm suggests that people make less risky financial and monetary decisions for others, as they feel more responsible for the decision that they make [76, 63]. This suggests that a potential decrease in accountability can lead to riskier decisions.

### *Less Perspective Taking*

Reduced closeness can also result in less effort in perspective taking [11]. That is, decision-makers may make a riskier decision as they base their decision on their own perspective (self) rather than their decision targets’ perspectives (others). Reduced relational closeness may also induce more mechanistic dehumanization (i.e., perceiving other people as devoid of the capability of feeling emotion), which can result in a more dehumanized decision.

### **Interdependent and Independent Self-Construals**

We posit that whether mediating technologies increase distance may depend on an individual’s cultural self-construal, or the way they perceive and define their identity as interdependent or independent (Figure 2). People with more interdependent self-construals define themselves through their relationships with others, while people with independent self-construals define themselves through their individual achievements and personal attributes [10, 48]. Research on social cognition and psychology suggests that



**Figure 2. Interdependent versus independent self-construal may influence whether mediating technology creates distance from a remote decision target.**

this self-construal influences cognitive and social information processing. People with interdependent self-construals are more sensitive to others’ emotions, social cues and social presence, and base their judgment both on these social cues and their internal states. On the other hand, people with independent self-construals are less sensitive to others’ emotion and put more weight on their internal states in making decisions [10, 48]. This suggests individuals with interdependent self-construal may be more sensitive to reduced social cues caused by technological mediation.

A growing body of research on cultural differences in the use of CMC also lends support for this prediction. For example, Wang, Fussell & Setlock found that Chinese participants, associated with highly interdependent self-construals, were significantly less engaged (i.e., made fewer attempts to understand the other) when using text-based chat when compared to face-to-face communication. However, American participants’ engagement did not differ across mediums [68]. There is evidence that people with interdependent self-construals rely more on contextual information during communication than people with independent self-construals [77].

### **No Increase in Distance with Technological Mediation**

Despite the above-mentioned reasons why mediating technologies may increase decision makers’ distance from a decision target, recent mediating technologies with high communication bandwidth such as video-conferencing or telepresence robots may not influence distance from the decision target and qualities of decision-making. Even though the decision targets are geographically distant from the decision-makers, a high quality live video-feed of the decision target may create experiences realistic enough that decision-makers may feel like *being there*.

Most research on psychological distance has been conducted using textual scenarios (e.g., asking people to think about a person in the same city versus in a distant city). Recent research, however, suggests that an engaging experience can compensate for physical distance. In a study conducted by Ebert & Myvis, when a description of a temporally distant event was very engaging, the

engagement eliminated the effect of temporal distance, making people construe the story in a low-level, concrete way [20]. Similar phenomena may be at work when interacting through higher-bandwidth communication media, possibly cancelling out any psychological distance caused by differences in location.

In order to better understand these variables, we empirically investigate the impact of mediating technology on the decision makers' distance from the decision targets, and its impact on the riskiness and dehumanization of their decision-making.

## METHODS

To measure the impact of mediating technologies on decision-making, we conducted a between-subjects laboratory experiment where a participant was asked to give advice to another participant (confederate) on health issues. Participants were told that the aim of the study was to learn how people give advice to other people to inform the design of a virtual health advisor. The participants were randomly assigned to talk with another participant either face-to-face or through video conferencing (Figure 3). The experiment was approved by the Institutional Review Board in the university where this research was conducted.

### Decision Tasks

In order to measure risk preferences and dehumanization, we adopted two medical decision-making tasks used in previous psychology and decision science research about the decision-making behaviors of lay people without medical expertise. One decision task involved a risky decision (deciding whether to add a medication with an 85% chance of success and 15% chance of failure) (see [62]) and the other involved a 'tough' decision with a pain-efficacy tradeoff (choosing between a painful, effective treatment and a painless, less effective treatment), as a lack of sensitivity to others' emotions is one indicator of dehumanization (see [42]).

Both tasks were presented as hypothetical, textual scenarios in previous research, so we adopted them to be conversational and suitable for our confederate's age. The confederate stated that she was encouraged to seek advice from others by their doctor and the experimenter emphasized that there were no right or wrong answers. The order of the tasks was counterbalanced. One confederate, an

Indian American female in her early 20s, played the advisee role for all of the experiment's sessions.

### Scenario Text

**Introduction** Ok. I've been dealing with many health issues lately, and have some tough decisions I need to make. My doctor told me that there's no right or wrong answer, so he recommended that I talk to many people for a second opinion. When I found about this study online, I thought that it would be a really good opportunity to do so. I was hoping you would give me some advice and help me make the decision. So I guess I'll just get started.

**Abdominal Treatment Choice (adapted from [62])** Last month, I was diagnosed with an abnormality in my abdominal wall, and my doctor told me that this will cause problems in the long run even though I don't have any symptoms now. There are two different treatments available. The first treatment is painless but the abnormality has a chance of recurrence like 20-25%, so I may need another treatment if this happens. The second treatment is tougher and has almost 0 chance of recurrence, but the disadvantage is that anesthesia is impossible. So I would experience a lot of distress and pain. Which treatment would you recommend I choose?

**Allergy Treatment Choice (adapted from [42])** Another question that I have is about a medication for my allergy. I developed a rare and serious allergy, which gave me painful headaches all the time. This made it really hard for me to study and sometimes I couldn't even carry out daily tasks. I started a treatment last month, and it worked, so I can have a normal life again. With this treatment, I am expected to not have any symptoms for the next 5 to 10 years. What is unknown about this treatment is whether the same treatment would work again after this first one loses its effect after 5 to 10 years. This means that there might not be anything that I can do at that point, and I would experience the symptoms again. My doctor told me that there is a medication that can be added to my treatment, which has been shown to work overall, although sometimes it makes things worse. With this medication, there is an 85% chance that I will gain 2 more symptom-free years, and a 15% chance that I will lose 2 symptom free-years. What do you think? Should I take this medication or not?

### Participants

We recruited participants who resided in an east coast American city. Participants were recruited through a participant recruitment website managed by the university and through flyers posted on campus and around the city. Starting with 74 participants, we omitted those who reported being suspicious about the other participant (confederate) during the debriefing session and who responded incorrectly to our attention check. This left 46 participants (M age = 29.8 years, SD = 8.8, 52% female).

Participants had diverse ethnicities: there were 18 Caucasians, 18 Asians, 6 African Americans, 1 Pacific Islander, and 3 with mixed ethnicities. Participants' ethnicities and genders were equally distributed across categories of self-construal and conditions. 29 were native English speakers, and the remaining 17 non-native English speakers were fluent, having lived in the US for 10 years (SD = 16.9) on average. The participants reported using video conferencing once a month on average (M = 2.7, SD = 1.4; "Less than a month" = 2, "1-3 times a month" = 3).

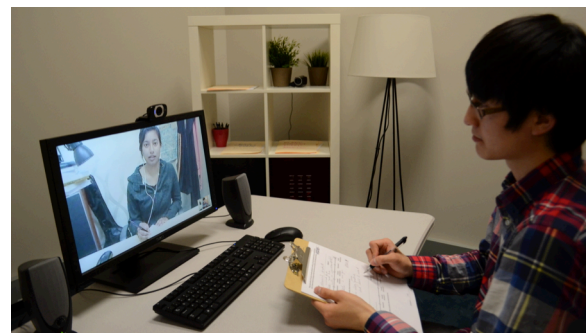


Figure 3. Face-to-face condition (a) versus video conferencing condition (b).

## Procedures

Participants were randomly assigned to either the face-to-face or video conferencing conditions. The procedure was adapted for each condition as described below to maintain realism.

### *Introduction and Cover Story*

Following arrival at the lab space, participants were told that they were waiting on a second participant (the confederate) in order to enhance realism. In the face-to-face condition the other “participant” (the confederate) arrived in the lab a couple of minutes after the participant arrived. In the video conferencing condition, the experimenter called the confederate in front of the participant in order to “confirm their availability for participation.”

In the face-to-face condition, participants were then seated across from each other at a table. In the video conferencing condition participants were seated in front of a computer with active video conferencing software. In the latter condition, the confederate was seated in front of a backdrop made to look like a house or dormitory room, as opposed to an academic building (see Figure 3). Additionally, both webcams were angled to show the participants’ upper torsos.

After reviewing the consent form, participants were given a brief explanation of the study, expanding on the cover story of a “human conversation study.” Participants were told that the other participant was recruited from local medical community boards by soliciting those who wanted to get health advice from non-experts. They were told that both participants were there to help with the creation of a “virtual conversational system with collective intelligence” and that the experimenters were “collecting types of health issues that people will ask other people about and the types of advice that people give.”

Participants were then informed (or reminded, in the case of the confederate) of their roles in the experimental task. Real participants always took the role of *advisor* and the confederate was always the *advisee*. The experimenter explained that the advisee had been contacted prior to the experiment and told to “think about what they wanted to ask.” To further reinforce this cover story, the confederate took out notes and was reminded to review them and make sure their options were presented in a two-choice format.

### *Experimental Task*

Participants were given a “decision sheet” to record their answers to the advisee’s questions and were told to note down several things: the advisee’s question, the two choices the advisee offered, which choice the participant recommended, and any notes or follow-up questions they had for the advisee. (It was explained to both the advisor and advisee that follow-up questions needed to be limited and that responses should be recorded on the decision sheet as the dialogues needed to be “structured” for computer simulation.)

After explanation of the task concluded, participants were reminded that their interaction would be recorded and that they had ten minutes to complete the task. Participants were then told to find the experimenter in the lab waiting room when they finished the task or if they had questions.

### *Survey and Debrief*

Once participants finished conversing, the experimenter re-entered the room. The advisor and advisee were then asked to complete the survey portion of the study (see *Measures*). In the face-to-face condition, advisors completed the survey on a computer in the same lab space and advisees were told to follow the experimenter out of the room to another computer. In the video conferencing condition, advisees were told that a survey link would be emailed to them. Advisees then disconnected from the videoconference and advisors completed the survey on the same computer they had used for videoconferencing. After completing the survey, advisees were asked for their opinions on the confederate and study, debriefed about the study goal study and the use of confederate, and compensated.

Participants in both conditions filled out the same survey. The video conferencing condition had two questions about where they thought the other participant was located during the videoconference, and in which city they thought the other participant lived. The survey included questions that measured participants’ construal-level, experiential-level, and relational-level distances from the other participant (confederate), dehumanization of the other participant, individual differences, and demographics. One attention check was also included. All questions were presented using seven-point scales.

### *Interaction Recordings*

We recorded participants’ conversation using a digital camcorder set up in the room in both conditions. Screen recording software was used to record video-conferencing.

### **Measures**

We used both behavioral and subjective measures to evaluate the influence of technological mediation.

### *Risky and Dehumanizing Decisions*

To measure riskiness and dehumanizing aspects of decisions, we calculated the percentage of the participants who recommended the risky treatment (i.e., adding the risky medication) and the percentage of the participants who recommended the dehumanizing treatment (i.e., effective but painful treatment). As a subjective measure of dehumanization, the survey asked participants to rate how well a set of adjectives would describe the other participant they interacted with. Eight adjectives (e.g., ambitious, jealous) were used to measure “infrahumanization”, or the denial of “uniquely human” qualities to out-groups [32, 14]. An additional four adjectives (cold, superficial, responsive, and sensitive) were used to measure “mechanistic dehumanization”, the tendency to attribute cold, object-like characteristics to others [31].

### *Construal Level Distance*

We adopted three measures to assess participants' construal level distance from their advisee, which have been commonly used in psychological distance research. People have been shown to describe another person more abstractly when they have greater psychological distance from them [22, 75]. Thus, four behavior identification questions from [22] asked participants to choose which activity description – abstract (e.g., getting organized) versus concrete (e.g., writing things down) – better described an imagined task being done by the advisee. Each abstract response was coded as 1 (versus 0), and responses were summed to calculate a score.

Greater psychological distance deemphasizes individual particularities and reinforces the belief that the individual will follow the average behavior of a group that the individual belongs to. Three questions adapted from Henderson et al. [34] asked participants to estimate the likelihood that their advisee will exhibit typical behaviors (e.g., “the likelihood that [the advisee] will spend more than 3.8 hours online when the average student spends 4.6 hours per day”), and the answers were averaged. Participants were also asked to describe the advisee. We analyzed the answers to count the prevalence of linguistic categories (such as the use of past tense, as well as more concrete and less tentative language) that suggest low-level construal using the LIWC software [71].

To check whether participants felt spatial distance with their advisee, we also asked how far the other participant seemed to the participant and how much geographical space there seemed to be between the participants and their advisee [34].

### *Relational Level Distance*

We measured participants' relational level distance from their advisee using constructs such as liking, closeness, similarity, enjoyment, empathy, and care. The survey included questions about how much participants liked, identified with, and felt close and similar to their advisee, and a self-other inclusion question [4]. We used a 5-item empathy scale from Batson [5] to measure how participants felt while interacting with their advisee ( $\alpha=0.86$ ). We also asked how much they enjoyed the interaction overall. As a measure of care, we asked whether participants would share their email address with their advisees for a potential follow-up, and how willing they were to check on their advisee regarding the situation that she talked about.

We posited that relational level distance would influence how much the participants took the perspectives of their advisee and how accountable they felt about their advice. To this end, we included 2 items about perspective taking from [15] as well as a perceived accountability question.

### *Experiential Level Distance*

To measure how engaged and immersed participants were in interacting with their advisee, we included four questions

that assessed four aspects of engagement (e.g., “the interaction was very engaging”) [47].

We theorized that stress felt during the interaction and perceived control over the advisee could influence decision-making. Thus, we asked how tense or relaxed and how comfortable participants felt during the interaction. To measure perceived control, we also asked how much influence participants felt like they had on the opinion of their advisee, and how likely it was that their advisee would follow their advice.

To check whether any differences in decision-making were due to cognitive effort as opposed to distance, we asked participants how much they concentrated on their advisee, how much effort they put into evaluating their situation, and how important they thought the situation was to their advisee.

### *Interdependent and Independent Self-Construal*

The survey also measured individual differences in self-construal. To measure cultural self-construal, we included three items from the interdependent self-representation scale (e.g., “My happiness depends very much on the happiness of those around me”;  $\alpha=0.70$ ) and three items from independent self-representation scale (“I enjoy being unique and different from others in many ways”;  $\alpha=0.76$ ) [10]. We performed a median split on the independent self-representation scale such that half of the participants were coded as having a high independent self-construal and the remaining half were coded as having a low independent self-construal.

### *Individual Differences and Control Variables*

We used scales from the International Personality Item Pool [26] to measure extroversion ( $\alpha=0.81$ ). We also included 5 items on dispositional empathy from Davis [15] in the survey (e.g., “I often have tender, concerned feelings for people less fortunate than me”;  $\alpha=0.73$ ). Finally, we asked whether the participants had personally encountered any of the situations that their advisee discussed.

### **Conversation and Eye-Gaze Analysis**

We transcribed participants' speech to understand reasons the participants gave to support their treatment recommendations. The effectiveness and increased odds of success were given in support of risky and dehumanizing decisions. Less risky and dehumanizing decisions were supported with “wait and see” approaches. We also annotated video recordings using ELAN behavioral analysis software. Participants' head direction and eye direction were marked to understand how much time they spent looking at the other participant, the decision form, and other places in the room.

### **RESULTS**

To analyze the impact of mediating technologies on decisions and cultural self-construal, we built a multi-level regression model. We included dispositional empathy traits and participants' presence of similar experience as control

variables since low empathy ( $p = 0.05$ ) and presence of similar experiences ( $p = 0.1$ ) was correlated with higher levels of risk taking.

**Effects of Mediation on Risky Decision Making**

There were no main effects of communication medium on decision-making. Self-construal had a significant main effect ( $p = .03$ ), and the interaction between self-construal and communication medium was also significant ( $F(5, 36) = 3.2, p = .02$ , interaction  $p=.03$ ). Participants with interdependent self-construals were significantly more risky, with 100% recommending adding the risky medication when they consulted their advisee through video conferencing while only 66% recommended the risky medication face-to-face ( $F(1, 31) = 4.8, p = .04$ ) (Figure 4). Participants with independent self-construal did not make different recommendations when face-to-face versus video conferencing (Independent face-to-face = 66%, Independent Video = 47%;  $F(1, 31) = 1, p = .3$ ).

**Effects of Mediation on Dehumanizing Decision Making**

There were no main effects of communication medium or cultural self-construal on dehumanization, but the interaction effect was significant. Less than half of the participants with interdependent self-construal (44%) recommended the painful, effective treatment in face-to-face whereas most of them (91%) recommended the more dehumanizing painful, effective treatment in video conferencing ( $F(1, 34) = 5.6, p = .02$ ). Most participants with independent self-construals recommended the painful, but more effective treatment regardless of the communication medium (Independent Face-to-face = 91%, Independent Video = 84%;  $F(1, 34) = 0.13, p = .7$ ).

This difference in sensitivity to pain was not observed in dehumanization measures in the survey. While empathy strongly negatively correlated with all dehumanization measures, there were no difference in our measures of infrahumanization and mechanistic dehumanization.

**Effects of Technological Mediation on Distance**

The analysis of the survey measures suggests that the differences in the treatment choices of the participants with

interdependent self-construals were driven by differences in experiential level distance.

*Construal Level Distance*

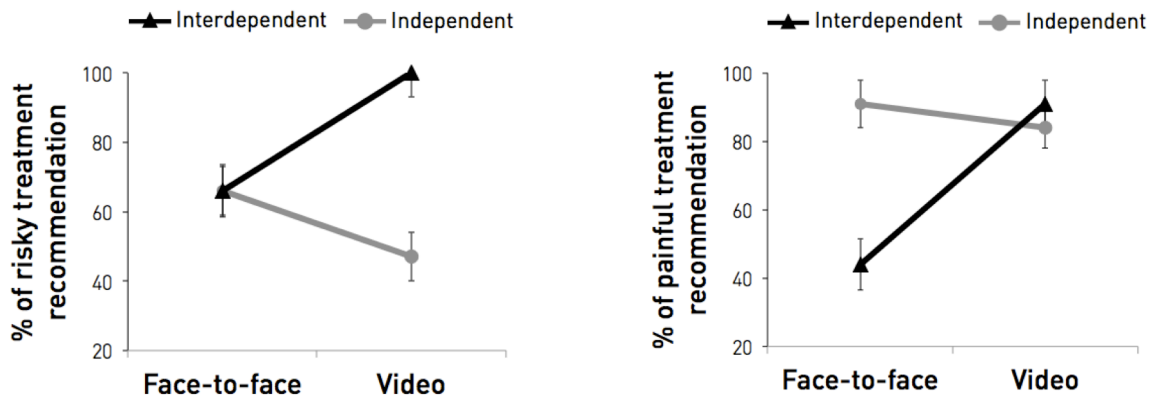
There were no effects of communication medium and cultural self-construal on the three measures of psychological distance in the survey: behavioral identification questions, predictability of behavior questions, and analysis of participant descriptions.

The analysis of perceived spatial distance questions suggests that technological mediation did not create substantial distance from the advisee. Participants in the video condition reported having equal geographical distance and feeling equally spatially close to their advisee as the participants in the face-to-face condition. As indicated in the survey responses, participants did not think that their advisee was far away as both were located in the same city. On the other hand, cultural self-construal had an impact on perceived spatial distance – participants with independent self-construal felt that there was less geographical distance (Independent  $M = 3.5, SE = .26$ ; Interdependent  $M = 4.3, SE = .3$ ; “A little space” = 3, “Some space” = 4;  $F(1, 40) = 4.79, p = .03$ ), consistent with cultural differences in relational level distance which will be reported in the later part of the paper. There was no interaction effect of the medium and culture.

*Experiential Level Distance*

There were no main effects of communication medium or cultural self-construal on participants’ engagement measures. However, there was a significant interaction between the two. Participants with interdependent self-construals reported less feelings and emotions for the advisee in video conferencing ( $M = 5, SE = .43$ ) than in face-to-face ( $M = 6.48, SE = .5; F(1, 37) = 5.51, p = .02$ ). Participants with independent self-construals reported similar feelings and emotions in both face-to-face ( $M = 6, SE = .43$ ) and videoconferencing ( $M = 6.67, SE = .41$ ).

This reduced social presence suggests that video conferencing attenuated the salience of social attributes of the decision for people with interdependent self-construals.



**Figure 4.** Participants with interdependent self-construal recommended riskier treatments in videoconferencing than face-to-face (a) and recommended less painful treatments in face-to-face than in videoconferencing (b).



While participants felt that videoconferencing ( $M = 5.76$ ,  $SE = .26$ ) was marginally more relaxed than face-to-face ( $M = 5.18$ ,  $SE = .29$ ;  $F(1, 40) = 2.4$ ,  $p = .1$ ), and participants with independent self-construal felt the interaction was more comfortable ( $M = 6.3$ ,  $SE = .24$ ) than those with interdependent self-construal ( $M = 5.5$ ,  $SE = .27$ ;  $F(1, 40) = 5.7$ ,  $p = .02$ ), there was no interaction effect between the two. There were also no effects of communication medium or cultural self-construal on perceived control.

#### *Relational Level Distance*

There were no significant effects of communication medium and no interaction effect, but cultural self-construal had a significant main effect on most relational distance measures. Participants with independent self-construals were more likely to share their email address for a follow-up (Independent  $M = 1$ ,  $SE = .06$ ; Interdependent  $M = 0.8$ ,  $SE = .07$ ;  $F(1, 40) = 5.4$ ,  $p = .03$ ) and were marginally more willing to check on their advisee in the future (Independent  $M = 5.9$ ,  $SE = .23$ ; Interdependent  $M = 5.3$ ,  $SE = .3$ ;  $F(1, 40) = 3.2$ ,  $p = .08$ ). They also identified with (Independent  $M = 4.55$ ,  $SE = .26$ ; Interdependent  $M = 3.75$ ,  $SE = .3$ ;  $F(1, 40) = 4.2$ ,  $p = .05$ ) and liked their advisee more (Independent  $M = 5.57$ ,  $SE = .2$ ; Interdependent  $M = 4.9$ ,  $SE = .23$ ;  $F(1, 37) = 5.1$ ,  $p = .03$ ) and enjoyed the interaction marginally more (Independent  $M = 5.4$ ,  $SE = .25$ ; Interdependent  $M = 4.8$ ,  $SE = 2.9$ ;  $F(1, 40) = 2.75$ ,  $p = .1$ ). This result is consistent with previous research that suggests people with interdependent culture exhibit more hostile attitudes to out-group members and strangers [28].

Relational distance, however, did not influence how accountable they felt for their advice and how much they took the perspectives of their advisee. There were no significant main and interaction effects of communication medium or cultural self-construal on perceived accountability and perspective taking.

#### *Cognitive Effort*

Another factor that might have contributed to differences in people's treatment choices may be that people put less effort in making decisions about the remote advisee, which would result in cursory decisions. However, survey responses do not support this idea. In fact, participants in the video conferencing condition ( $M = 5.91$ ,  $SE = .13$ ) reported putting significantly more effort into evaluating their advisee's situation than those in the face to face condition ( $M = 5.51$ ,  $SE = .15$ ;  $F(1, 40) = 4.15$ ,  $p = .05$ ). This difference may be due to the fact that participants had more cognitive resources free for problem solving, as the interaction was more relaxed. The problem was also perceived to be marginally more important to the advisee over video conferencing (Face  $M = 5.92$ ,  $SE = .2$ ; Video  $M = 6.4$ ,  $SE = .17$ ;  $F(1, 37) = 3.49$ ,  $p = .07$ ), which may have influenced participants in the video-conferencing condition to put more effort. However, there were no main effects of cultural self-construal on cognitive effort and no interaction with medium.

#### **Gaze Behavior**

One reason why the participants with independent self-construal might have felt less emotion from the interaction might be the lack of gaze at their advisee. On average, participants interacted with their advisee for 7.7 minutes ( $SD = 2.3$ ), looking at their advisee 55% of the time ( $SD = 17.8\%$ ) and looking at the decision form 43% of the time ( $SD = 18.3\%$ ). However, we found no significant differences in the percentage of time that participants spent looking at their advisee (either in person or on screen) or at their decision form, which suggests that the reduced engagement was not due to differences in gaze behavior.

#### **DISCUSSION**

This study examined the impact of mediating technologies and decision makers' cultural self-construals on riskiness and dehumanization in decision-making. Results suggest that participants with interdependent self-construals were influenced by technological mediation, recommending riskier and more painful treatments when video conferencing. On the other hand, participants with independent self-construals were not influenced by the medium. Our survey results suggest that experiential-level distance in mediated communication contributes to these differences. In the following section, we revisit the framework presented at the beginning of this paper to consider explanations for our results.

#### **Effects of Mediation on Experiential Level Distance**

Our results are best explained by the *salience change in decision attributes* hypothesis, with its interaction with cultural self-construal. This hypothesis suggests that the reduced bandwidth of mediating technologies influences the relative weights given to social and factual attributes of decisions, and this process is dependent on cultural self-construal.

Consistent with research on the differences in social-cognitive processing styles and types of self-construal, participants with interdependent self-construals were sensitive to the reduced bandwidth of mediating technologies. Despite spending equal amounts of time looking at their advisees and reporting equal (compared to participants with independent self-construal in the video conferencing condition) or more (compared to participants in the face-to-face condition) amounts of effort in evaluating the advisee's situation, participants with interdependent self-construals found interaction less engaging and perceived less emotion from their advisee when video conferencing. This suggests a decreased social and emotional presence of their advisee.

The attenuation of the advisee's social presence in the video conferencing condition may have influenced participants with interdependent self-construals to put more weight on factual information rather than social attributes of the decision. This reasoning supports the pattern of increased risk and dehumanization in treatment decisions made over video conferencing.

On the other hand, people with independent self-construals were not sensitive to the reduced bandwidth of mediating technologies and put equal weights on both social and factual attributes of decisions. A lack of difference in relational distance suggests that this process may be subconscious, and not the result of a judgment (e.g., a conscious dislike of the advisee.)

This result suggests that mediating technologies can influence the mindset or orientation people have when approaching and assessing situations and problems, leading people to differentially engage in social or utilitarian decision processes [6, 13, 19].

#### *No Changes in Stress & Perceived Control*

In our study, technological mediation did not influence decision makers' stress levels in interactions or perceived control of their decision target. This may be because our task involved low levels of stress and advice giving. Mediation may influence decisions differently in a higher-stress context because of associated stress-induced changes in perception and cognition. Results may vary in contexts involving physical objects, where illusion of control may be more of a factor.

#### **No Effects of Mediation on Construal Level Distance**

We did not observe any relationship between mediation and construal level distance between participants and their advisee. There are two possible explanations for this lack of relationship. First, as mentioned earlier, the vivid, interactive representation of a remote decision target in video conferencing may have overridden any changes in construal level distance, which occurs when people take an abstract view of their decision target.

Second, the location of our remote decision target may have been too close geographically to change construal level distance. Survey responses indicate that participants did not feel that they were farther away from their advisee in the video conferencing condition than in the face-to-face condition. We deliberately chose to tell our participants that the advisee was located in the same city as them in order to separate the effects of technological mediation from ones of spatial distance. On the other hand, most previous research on psychological distance has manipulated distance so that the decision target is in a distant location (e.g., a city 1,000 miles away), if not in another country. This suggests that, for a geographically distant decision target, the effects of distance may intensify as both experiential and conceptual level distance may be created. In other words, mediating technologies could lead decision makers to be more risk seeking and dehumanizing, regardless of decision makers' self-construal.

#### **No Effects of Mediation on Relational Level Distance**

In our study, mediating technologies did not increase relational distance between participants and the advisee. This is seemingly contrary to previous research where video conferencing led to poorer impressions of another party [23,

55]. We believe this discrepancy could be due to differences in experimental tasks.

Tasks in previous research on impression formation were primarily social – either getting to know each other [55] or playing a game without performance evaluation [23] – whereas the task in our study was more utilitarian and goal-directed. This suggests that in decision tasks where social interaction plays a greater role, differences could be accentuated, depending on the medium through which the decision is made.

#### **LIMITATIONS**

Like any study, the present study has several limitations. This was a laboratory study with a confederate and structured conversations. This format allowed us to study people's decision making in a systematic way with decision tasks used in previous research; however, further research in the real world, either with field studies or archival data is needed to examine whether the same bias occurs when people can converse freely. We also had a small set of participants, and the main effect of media may be present with a larger set of participants. Further research with a large-scale experiment or archival data analysis will shed more insights. Additionally, follow-up research should examine the effects of expertise. Expert knowledge and training may influence decision makers to behave differently, even if some experts like physicians are subject to cognitive and psychological biases in making treatment decisions [74]. Because we used a controlled experiment we investigated a limited set of variables. Our study only used one operationalization of risky and dehumanizing treatments, and did not explicitly evaluate the impact of other individual differences such as gender [17], race [3], or dyad demographics [80] that could have influenced the results. The influence of these and other individual differences are worth exploring in future research.

#### **IMPLICATIONS**

This study is one of the first that investigates how mediation influences decision making at a distance. It opens up new areas of research in CSCW and HCI, and offers implications for theory and future research.

#### **Implications for Theory**

Our study demonstrates that mediating technologies can influence people to make riskier and more dehumanizing decisions because they change the salience of decision attributes. This is particularly true for decision makers with interdependent self-construals. This finding contributes to the literature on CSCW, CMC, and intercultural studies.

The present study offers opportunities to expand existing theories of trust, awareness and collaboration in CSCW and CMC to new tasks and contexts. In our task, the relationship between two parties—decision maker and decision target—was asymmetric, involving different roles, statuses and levels of power. The majority of collaboration studies in CSCW investigate symmetric relationships. Our

results suggest that mediation may influence well-studied aspects of interaction in unexpected ways during asymmetric relationships. In particular decision makers may take social information into account less at a distance, and this may be true particularly for individuals with interdependent self-construals. As asymmetric relationships and interactions become more common we will need to update our existing theories of social outcomes such as trust development or awareness at a distance.

Our study offers initial evidence that mediating technologies may influence the mindset, schema or orientation that people bring to the table when making decisions. The mindset concept has been applied in CSCW in a limited way. Previous research has shown that mindsets or schemas have profound impacts on how people behave and interpret situations [1, 19].

Finally, this study provides evidence that culture can significantly influence the nature and effectiveness of mediated decision-making, adding to the growing literature on intercultural studies in CSCW and CMC. Additionally, our results highlight the importance of examining individual-level cultural differences, in addition to more commonly studied nationality-based cultural differences. Individual-level cultural differences offer a complementary analytic lens as previous research suggests that individual and nationality-based cultural differences are not always correlated.

#### **Future Research Directions**

Further research can untangle what aspects of reduced social cues influence the sensitivity of people with interdependent self-construal in their perception of social presence. Investigating other mediating technologies with varying communication bandwidth – such as text, voice, video, telepresence robots, and VR glass – can also help us unpack the impact of technology on risky and dehumanizing decision-making.

More broadly, the present research points to a critical, yet unexplored area of mediated decision-making on remote decision targets. Our study covers just one dimension, one task, and one stakeholder in this area. There are many other important decision dimensions such as liability, accountability, ethics, morality, as well as the effects of biases documented in the decision science and psychology literature. In addition to making decisions for others, people also enact or make judgments about remote objects, persons, and events through mediating technologies. Empirically investigating how mediation changes (or does not change) these decisions and actions is a very important line of research. We believe the frameworks explained in this paper can help devise hypotheses for these areas.

Another important line of research is the design of interventions that optimize mediated decision contexts for various problems and situations. For example, how can we design novel telepresence systems to elicit the right

combination of weights on social versus factual attributes to yield an optimal decision outcome? Simply zooming in on the face of a remote person could increase their social presence for people with interdependent self-construals. On the other hand, presenting information about the decision (such as a medical chart or interaction history) next to a video conferencing screen may reinforce people to put more weight on factual information. Systematically investigating this design space is an important area for future research.

#### **CONCLUSIONS**

Mediating technologies support sharing and collaboration in many important sectors such as business, healthcare, policy, defense, education and manufacturing, removing decision makers from the person and event that they are making decisions about. Drawing from the literature on social psychology, decision-making, and CSCW, we provide an early theoretical framework that explains how distance created by mediating technologies can influence decision makers to make riskier or more dehumanizing decisions on remote decision targets. To test our model, we conducted a laboratory experiment where participants recommended risky and dehumanizing treatment decisions to an advisee, either face-to-face or via video conferencing. Results suggest that participants with interdependent self-construals made riskier and more painful treatment decisions when videoconferencing. They were less engaged and felt less emotion from their advisee, which may have influenced them to put more weight on factual, probability-based information while video conferencing. Our results begin to illuminate a critical, but unexplored research area of mediated decision-making. We hope that this research can inform future designs in order to improve decisions and decision outcomes.

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#### **REFERENCES**

1. Abelson, R. P. (1981). Psychological status of the script concept. *American Psychologist*, 36(7), 715.
2. Ackerman, M. S. (1998). Augmenting organizational memory: A field study of answer garden. *ACM Transactions on Information Systems (TOIS)*, 16(3), 203–224.
3. Ainscough, T. L., & Motley, C. M. (2000). Will you help me please? The effects of race, gender and manner of dress on retail service. *Marketing Letters*, 11(2), 129–136.
4. Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology*, 63(4), 596–612.

5. Batson, C. D., Polycarpou, M. P., Harmon-Jones, E., Imhoff, H. J., Mitchener, E. C., Bednar, L. L., Klein, T. R., & Highberger, L. (1997). Empathy and attitudes: Can feeling for a member of a stigmatized group improve feelings toward the group. *Journal of Personality and Social Psychology*, 72(1), 105–118.
6. Bhanji, J. P., & Beer, J. S. (2012). Taking a different perspective: Mindset influences neural regions that represent value and choice. *Social Cognitive and Affective Neuroscience*, 7(7), 782-793.
7. Blais, A., & Weber, E. U. (2006). A domain-specific risk-taking (DOSPERT) scale for adult populations. *Judgment and Decision Making*, 1(1), 33–47.
8. Bos, N., Olson, J., Gergle, D., Olson, G., & Wright, Z. (2002). Effects of four computer-mediated communications channels on trust development. In *Proc. of CHI'02*, 135–140.
9. Bradner, E., & Mark, G. (2002). Why distance matters: Effects on cooperation, persuasion and deception. In *Proc. of CSCW'02*, 226–235.
10. Brewer, M. B., & Chen, Y. R. (2007). Where (who) are collectives in collectivism? Toward conceptual clarification of individualism and collectivism. *Psychological Review*, 114(1), 133-151.
11. Cialdini, R. B., Brown, S. L., Lewis, B. P., Luce, C., & Neuberg, S. L. (1997). Reinterpreting the empathy–altruism relationship: When one into one equals oneness. *Journal of Personality and Social Psychology*, 73(3), 481-494.
12. Clark, H. H., & Brennan, S. E. (1991). Grounding in communication. *Perspectives on socially shared cognition*, 13, 127-149.
13. Costa, A., Foucart, A., Hayakawa, S., Aparici, M., Apestequia, J., Heafner, J., & Keysar, B. (2014). Your morals depend on language. *PLoS one*, 9(4), e94842.
14. Costello, K., & Hodson, G. (2010). Exploring the roots of dehumanization: The role of animal–human similarity in promoting immigrant humanization. *Group Processes & Intergroup Relations*, 13(1), 3-22.
15. Cramton, C. D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science*, 12(3), 346–371.
16. Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, 44(1), 113–126.
17. Dennis, A. R., Kinney, S. T., & Hung, Y. T. C. (1999). Gender differences in the effects of media richness. *Small Group Research*, 30(4), 405-437.
18. Dourish, P., & Bellotti, V. (1992). Awareness and coordination in shared workspaces. In *Proc. of CSCW'92*, 107–114.
19. Dweck, C. (2006). *Mindset: The new psychology of success*. Random House LLC.
20. Ebert, J., & Meyvis, T. (2014). Reading fictional stories and winning delayed prizes: The surprising emotional impact of distant events. Social Science Research Network, ID No. 1654673. <http://papers.ssrn.com/abstract=1654673>
21. Federman, M. (2006). On the media effects of immigration and refugee board hearings via videoconference. *Journal of Refugee Studies*, 19(4), 433–452.
22. Fujita, K., Henderson, M. D., Eng, J., Trope, Y., & Liberman, N. (2006). Spatial distance and mental construal of social events. *Psychological Science*, 17(4), 278–282.
23. Fullwood, C. (2007). The effect of mediation on impression formation: A comparison of face-to-face and video-mediated conditions. *Applied Ergonomics*, 38(3), 267–273.
24. Fussell, S. R., Setlock, L. D., & Kraut, R. E. (2003). Effects of head-mounted and scene-oriented video systems on remote collaboration on physical tasks. In *Proc. Of CHI'03*, 513-520.
25. Goh, L. Y. Q., Phillips, J. G., & Blaszczynski, A. (2011). Computer-mediated communication and risk-taking behaviour. *Computers in Human Behavior*, 27(5), 1794–1799.
26. Goldberg, L. R., Johnson, J. A., Eber, H. W., Hogan, R., Ashton, M. C., Cloninger, C. R., & Gough, H. G. (2006). The international personality item pool and the future of public-domain personality measures. *Journal of Research in Personality*, 40(1), 84–96.
27. Grudin, J. (1988). Why CSCW applications fail: Problems in the design and evaluation of organizational interfaces. In *Proc. of CSCW'88*, 85-93.
28. Gudykunst, W. B., Yoon, Y., & Nishida, T. (1987). The influence of individualism-collectivism on perceptions of communication in ingroup and outgroup relationships. *Communication Monographs*, 54(3), 295–306.
29. Gutwin, C., & Greenberg, S. (2002). A descriptive framework of workspace awareness for real-time groupware. *Computer Supported Cooperative Work (CSCW)*, 11(3-4), 411-446.
30. Haque, O. S., & Waytz, A. (2012). Dehumanization in medicine causes, solutions, and functions. *Perspectives on Psychological Science*, 7(2), 176–186.

31. Haslam, N. (2006). Dehumanization: An integrative review. *Personality and Social Psychology Review*, *10*(3), 252–264.
32. Haslam, N., Bain, P., Douge, L., Lee, M., & Bastian, B. (2005). More human than you: Attributing humanness to self and others. *Journal of Personality and Social Psychology*, *89*(6), 937–950.
33. Google Inc. June 4, 2014. Helpouts by Google. <https://helpouts.google.com/>.
34. Henderson, M. D., Fujita, K., Trope, Y., & Liberman, N. (2006). Transcending the “here”: The effect of spatial distance on social judgment. *Journal of Personality and Social Psychology*, *91*(5), 845–856.
35. Henderson, M. D., & Wakslak, C. J. (2010). Psychological distance and priming: When do semantic primes impact social evaluations? *Personality and Social Psychology Bulletin*, *36*(7) 975–985.
36. Hersh, W. R., Hickam, D. H., Severance, S. M., Dana, T. L., Krages, K. P., & Helfand, M. (2006). Diagnosis, access and outcomes: Update of a systematic review of telemedicine services. *Journal of Telemedicine and Telecare*, *12*(s2), 3–31.
37. Hsee, C. K., & Weber, E. U. (1997). A fundamental prediction error: Self–others discrepancies in risk preference. *Journal of Experimental Psychology: General*, *126*(1), 45–53.
38. Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, 263–291.
39. Kane, B., & Luz, S. (2009). Assimilating information and offering a medical opinion in remote and co-located meetings. In *Proc. of CBMS'09*, 1-6.
40. Kiesler, S., Siegel, J., & McGuire, T. W. (1984). Social psychological aspects of computer-mediated communication. *American Psychologist*, *39*(10), 1123–1134.
41. Kray, L. J. (2000). Contingent weighting in self-other decision making. *Organizational Behavior and Human Decision Processes*, *83*(1), 82–106.
42. Lammers, J., & Stapel, D. A. (2011). Power increases dehumanization. *Group Processes & Intergroup Relations*, *14*(1), 113–126.
43. Langer, E. J. (1975). The illusion of control. *Journal of Personality and Social Psychology*, *32*(2), 311–328.
44. Lee, M. K., & Takayama, L. (2011, May). Now, I have a body: Uses and social norms for mobile remote presence in the workplace. In *Proc. of CHI'11*, 33-42.
45. Liberman, N., Trope, Y., & Stephan, E. (2007). Psychological distance. In A. W. Kruglanski & E. T. Higgins (Eds.), *Social Psychology: Handbook of Basic Principles* (353-385). Guilford Press, New York, NY
46. Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, *127*(2), 267–286.
47. Lombard, M., Ditton, T. B., Crane, D., Davis, B., Gil-Egui, G., Horvath, K., Rossman, J., Park, S. (2000). Measuring presence: A literature-based approach to the development of a standardized paper-and-pencil instrument. In *The third international workshop on presence*. Delft, The Netherlands.
48. Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, *98*(2), 224-253.
49. McGuire, T. W., Kiesler, S., & Siegel, J. (1987). Group and computer-mediated discussion effects in risk decision making. *Journal of Personality and Social Psychology*, *52*(5), 917–930.
50. Milgram, S. (1965). Some conditions of obedience and disobedience to authority. *Human Relations*, *18*(1), 57–76.
51. Nakanishi, H., Kato, K., & Ishiguro, H. (2011). Zoom cameras and movable displays enhance social telepresence. In *Proc. CHI'11*, 63–72.
52. Nardi, B. A., Whittaker, S., & Bradner, E. (n.d.). Interaction and outeraction: Instant messaging in action. In *Proc. CSCW'00*, 79-88.
53. Nisan, M., & Minkowich, A. (1973). The effect of expected temporal distance on risk taking. *Journal of Personality and Social Psychology*, *25*(3) 375–380.
54. O’Conaill, B., Whittaker, S., & Wilbur, S. (1993). Conversations over video conferences: An evaluation of the spoken aspects of video-mediated communication. *Human-Computer Interaction*, *8*(1), 389–428.
55. Okdie, B. M., Guadagno, R. E., Bernieri, F. J., Geers, A. L., & McLaren-Vesotski, A. R. (2011). Getting to know you: Face-to-face versus online interactions. *Computers in Human Behavior*, *27*(1), 153–159.
56. Olson, G. M., & Olson, J. S. (2000). Distance matters. *Human-Computer Interaction*, *15*(1), 139–178.
57. Patterson, M. (1991). A functional approach to nonverbal exchange. In R. S. Feldman (Ed.), *Fundamentals of Nonverbal Behavior* (458-513). Location: Cambridge University Press, Cambridge, MA.
58. Pennington, G. L., & Roese, N. J. (2003). Regulatory focus and temporal distance. *Journal of Experimental Social Psychology*, *39*(6), 563–576.
59. Polman, E. (2012). Effects of self–other decision making on regulatory focus and choice overload.

- Journal of Personality and Social Psychology*, 102(5), 980–993.
60. Porcelli, A. J., & Delgado, M. R. (2009). Acute stress modulates risk taking in financial decision making. *Psychological Science*, 20(3), 278–283.
61. Psozka, J., Lewis, S. A., & King, D. (1998). Effects of field of view on judgments of self-location: Distortions in distance estimations even when the image geometry exactly fits the field of view. *Presence: Teleoperators and Virtual Environments*, 7(4), 352–369.
62. Redelmeier, D. A., & Tversky, A. (1990). Discrepancy between medical decisions for individual patients and for groups. *New England Journal of Medicine*, 322(16), 1162–1164.
63. Reynolds, D. B., Joseph, J., & Sherwood, R. (2011). Risky shift versus cautious shift: Determining differences in risk taking between private and public management decision-making. *Journal of Business & Economics Research*, 7(1), 63–78.
64. Rim, S., Uleman, J. S., & Trope, Y. (2009). Spontaneous trait inference and construal level theory: Psychological distance increases nonconscious trait thinking. *Journal of Experimental Social Psychology*, 45(5), 1088–1097.
65. Royakkers, L., & Van Est, R. (2010). The cubicle warrior: The marionette of digitalized warfare. *Ethics and Information Technology*, 12(3), 289–296.
66. Sagristano, M. D., Trope, Y., & Liberman, N. (2002). Time-dependent gambling: Odds now, money later. *Journal of Experimental Psychology: General*, 131(2), 364.
67. Why are search-and-rescue drones grounded? <http://spectrum.ieee.org/automaton/robotics/aerial-robots/search-and-rescue-drones-grounded>.
68. Setlock, L. D., Fussell, S. R., & Neuwirth, C. (2004). Taking it out of context: Collaborating within and across cultures in face-to-face settings and via instant messaging. In *Proc. CSCW'04*, 604–613.
69. Stone, E. R., Yates, A. J., & Caruthers, A. S. (2002). Risk taking in decision making for others versus the self. *Journal of Applied Social Psychology*, 32(9), 1797–1824.
70. Straus, S. G., Miles, J. A., & Levesque, L. L. (2001). The effects of videoconference, telephone, and face-to-face media on interviewer and applicant judgments in employment interviews. *Journal of Management*, 27(3), 363–381.
71. Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology*, 29(1), 24–54.
72. Tidwell, L. C., & Walther, J. B. (2002). Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluations: Getting to know one another a bit at a time. *Human Communication Research*, 28(3), 317–348.
73. Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, 117(2), 440–463.
74. Ubel, P. A., Angott, A. M., & Zikmund-Fisher, B. J. (2011). Physicians recommend different treatments for patients than they would choose for themselves. *Archives of Internal Medicine*, 171(7), 630–634.
75. Vallacher, R. R., & Wegner, D. M. (1989). Levels of personal agency: Individual variation in action identification. *Journal of Personality and Social Psychology*, 57(4), 660.
76. Wallach, M. A., Kogan, N., & Bem, D. J. (1964). Diffusion of responsibility and level of risk taking in groups. *The Journal of Abnormal and Social Psychology*, 68(3), 263–274.
77. Wang, H. C., Fussell, S. F., & Setlock, L. D. (2009). Cultural difference and adaptation of communication styles in computer-mediated group brainstorming. In *Proc. of CHI'09*, 669–678.
78. Williams, E. (1977). Experimental comparisons of face-to-face and mediated communication: A review. *Psychological Bulletin*, 84(5), 963–976.
79. Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence: Teleoperators and Virtual Environments*, 7(3), 225–240.
80. Zambaka, C., Goolkasian, P., & Hodges, L. (2006). Can a virtual cat persuade you? The role of gender and realism in speaker persuasiveness. In *Proc. of CHI'06*, 1153–1162.
81. Zikmund-Fisher, B. J., Sarr, B., Fagerlin, A., & Ubel, P. A. (2006). A matter of perspective: Choosing for others differs from choosing for yourself in making treatment decisions. *Journal of General Internal Medicine*, 21(6), 618–622.