AGENT OR AVATAR? USING VIRTUAL CONFEDERATES IN CONFLICT MANAGEMENT RESEARCH

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ABSTRACT

Virtual confederates–i.e., three-dimensional virtual characters that look and act like humans–are used in a growing number of empirical studies, especially in the behavioral and medical sciences. The growing popularity of this research method stems from increased experimental control, ease of replication, facilitated access to broader samples and lower costs. In this paper we investigate the plausibility of virtual confederates for conducting research in conflict management. We posit that generality studies that compare findings with human and virtual confederates are required to determine the merits of virtual confederates. To accomplish this we present two novel studies where people engaged in a social dilemma (Experiment 1) and in a negotiation (Experiment 2) with virtual confederates that expressed emotions in their faces. Experiment 1 showed that people cooperated more with a virtual confederate that showed cooperative displays (e.g., smile in mutual cooperation) than one that showed competitive displays (e.g., smile after exploiting the participant). Experiment 2 showed that people conceded more to an angry virtual confederate than to a neutral one. These results comport with previous findings from similar studies with humans thus supporting the viability of virtual confederates as a research tool. Our results also reveal that virtual confederates are more successful in achieving social influence when participants are convinced that humans control the virtual images (i.e., the confederate is an avatar), rather than computer programs (i.e., the confederate is an agent). We discuss implications for research in conflict management.

Keywords:

Virtual Confederates; Emotion; Decision Making

Agent or Avatar? Using Virtual Confederates in Conflict Management Research

Virtual confederates are digital representations of humans (Gratch et al., 2002). They have three-dimensional bodies and can communicate, like humans, using multiple modalities such as the face, voice and gesture. Virtual confederates have recently been given considerable attention for their potential as a research tool, especially in the social (Blascovich et al., 2002) and medical (Bohil, Alicea, & Biocca, 2011) sciences. In the social sciences, virtual confederates have been used to study nonverbal behavior (Bente, Krämer, Petersen, & de Ruiter, 2001), pedagogy (Blascovich & Beall, 2010), proxemics (Bailenson, Blascovich, Beall, & Loomis, 2001), rapport (Gratch et al., 2006), attitude change (Guadagno, Blascovich, Bailenson, & McCall, 2007), social anxiety (Garau, Slater, Pertaub, & Razzaque, 2005), social facilitation and inhibition (Park & Catrambone, 2007) and stereotyping and prejudice (Dotsch & Wigboldus, 2008). In the medical sciences, virtual confederates have been used for medical training (Johnsen et al., 2006; Kenny, Parsons, Gratch, & Rizzo, 2008) and to treat public speaking anxiety (Harris, Kemmerling, & North, 2002), social phobia (Roy et al., 2003), combat-related posttraumatic stress disorder (Rizzo et al., 2009) and attention deficit and hyperactivity disorder (Parsons, Bowerly, Buckwalter, & Rizzo, 2007). Virtual worlds, including virtual confederates, have also been argued to be useful for the study of economic science (Bainbridge, 2007; Castronova, 2005). In contrast, the management sciences have been lagging in adopting virtual confederates (Fox, Arena, & Bailenson, 2009). This paper addresses this opportunity and discusses the advantages (and disadvantages) of using virtual confederates for conducting research in conflict management and presents two novel experiments that serve as concrete examples of how this technology can be used to study decision making in social dilemmas and negotiation.

There are several reasons virtual confederates have been gaining popularity as a research tool, especially when compared to the more traditional method of using human confederates.

Social psychologists (Blascovich et al., 2002; Loomis, Blascovich, & Beall, 1999) have traditionally emphasized three advantages, which are also relevant to management research: experimental control, ease of replication and broader samples. Virtual confederates support precise definition of the manipulation (e.g., nonverbal behavior) while maintaining all other factors constant (e.g., human confederates can introduce inadvertent variation in nonverbal behavior). Moreover, since virtual confederates can be made to look and act like real humans, this added experimental control can be achieved without comprising mundane realism (and, thus, the generalizability of the results). Virtual confederates also facilitate replication of the experimental treatment since everything is recorded in the program that defines how the virtual confederate looks and acts, which can then be shared with other researchers. Because virtual confederates can run in online environments, it also becomes easier to recruit a broader and likely more representative sample than what is available through local student pools. Other advantages include: lower costs, since virtual confederates work for free and don't require sleep; avoiding ethical concerns, as was the case, for instance, in the virtual replication of Milgram's famous experiments (Slater et al., 2006); and, easy manipulation of physical attributes including age, gender or race.

Virtual confederates can be distinguished by whether they are controlled by humans, in which case we refer to them as *avatars,* or by computer algorithms, in which case we refer to them as *agents*. There are two contrasting theoretical frameworks that predict how agents and avatars impact humans. The "computers are social actors" theory (Nass, Steuer, & Tauber, 1994; Reeves & Nass, 1996) argues that as long as machines displays social cues (e.g., nonverbal behavior) people will treat them in a fundamentally social manner. The argument is that people "mindlessly" treat computers that exhibit social traits like other people as a way to conserve cognitive effort and maximize response efficiency (Nass & Moon, 2000). According to this

theory, thus, agents and avatars should impact humans in the same manner. In contrast, Blascovich and colleagues (Blascovich et al., 2002; Blascovich & McCall, 2013) argue that, everything else being equal, social influence will be greater the higher the perceived "agency" of the virtual confederate. Agency refers to people's theories of mind regarding these virtual entities, i.e., the perceived sentience (e.g., attributions of consciousness, free will). According to this theory, thus, the impact of agents and avatars should be different. Indeed, the emerging field of neuroeconomics has been showing consistent evidence that people reach different decisions with computers than with humans in the same social decision making tasks, for the same financial stakes; moreover, people show higher activation of brain regions usually associated with emotion and mentalizing (i.e., inferring of the other's beliefs, desires and intentions) when engaging with humans in comparison to computers (Gallagher, Jack, Roepstorff, & Frith, 2002; Kircher et al., 2009; McCabe, Houser, Ryan, Smith, & Trouard, 2001; Rilling et al., 2002; Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003, van't Wout, Kahn, Sanfey, & Aleman, 2006). These findings, thus, suggest we should expect the social impact of virtual confederates to be greater when people believe the confederate to be driven by a human as opposed to a computer program.

In this paper we demonstrate the viability of virtual confederates for conducting research in the management sciences by presenting two novel experiments that study the impact of emotion expressions on people's decision making in a social dilemma and in negotiation. Indeed, complementing research on the intrapersonal effects of emotion (e.g., Blanchette & Richards, 2010), recent studies show that people's emotion displays play a critical role in social regulation (e.g., Frijda & Mesquita, 1994) and can impact other's decision making (de Melo, Carnevale, Read, & Gratch, in press; Van Kleef, De Dreu, & Manstead, 2010). Specifically, emotion expressions have been theoretically argued to influence cooperation in social dilemmas (Frank,

1988; Nesse, 1990; Trivers, 1971) and empirically shown to impact concession-making in negotiation (Van Kleef, De Dreu, & Manstead, 2004, 2010). We, thus, had participants engage in a social dilemma (Experiment 1) and in negotiation (Experiment 2) with virtual confederates that displayed emotion. Our general expectation was that the social effects of virtual confederates' emotion displays on people's decision making would be similar to those expected or reported in the literature on human-human interaction.

Additionally, we further study the impact of agency–i.e., the belief that the virtual confederate is being driven by either a human or a computer program–on the social effects of emotion expressions on people's decision making. To accomplish this we manipulated, in both experiments, participants' beliefs about whether they were engaging with an agent or an avatar. Following Blascovich et al.'s social influence theory and the aforementioned findings in the neuroeconomics literature, our expectation was that the effect sizes would be larger with avatars than with agents.

EXPERIMENT 1

In this experiment participants engaged in a social dilemma with emotional virtual confederates. Social dilemmas are situations where an individual gets a higher payoff by defecting rather than cooperating, regardless of what others in society do, yet all individuals end up receiving a lower payoff if all defect than if all cooperate (Dawes 1980). In this experiment, participants engaged in the iterated prisoner's dilemma, a social dilemma commonly used to study emergence of cooperation. The prisoner's dilemma is a two-player game where the payoffs of each player depend on the simultaneous choice of both players. The payoff matrix for this task is shown in Table 1. The task represents a dilemma because the rational (i.e., utility-maximizing) choice for both players is to defect, which results in an outcome (mutual defection) that is worse

than mutual cooperation. Participants played 20 rounds of this task. Moreover, following the approach by Kiesler, Waters and Sproull (1996), the task was recast as an investment game.

Insert Table 1 about here

Researchers have argued that emotion expressions can signal others that one is willing to cooperate in a social exchange and people look for such cues before making a decision (Frank, 1988; Nesse, 1990; Trivers, 1971). Similarly, emotion displays can also signal that one has competitive intentions (Matsumoto & Willingham, 2006; Matsumoto, Haan, Gary, Theodorou, & Cooke-Carney, 1986). Therefore, in this experiment participants engaged with virtual confederates that, despite always following the same strategy to choose their actions, displayed emotion that either reflected cooperative or competitive goals. The *expressively cooperative* confederate (Table 2, top) displayed joy in mutual cooperation and regret when it exploited the participant. Acknowledging that the meaning of emotion displays can vary according to context (Aviezer et al., 2008; Hareli & Hess, 2010; Lanzetta & Englis, 1989; Van Kleef et al., 2010), the *expressively competitive* confederate (Table 2, bottom) displayed joy when it exploited the participant and regret in mutual cooperation. The rationale for the cooperative confederate is that joy after mutual cooperation signals an intention to cooperate, whereas regret after exploitation acknowledges the transgression; the rationale for the competitive confederate is that joy after exploitation signals an intention to compete, whereas regret after mutual cooperation signals regret for missing the chance to exploit the participant.

Insert Table 2 about here

Participants engaged with either an agent or an avatar. Agents were always referred to as "computer agents" and were described to the participants as "a computer program that was designed to make decisions just like other people". Avatars were described as "the players' visual representation in the game". Participants were asked to choose an avatar for themselves, of the same gender, and were informed that their avatar "would be visible to the other player" and that the they "would be able to control aspects of the avatar's behavior which would be visible to the other player, and vice-versa". In reality, participants always played with a computer program that followed the same strategy: tit-for-tat, starting with a defection. To make this deception believable, we further implemented a server that matched pairs of participants that were supposed to engage with other participants; participants would then proceed in lockstep throughout the task but the responses they would see always followed the tit-for-tat strategy. Participants were also made to believe they were engaging with a participant of the same gender when, in fact, this might have not been the case. Lastly, participants were told that the identities of other participants would be concealed and the software always referred to the human counterpart as "anonymous". Following our discussion in the Introduction, our expectation was:

> ***Hypothesis 1.*** *People will cooperate more with the expressively cooperative than the expressively competitive confederate but, this effect will be stronger with avatars.*

Design

The experiment followed a 2 × 2 factorial design: *Emotion Displays* (Cooperative vs. Competitive) × *Agency* (Agent vs. Avatar). We used the same emotion facial displays that were validated and used by de Melo, Carnevale, Read and Gratch (in press). These facial displays were animated using a muscular model of the face that replicates prototypical emotional expressions (de Melo & Paiva, 2006) with blushing and wrinkles (de Melo, Kenny, & Gratch, 2010). One male and one female avatars are shown in Figure 1.

Insert Figure 1 about here

Our main dependent variable was cooperation rate, i.e., the number of times participants cooperated over all rounds. To validate that participants were correctly perceiving some counterparts as agents and others as humans we asked them, after the task was completed, to rate the counterpart according to the following pairs of adjectives on a 7-point scale (e.g., for Fake-Natural, 1 corresponded to Fake and 7 to Natural): Robot like-Human like; Fake-Natural; Unconscious-Conscious; Artificial-Lifelike; Stagnant-Lively; Mechanical-Organic; Inert-Interactive; Apathetic-Responsive; and, Computer-Human.

One-hundred and twenty six participants were recruited at the USC Marshall School of Business. This resulted in approximately 30 participants per condition. Regarding gender, 69.7% were males. Age distribution was as follows: 21 years and Under, 70.6%; 22 to 34 years, 29.4%. Most participants were undergraduate students (95.8%) majoring in Business-related courses and with citizenship from the United States (81.5%). The incentive to participate followed standard practice in experimental economics (Hertwig & Ortmann, 2001): first, participants were given school credit for their participation; second, with respect to their goal in the task, participants were instructed to earn as many points as possible, as the total amount of points would increase their chances of winning a lottery for $100. Upon completion of the experiment participants were verbally debriefed about the deception pertaining to the avatar conditions.

Results

Participants that did not experience both joy and regret with the counterpart[1]–i.e., our experimental manipulation–were excluded from analysis (though keeping them would lead to the same pattern of results). After exclusion, 84 participants remained for analysis.

Regarding the agency manipulation check, the nine adjective classification questions were highly correlated (Cronbach α = .972) and, thus, were averaged into a single measure we called anthropomorphism. We then ran an Emotion Displays × Agency ANOVA which revealed no main effect of Emotion Displays, $F(1, 80) = 1.13$, $p = .291$, but, as expected, confirmed a main effect of Agency, $F(1, 80) = 4.48$, $p = .037$, partial $\eta^2 = .053$: people perceived the human counterparts ($M = 4.87$, $SD = 1.54$) to be more anthropomorphic than the agent counterparts ($M = 4.12$, $SD = 1.64$). The Emotion Displays × Agency interaction was not significant, $F(1, 80) = .541$, $p = .464$.

Regarding cooperation rate, the means and standard errors are shown in Figure 2. To test our Hypothesis 1, we split the data across Agency and ran independent *t* tests to compare cooperation rates between cooperative and competitive virtual humans. This analysis revealed that, for agents, people cooperated more with cooperative ($M = .64$, $SD = .26$) than competitive agents ($M = .54$, $SD = .30$) but this result did not reach significance, $t(37) = 1.12$, $p = .269$, $r = .181$. For avatars, people cooperated more with cooperative ($M = .73$, $SD = .26$) than competitive avatars ($M = .55$, $SD = .28$) and this result was significant, $t(43) = 2.31$, $p = .026$, $r = .332$.

[1] Notice this paradigm did not guarantee participants would experience all outcomes in the prisoner's dilemma task.

Insert Figure 2 about here

Discussion

The results showed that participants' decision making was influenced by virtual confederates' emotion expressions, with people cooperating more with cooperative than competitive confederates. This finding is well in line with expectations from the human-human interaction literature (Frank, 1988; Nesse, 1990; Trivers, 1971) and, therefore, validates the plausibility of virtual confederates as a research tool for studying the social effects of emotion expressions on decision making. In support of Hypothesis 1, the results confirmed that perceptions of agency matter and that, despite always cooperating more with cooperative confederates, the effects of emotion expressions were only significant and much larger (r = .332 vs. r = .181) with confederates that were perceived to be controlled by humans.

EXPERIMENT 2

In this experiment participants engaged in negotiation, a domain inherently different from social dilemmas (Pruitt & Kimmel, 1977), with emotional virtual confederates. According to Pruitt and Carnevale (1993), negotiation is "a discussion among two or more parties aimed at reaching agreement when there is a perceived divergence of interest". Recently, researchers began looking at the impact of emotion displays on negotiation outcome (e.g., Van Kleef et al., 2010). One finding that is relevant to this work is that people concede more when facing an angry than a neutral counterpart (Sinaceur & Tiedens, 2006; Van Kleef et al., 2004). The argument is that people infer the angry counterpart to have high aspirations and, so as to avoid costly impasse, are forced to lower their demand. In this experiment we replicate Van Kleef et al.'s (2004)

experiment with virtual confederates that, instead of expressing emotion through text, display emotion in their faces.

Once again, we manipulated whether confederates were perceived to be avatars or agents. As in Experiment 1, the agent was always referred to as "computer agent" and the avatar was always described as "anonymous". In reality, participants always engaged with a computer program that followed a scripted strategy. A server was also used to implement the deception when participants were supposed to engage in negotiation with other participants. In this case, the server would synchronize the participants at the beginning of the task and, from that point onward, a scripted strategy would be played. Participants were also made to believe they were engaging with another participant of the same gender, even though that might have not been the case. Our hypothesis was that:

> ***Hypothesis 2.*** *People will concede more to an angry confederate than to a neutral one, but this effect will be stronger with avatars.*

Design

Participants engaged in a multi-issue negotiation task (Van Kleef et al., 2004) where they play the role of a seller of a phone company whose goal was to negotiate three issues: the price, the warranty period and the duration of the service contract of the phones. Each issue had 9 levels, being the highest level the most valuable for the participant, and the lowest level the least valuable. Level 1 on price ($110) yielded 0 points and level 9 ($150) yielded 400 points (i.e., each level corresponded to a 50 point increment). Level 1 on warranty (9 months) yielded 0 points and level 9 (1 month) yielded 120 points (i.e., each level corresponded to a 15 point increment). For duration of service contract, level 1 (9 months) yielded 0 points, and level 9 (1 month) yielded 240 points (i.e., each level corresponded to a 30 point increment). It was pointed out to the participant that the best deal was, thus, 9-9-9 for a total outcome of 760 points (400 +

120 + 240). The participant was also told that the counterpart had a different payoff table which was not known. The negotiation would proceed according to the alternating offers protocol, being the counterpart the first to offer, and until someone accepted the other's offer or "time expired"; in reality, if no agreement had been reached, the task would always terminate in round 6.

The experiment followed a 2 × 2 factorial design: *Emotion Displays* (Neutral vs. Anger) × *Agency* (Agent vs. Avatar). We used the same emotion facial displays that were validated and used in de Melo, Carnevale, Read, and Gratch's (in press) experiments. One male and one female avatars are shown in Figure 3. Emotion displays would be shown after the participant had made an offer in rounds 1, 3 and 5. Regarding strategy, independently of the agency condition, participants always saw the same fixed sequence of offers: 2-3-2, 2-3-3, 2-4-3, 3-4-3, 3-4-4, and 4-4-4. This pattern had been argued before to strike a good balance between cooperation and competition (Van Kleef et al. 2004).

Insert Figure 3 about here

Regarding measures, our main dependent variable was *demand difference* between demand level in round 1 (initial offer) and round 6 (final offer). To calculate demand level, the number of points demanded in each round was summed across all issues of price, warranty and service. Demand difference was then calculated by subtracting demand level in round 1 (first offer) and demand level in round 6 (last offer). To validate that participants were correctly perceiving some counterparts as agents and others as humans we asked them to rate the counterpart on the same adjective pairs as in Experiment 1.

Seventy-eight participants were recruited at the USC Marshall School of Business. This resulted in approximately 20 participants per condition. Regarding gender, 45.8% were males.

Age distribution was as follows: 21 years and Under, 52.8%; 22 to 34 years, 47.2%. Most participants were undergraduate (63.9%) and graduate (34.7%) students majoring in diverse fields and mostly with citizenship from the United States (59.7%) and India (27.8%). The incentive to participate followed standard practice in experimental economics (Hertwig & Ortmann, 2001): first, participants were paid $20 for their participation; second, with respect to their goal in the task, participants were instructed to earn as many points as possible, as the total amount of points would increase their chances of winning a lottery for $100. After finishing the experiment, participants were verbally debriefed about the deception in the avatar conditions.

Results

Participants that accepted the counterpart's first offer or whose first offer was accepted by the counterpart did not see any emotion expression–i.e., our experimental manipulation–and, thus, were excluded from analysis (though keeping them would lead to the same pattern of results). After exclusion, 72 participants remained for analysis.

Regarding the agency manipulation check, the nine adjective classification questions were highly correlated (Cronbach α = .952) and, thus, were averaged into a single measure we called anthropomorphism. We then ran an Emotion Displays × Agency ANOVA which revealed no main effect of Emotion Displays, $F(1, 68) = 2.96$, $p = .090$, but, as expected, confirmed a main effect of Agency, $F(1, 68) = 9.87$, $p = .002$, partial $\eta^2 = .127$: people perceived the human counterparts ($M = 3.84$, $SD = 1.29$) to be more anthropomorphic than the agent counterparts ($M = 2.98$, $SD = 1.38$). The Emotion Displays × Agency interaction was not significant, $F(1, 68) = 2.45$, $p = .123$.

Regarding demand difference, the means and standard errors are shown in Figure 4. To test Hypothesis 2, we split the data across Agency and ran independent *t* tests to compare demand difference between angry and neutral counterparts. This analysis revealed that, for agents,

demand difference was higher with angry agents (M = 166.75, SD = 160.19) than neutral agents (M = 157.25, SD = 127.38) but this result was not significance, $t(38) = -.208$, $p = .837$, $r = .034$. For humans, demand difference was higher with angry humans (M = 286.67, SD = 218.55) than neutral humans (M = 101.50, SD = 111.57) and this results was significant, $t(30) = -3.182$, $p = .003$, $r = .502$.

Insert Figure 4 about here

Discussion

The results showed that people conceded more to angry than neutral virtual confederates. This result replicates findings in human-human negotiation (Van Kleef et al., 2010), adding further support that virtual confederates are a plausible research tool for studying the social effects of emotion. In support of Hypothesis 2, the results also showed that, despite always conceding more with angry confederates, the effects of emotions expressions were only significant and the effects much larger ($r = .502$ vs. $r = .034$) when people engaged with confederates that were perceived to be avatars.

GENERAL DISCUSSION

The results show that people responded similarly to virtual confederates as with humans in social decision making. In Experiment 1 people cooperated more in the iterated prisoner's dilemma with a virtual confederate that showed cooperative emotional displays (e.g., smile after mutual cooperation) than one that showed competitive emotional displays (e.g., smile after exploiting the participant). This result is compatible with the argument that people use non-verbal cues, such as emotion expressions, to infer whether others are likely to cooperate in a social dilemma (Frank, 1988; Nesse, 1990; Trivers, 1971) and with empirical findings that show that

the meaning of emotion displays can vary with context (Aviezer et al., 2008; Hareli & Hess, 2010; Lanzetta & Englis, 1989; Van Kleef et al., 2010). Experiment 2, in turn, replicated with virtual confederates the finding that people, when engaged in negotiation, tend to concede more with an angry than a neutral person (Sinaceur & Tiedens, 2006; Van Kleef et al., 2004). Since our findings with virtual confederates were aligned with expectations or previous findings in the human-human interaction literature, we argue virtual confederates are a plausible research tool for studying topics that are relevant for the management sciences.

However, our results also show that people make a distinction between virtual confederates that are driven by a computer–i.e., an agent–or by a human–i.e., an avatar. In fact, even if the confederate shows the same behavior, the mere belief about who or what controls the confederate seems sufficient for this distinction to occur. In Experiment 1, people always cooperated more with a cooperative than a competitive confederate; however, this effect was larger when people believed they were engaging with an avatar rather than an agent. In Experiment 2, people always conceded more to an angry than to a neutral confederate; however, once again, the effect was larger with avatars. The results seem aligned with recent findings in neuroeconomics that reveal people show higher activation of brain regions associated to mentalizing when engaged in decision making with humans rather than computers (e.g., Rilling et al., 2002; Sanfey et al., 2003). Effectively, several researchers have argued that a key for the social effects of emotion expressions is the information people retrieve from such displays about the other's beliefs, desires and intentions (de Melo et al., in press; Hareli & Hess, 2012; Van Kleef et al., 2010). In this sense, a higher activation of the mentalizing brain regions with humans might have meant people tried harder to infer the human's mental states from their emotion displays, which then led to increased effects when compared to agents. Our results also seem compatible with Blascovich et al.'s (Blascovich et al., 2002; Blascovich & McCall, 2013)

argument that a virtual entity, such as a virtual confederate, is more likely to socially influence people the higher the perceived agency (e.g., attributions of consciousness, free will). In sum, management researchers should be aware that they are more likely to maximize virtual confederates' social impact if participants are made to believe humans (e.g., other participants) are controlling the confederates.

We have argued in this paper that virtual confederates are a promising research tool for the management sciences that bring advantages in increased experimental control, ease of replication, facilitated access to broader samples and lower costs. It is important, however, that researchers understand some of the drawbacks of this technology. Unlike fully immersive virtual reality (Blascovich et al., 2002; Loomis et al., 1999), virtual confederate technology is not expensive; nevertheless, considerable programming effort is still required. In this sense, management researchers could benefit by having someone with appropriate computer science expertise in their teams. These issues, however, are likely to become less relevant with time as commercial or open-source frameworks (e.g., the virtual human toolkit[2]) become available. Another issue is that virtual confederate technology is relatively recent and, therefore, still the object of much research (Fox et al., 2009). For instance, this paper showed that people distinguish between agents and avatars in social decision making. However, Blascovich and colleagues (Blascovich et al., 2002; Blascovich & McCall, 2013) argue that one could compensate for an agent's lack of agency by increasing the agent's (behavioral and visual) realism; and this is, in fact, a promising line of inquiry. Overall, we feel the advantages and possibilities introduced by virtual confederates far outweigh these disadvantages and that,

[2] The virtual human toolkit is available at: https://vhtoolkit.ict.usc.edu/ (last checked 01/06/2013)

therefore, virtual confederates have the potential to become an important research tool in the management sciences.

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TABLES

Table 1

Payoff Matrix for the Prisoner's Dilemma

		Confederate	
		Cooperation	Defection
Participant	Cooperation	Confederate: 6 pts Participant: 6 pts	Confederate: 10 pts Participant: 0 pts
	Defection	Confederate: 0 pts Participant: 10 pts	Confederate: 3 pts Participant: 3 pts

Table 2

Facial Displays for the Emotional Virtual Confederates in Experiment 1

Cooperative *Confederate*

Participant	Cooperation	Defection
Cooperation	Joy	Regret
Defection	Neutral	Neutral

Competitive *Confederate*

Participant	Cooperation	Defection
Cooperation	Regret	Joy
Defection	Neutral	Neutral

FIGURES

Figure 1. The virtual confederates and emotion facial displays used in Experiment 1.

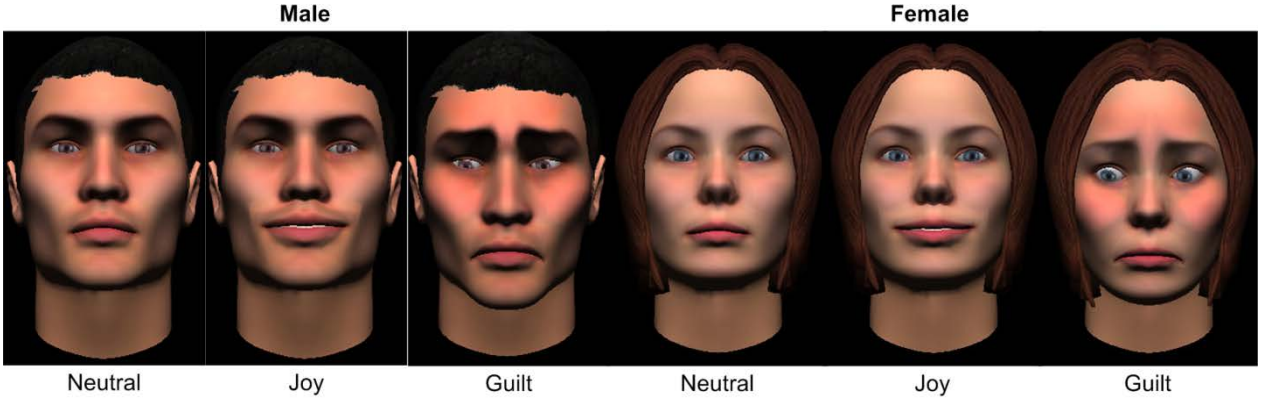

Figure 2. Cooperation rates in Experiment 1.

Figure 3. The virtual confederates and emotion facial displays used in Experiment 2.

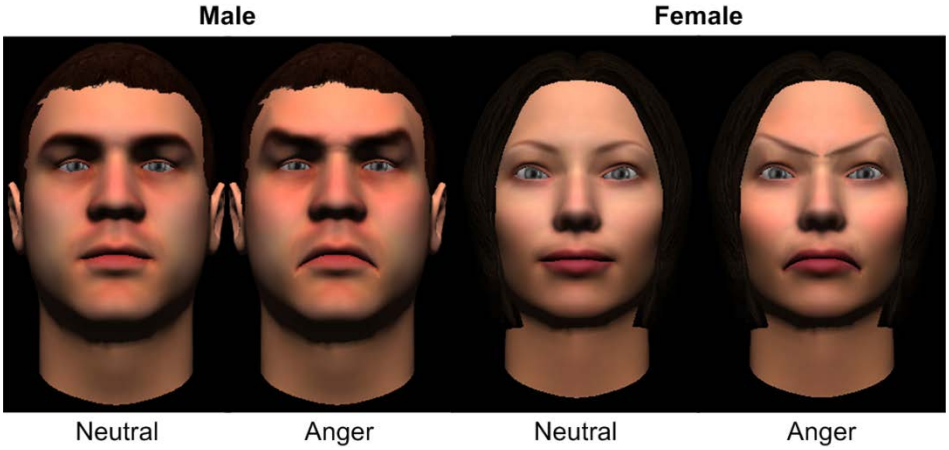

Figure 4. Demand difference in Experiment 2.