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Politeness in Teams: Implications for Directive Compliance Behavior and Associated Attitudes

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Abstract: This article reports an experiment in which college students and professional combat air controllers performed a simulated team interaction task designed to explore the effects of the degree of politeness used by a directive giver and the degree of "social distance" (roughly, team affiliation and affinity between the directive giver and the recipient), on directive compliance behaviors and attitudes. The design and experimental approach was informed by the functional theory of politeness in social interactions developed by Brown and Levinson, although hypotheses are advanced that extend this essentially perceptual model to effects on behaviors and attitudes. Results showed that increased politeness in a directive significantly improved attitudes toward the directive giver. Social "nearness" operated similarly and influenced the degree of politeness perceived even when the request itself was unchanged. Both effects operate similarly for novices and experts. Compliance rates (and one portion of reaction time) were similarly affected by the politeness of the directive giver but, interestingly, were affected differently for novices and experts. The politeness of the directive giver increased compliance for novices but decreased it for experts. This result suggests that politeness perceptions are an important influence on work performance but that their interpretation can be influenced through training and/or work "culture."

Keywords: cognitive processes, decision making, expert performance, team processes, politeness, etiquette, directive compliance

Introduction

Politeness in interactions, even work-related interactions, is seldom studied in the field of human factors. This may be because of a historical focus on designed

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artifacts—machines and equipment—which may be assumed not to participate in social interaction dimensions normally reserved for humans. The notion that a machine could be polite or rude quite likely seemed nonsensical, or at least whimsical, when machines were impersonal collections of gauges, lights, and buzzers. Such concerns may still seem misplaced to many even in an age when machines speak and may come in cute, anthropomorphized forms, since, after all, they are still "just machines." Nevertheless, two trends are making this assumption increasingly less tenable: (a) Machines themselves are getting more complex, and designers are increasingly seeking to give them more human-like qualities (e.g., Breazeal, 2002; Cassell, 2000), and (b) there is increasing evidence that people frequently do interact with complex machines, even when they are not "embodied" or given explicit and overt human characteristics, using the same expectations and interpretations that are afforded to other humans (Nass & Moon, 2000; Nass, Moon, Morkes, Kim, & Fogg, 1997).

In spite of this traditional avoidance of social interaction dimensions, such as politeness, it seems reasonable to claim that many issues related to politeness are themselves central to human factors. These include trust, team coordination, and perceived workload. Indeed, the literature suggests that the "style" of interaction between team members can have an effect on team performance (McNeese, Salas, & Endsley, 2001) and that effect influences trust (Lee & See, 2004). Cockpit resource management (Weiner, Kanki, & Helmreich, 1993), which has revolutionized team interactions in aviation and medicine, can be regarded in part as training operators to be sensitive to personal style differences and, in some cases, to reduce those differences through defined protocols for critical interactions. Finally, Parasuraman and Miller (2004) suggests that politeness differences can make profound performance differences in human-machine systems.

Note that politeness effects are inherently team perception and performance effects, because politeness is a phenomenon that exists only between social actors—those who are presumed to have intentionality and goals and the ability to give or take offense (cf. Brown & Levinson, 1987; Dennett, 1989). This does not, however, mean that a single human working with a manufactured tool (such as a flight control joystick or a computer interface) is immune to politeness effects. Indeed, since humans are very prone to ascribing social status to the machines they work with and to approaching them with expectations and interpretations derived from human-human etiquette and protocols (Reeves & Nass, 1996; Miller, 2004; Zhang, Zhu, & Kaber, 2010), it is perhaps to be expected that perceived politeness and rudeness in human-machine interactions will have effects similar to politeness and rudeness in human-human teams.

But where should one begin to study politeness effects in teams? Does receiving a communication (for example, an order or request) from a team member cause it to be interpreted as more or less polite than receiving it from a nonteam member? How does politeness (or rudeness) from a team member affect compliance with a directive and attitudes toward the directive giver? Do the interpretations and effects of politeness, if any, vary between amateur and professional teams?

In recent work, the authors have been using a functional model of politeness emphasizing how and why specific actions are perceived as polite and how polite behaviors can be used to alter social contexts. This work stems from the sociolinguistic studies of Brown and Levinson (1987), which will be described next, followed by a description of the authors' extensions to that model to predict behaviors and attitudes stemming from variations in perceived politeness. Finally, results from a pair of experiments illustrating politeness effects in perception of and compliance with directives in a team setting are presented.

A Sociolinguistic Model of Politeness Perceptions and Functions

Brown and Levinson (1987) collected a large corpus of instances of politeness usage from multiple cultures and languages, primarily, Tzetzal, Tamil, and English. Their goal, in addition to simply characterizing similarities and differences in politeness usages, was to develop an explanation for why "inefficient" verbal behaviors were added to direct communications of intent. On the basis of analysis of that corpus, they proposed that the culturally universal function of politeness is to redress "face threat." That is, since any action one may take with regard to another human has the potential to intrude on the other's autonomy of thought and action, all actions have the potential to threaten "face" or, roughly, the "positive social value a person effectively claims for himself" (Goffman, 1967, p. 5). If one takes the action "baldly"—that is, without any form of mitigation, apology, or "redress"—then one may be implying that he or she has the right or power to make that intrusion. What is typically regarded as politeness behaviors—the use of *please, thank you*, apologies, honorifics, and so on—are "redressive acts" that are used to offset the face threat inherent in interaction whenever one does not wish to convey such a message. This relationship is illustrated in Figure 1.

Thus, the degree of face threat present is a critical determiner of how an interaction will be perceived—and of how much redress is required to offset it. Brown and Levinson (1987) propose three factors as influencing face threat:

- *Power difference* between the hearer and the speaker. A less powerful individual will threaten face simply by addressing a more powerful one—this is why a commoner cannot say just anything to the king or why a janitor cannot ask the CEO for a cup of coffee. On the other hand, a very powerful speaker may actually "build up" the face of a less powerful hearer by simply taking notice of him or her. All other things being equal, if one is asking a favor of a peer, one can use less redress than when asking the same thing of a boss or supervisor—because less face threat is being offered. Teams in work settings frequently include individuals with different power levels, and team interactions might be expected to encode those power differences via politeness cues.
- *Social distance* between the hearer and speaker. Social distance is roughly the inverse of familiarity. Familiar individuals (such as coworkers, family members, or friends) are expected and entitled to address one another; thus familiarity reduces face threat and social distance increases it. All

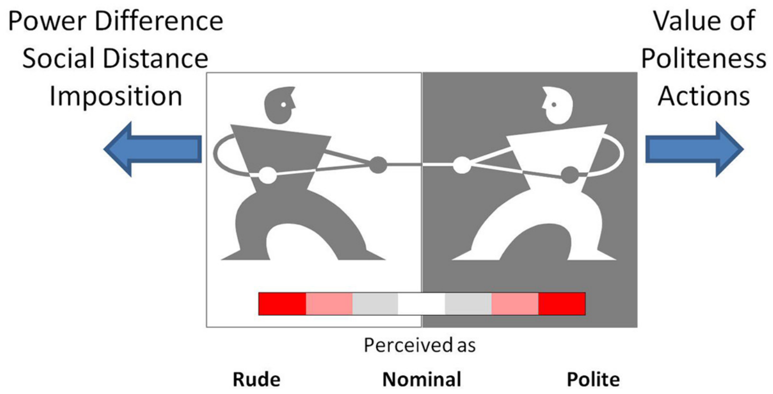

Figure 1. Abstract illustration of the relationship between overt politeness behaviors and contextual factors that interact to produce perceptions of politeness or rudeness in the Brown and Levinson (1987) model.

other things being equal, if one is asking a favor of a friend, one can use less redress than with a stranger. Familiarity can undercut power: If the president of the United States happens to be a close family member, chances are fair that one can address him much less formally than otherwise. Team members have an expectation of familiarity that stems from their shared organizational affiliation and shared goals, and team members who have worked together longer will tend to reduce social distance between each other still further.

- *Imposition* of the request or topic. Some topics are simply more imposing or face threatening than others. All other things equal, one can use less redress in asking a small favor than a large one. The fact that a team shares goals will tend to undercut the imposition of any request (as compared with the same request coming from a nonteam member) insofar as it is deemed a duty of the team participants, but different requests within the team will still have greater or lesser imposition values.

An individual's perception of these factors will determine his or her perception of the face threat inherent in the "raw" communicative act itself. More threatening acts will require more, or more powerful, redressive acts to reduce the threat. Much of Brown and Levinson's (1987) work involves the identification and categorization of types of redressive acts along with some rough claims about the relative potency across cultures. Although cultures certainly vary in how they assess and value these dimensions, and in what constitutes redressive acts, the model is claimed to function similarly across all cultures. Although exploring this complex relationship was a part of a larger research project (described later; see also Miller & Smith, 2008), this article focuses on politeness and its role in social and team relationships.

Inherent in Brown and Levinson's (1987) model, and explicit and computational in recent work (Miller, Wu, & Funk, 2008; Miller, Wu, Funk, Johnson, & Viljalmsson, 2007), is the assumption that using enough "redressive value" (through the types or combinations of redressive acts used in an utterance) to balance face threat yields an assessment of nominal or "neutral" politeness in the observer—about as much politeness as might be expected for this situation, given the social context. The use of more politeness than the observer thought necessary yields an assessment of excessive politeness, whereas using less results in an assessment of rudeness. For example, in a situation in which one wanted salt with a meal, one could say any of the following:

1. "Pass the salt."
2. "Please pass the salt."
3. "Excuse me sir, I'm sorry to intrude, but would you mind if I asked you to please pass the salt?"

Each of these is a directive speech act tasking the hearer to pass the salt, but the amount and type of redressive action used in each of them varies widely. Furthermore, it is impossible to say which of them is "appropriately polite" without knowing something more about the situation and relationships that exist between speaker and hearer when the utterances are made. For example, Utterance 1 is probably entirely polite if delivered to an old friend in a casual setting, whereas Utterance 3 would be exceedingly polite. By contrast, Utterance 3 might actually be seen as rude if used by, say, a janitor to interrupt a corporate CEO in the midst of an important business conversation at his or her table, and even Utterance 1 might be seen as overly polite in a high-urgency situation in which, say, the salt was needed to throw on a chemical fire.

Thus, note that this model offers an explanation for an intuitive property of politeness behaviors: that the same behavior or utterance can be only nominally polite in some contexts, far too polite in others, and not polite enough in still others. In Brown and Levinson's (1987) terms, this is because elements of the context differ (as captured by the power difference, social distance, and imposition terms) and, hence, demand that more or less redress be used to balance the resulting threat.

Brown and Levinson (1987) take one farther step by indicating that perceptions of the face threat parameters can themselves be influenced by the amount of politeness used. If a speaker uses less politeness than the hearer thought was necessary for a given interaction, the hearer might perceive the speaker as simply rude, but (especially if the hearer has prior knowledge and no particular reason to believe that the speaker intends to be rude) the hearer might also seek to "balance the equation" by adjusting his or her prior perception of the power difference, social distance or imposition of the context. The hearer may have thought the speaker was rude because the hearer thought he or she had power over the speaker—but the speaker's relative rudeness suggests that perhaps the speaker thinks he or she has power over the hearer, or perhaps they are old friends, or perhaps what they are talking about is not as imposing as assumed, and so on.

Politeness and Directive Compliance

This research, building on the Brown and Levinson (1987) model, examines the effects of perceived politeness on directive compliance and associated behaviors and attitudes, such as reaction time, memory, positive affect or "likeability" (terms used interchangeably here), trust, and perceived workload—which are collectively referred to as "directive compliance behaviors" in this article. Perceived politeness (as mediated by the functional model described earlier) is hypothesized to affect directive compliance behaviors as follows:

- *Trust and affect or likeability:* Both trust in a directive giver and positive affect about or likeability of the situation will improve as perceived politeness increases, whereas perceived rudeness will decrease trust and positive affect or likeability. This will hold true within a boundary of believable levels of politeness and rudeness—as politeness becomes unbelievable, more attention is paid to interpretation and motives of the speaker, and trust and positive affect or likeability will decline. That positive affect should enhance trust is a key feature of the trust model presented in Lee and See (2004). Norman (2002) reviews extensive results documenting the relationship between pleasure-producing events and likability or affect, and Cialdini (1993) documents the relationship between flattery (which, we suspect, may be a form of politeness) and likeability.
- *Compliance*: We hypothesize a general (but not uniform) increase in overt compliance with perceived politeness, at least until the perceived politeness becomes so extreme as to be seen as obsequious and unbelievable. This derives from the likely increase in trust and positive affect that comes with interactions that are expected, pleasing, and/or more than nominally polite. Intuitively, people certainly behave as if politenesss will have this effect—training their children to say *please* when asking for something if they want to get it—and some specific experimental data are provided in Parasuraman and Miller (2004) to support the effectiveness of politeness. On the other hand, the model itself suggests that the relationship is more complex: One may choose to comply because he or she likes the directive giver (a feeling that will be enhanced by reductions in social distance) or fears him or her (which may be enhanced by increased power), because it seems in his or her best interests to do so (low imposition), or because it costs little to do so (low imposition overall). The use of redressive behaviors can steer the hearer toward one of these interpretations on the basis of the prior assumed relationship and complex issues of personality and motivation. Nevertheless, in the absence of such complex special cases, it seems reasonable to predict that increased politeness should enhance compliance.
- *Accuracy*: The relationship between politeness and task performance accuracy is likely to be highly complex, since the relationship between emotion

and accuracy is known to be complex. Kensinger (2007) reports that negative emotions enhance memory for details from the event being remembered, while Brainerd, Holliday, Reyna, Yang, and Toglia (2010) report that negative events are remembered less accurately than positive ones. Norman (2004) claims that negative affect enhances focus and concentration, whereas positive affect relaxes and enhances creativity—so whether task performance is enhanced by positive or negative politeness might be a function of the requirements of the task. Given this complex relationship and ambiguity of results in the literature, how politeness will affect task performance accuracy is investigated without a priori hypotheses.

- *Reaction time:* Brown and Levinson (1987, pp. 95-96) themselves suggest that one context in which reduced redress is permissible is when action is both urgent and in the hearer's interests. Perceived rudeness may thus result in shorter reaction times because it suggests urgency, whereas politeness conveys reduced urgency or comparative relaxation. This effect may be highly sensitive: As more rudeness is used, net reaction times might increase as the hearer spends more time wondering why the speaker is behaving so rudely.
- *Perceived workload and memorability:* A cognitive interpretation of the Brown and Levinson (1987) model suggests that deviation from expected (nominal) levels of politeness provokes increased reasoning about the interaction and its context. Thus, interactions perceived as "off-nominal" should be associated with higher subjective cognitive workload, as the hearer tries to decipher possible "hidden messages." Similarly, "memorability" (i.e., memory for the interaction and its social context rather than overall situation awareness) might be expected to improve in off-nominal circumstances because the hearer spends additional time scrutinizing and reevaluating initial assumptions.

Prior relationships—in this case, team membership as an instance of social distance reduction—are expected to affect perceptions of politeness and, hence, compliance behaviors. Team membership should reduce social distance and, therefore, enhance perceived politeness—with the attendant directive compliance effects described above.

Method

This article reports the results of two experiments testing hypotheses about the effects of politeness on directive compliance in team settings. Each of these experiments used the same procedure and very similar experimental materials: the test bed described next, similar sets of directives (with content and politeness prefixes as described later), and the same set of team relationship markers and backstory to designate the team members as of high, nominal, or low familiarity. The experiments were conducted at different times and locations by different experimenters, but the primary difference between them was the participant pool drawn from—novice college students in the first experiment and expert combat air controllers in the second. This was done to allow testing an additional hypothesis: that politeness would have an effect on experts similar to that on novices. Thus, these two experiments can be treated as (and will be analyzed and presented as) two conditions in a broader experiment—wherein expertise level was varied between participants—making this essentially a single mixed-factor experiment with (as described in more detail later) variations in the social relationship of and the politeness used by a directive giver (DG) as within-subjects independent variables and the expertise level of the participant as a between-subjects independent variable.

Materials and Apparatus

To begin testing the effects of perceived politeness in team settings, a test bed was created that enabled varying and controlling aspects of the context that the models predicted would be of interest. The result was the Park Asset Management and Monitoring Interface (PAMMI) test bed, which built on the Tactical Tomahawk Interface for Monitoring and Retargeting (TTIMR; Cummings & Guerlain, 2004). Although TTIMR was initially created to study user interface impacts on users' ability to control multiple unmanned vehicles, it included a "chat channel" whereby text messages could be sent to the participant and the participant could respond. Initial experiments with TTIMR used this chat interface as a secondary task to measure workload. In this experiment, however, the chat interface was used as a means of both giving directives to users and controlling the contextual variables important to the interpretation of perceived politeness of those directives. PAMMI was chosen in part because it was readily available, because it was easily modifiable, and because it emulated a real-world task.

PAMMI, illustrated in Figure 2, presented a map interface showing the planned destinations and current locations of multiple air and ground vehicles heading to different destinations in a national park, notionally to fight a forest fire. Additionally, a matrix of vehicles names (in rows) and destination names (in columns) provided users with information about which vehicles were heading to which destinations, along with their projected arrival times (as entries in the table's cells). A timeline display offered a relational view of vehicle mission and arrival times to aid in answering questions such as "Which vehicle will arrive next?" and "Will Vehicle A arrive before or after Vehicle B?" Finally, the chat window mentioned earlier gave summary records of incoming and outgoing messages, although a larger popup window was created to present chat messages along with an icon indicating the DG sending the message.

Although the TTIMR test bed required participants to control and direct vehicle movements, this task was eliminated in PAMMI in favor of placing participants in the role of a dispatcher, who, through superior access to information and displays of vehicle movements and intended schedules, simply observed and reported on vehicle behaviors in response to requests from "field agents" but did

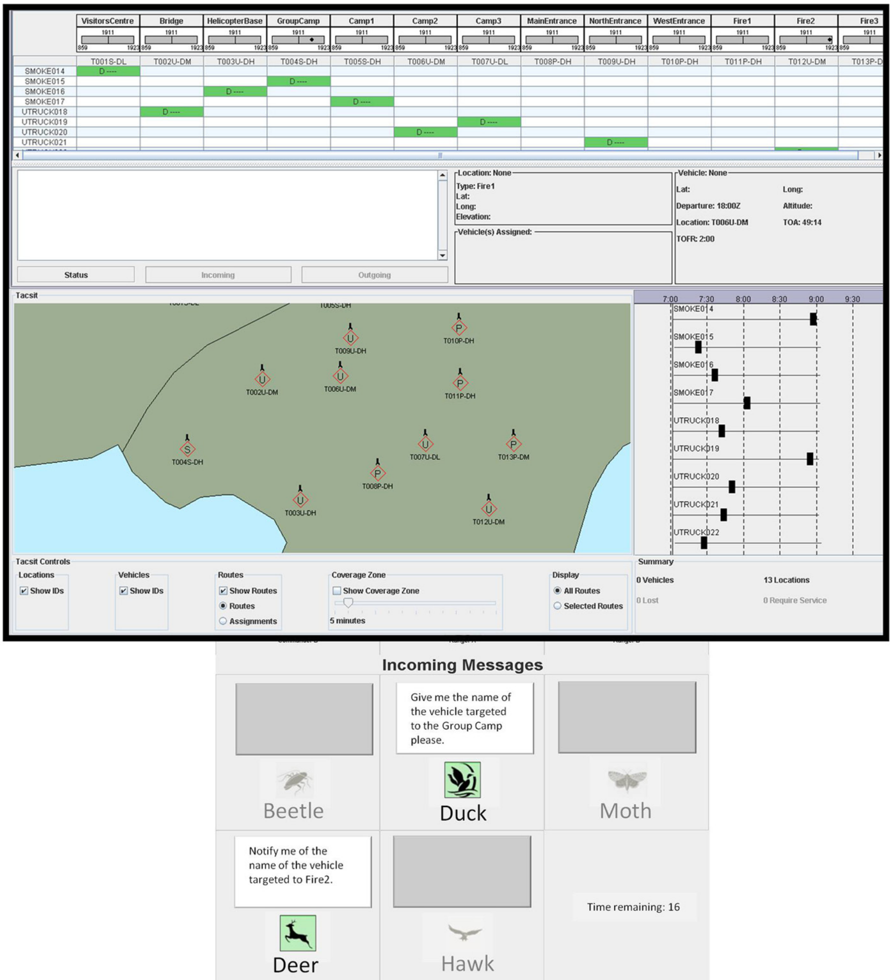

Figure 2. The Park Asset Management and Monitoring Interface's status (top) and incoming message (bottom) screens.

not influence the vehicles directly. This was done to prevent potentially unpredictable states of the simulated world from causing variations in participant workload and potential variations in the imposition that a directive would produce. As participants did not have any secondary tasks, a directive requesting or ordering information available from the participant's screens could be expected to always produce approximately the same level of "raw" imposition, thus holding that dimension of the perceived politeness model constant.

During initial training (as described next), participants were told they would support a group of five field agents who would periodically request information.

Directives requesting or ordering that the participant provide information arrived via a dialog screen showing the requestor's icon and a text message (cf. Figure 2). Directives consisted of an information request, which could be randomly combined with polite or rude redressive behaviors (phrases) drawn from either a polite, nominal, or rude group as determined by the use of the Brown and Levinson (1987) theory. Thus, for example, the information request ". . . the arrival time of UTRUCK 018?" could be combined with the polite prefix "Could you please let me know . . . ," the nominal prefix "Tell me . . . ," or the rude prefix "Stop being lazy and give me . . . ." All directives required short, one-word answers, and participants were encouraged to answer as briefly as possible. There was 100% agreement among three raters (all native-English speakers) as to which prefixes fell into the polite versus nominal versus rude category, but otherwise, the degree of politeness in each was not scored. Raters were aware of the context of presentation (team collaboration during a firefighting scenario) and were instructed to evaluate the politeness of the utterances as if from an "average" or unknown DG. Examples of the polite, rude and nominal redress behaviors and the directives are included in Table 1.

These utterances were delivered by a set of five DGs. Each DG occupied one square in the Incoming Message display illustrated in Figure 1. Although the square occupied by each DG was varied across participants, it was held constant for each participant within a trial such that each DG was associated both with a physical "location" in the grid and with that DG's icon (as explained later). Both manipulations were performed to enhance the sense that the participant was interacting with specific individual agents rather than impersonal incoming messages—and to enhance memory and association of the DG with the politeness level it was using. During incoming messages, the square occupied by the inquiring DG was displayed in color with the message appearing in the text box, and inactive DGs were shown in suppressed gray tones. Participants were instructed to read the message, close the Incoming Message screen, return to the main interface to determine the answer to the information request, and then select the Outgoing Message screen to input their answer.

The information content of each directive (that is, the core information requested in the directive) was randomly varied across DGs, but each of the five DGs was consistent in its use of polite, rude, or nominal directives: Two were consistently polite, two rude, and one nominal. In addition, the relationship of the participant to the DGs was varied along team membership dimensions (as a form of familiarity or social distance manipulation), as will be described next. This, then, produced the following categories of DGs used in each trial:

- Two DGs were high in familiarity (from one's own park and team, with positive prior working experiences).
- Of these, one consistently used high politeness and the other consistently used low politeness (i.e., was rude) in the directives given.
- Two were low in familiarity (from a different park and team, with prior conflicts).

TABLE 1. Example Redressive Phrases Combined With "Raw" Request Content to Provide Variable Politeness Directives Supplied by Directive Givers

Redress Level	Redressive Phrase	Raw Request
Polite	Could you please let me know . . . ? Excuse me, but could you tell me . . . ? I'd be grateful if you could provide . . . ? Sorry, but could you inform me of . . . ? Would you mind telling me . . . ?	. . . the vehicle targeted to the GroupCamp. . . the target location of PLANE023. . . which vehicle will get to its destination next. . . which vehicle has just arrived at its location
Nominal	Tell me . . . . Give me . . . . Give me an update on . . . . I need data on . . . . I need to know . . . . Notify me of . . . . Provide me with	
Rude	Hurry up and inform me . . . ! Immediately give me . . . ! Quit what you're doing and tell me . . . ! Stop being lazy and give me . . . ! You idiot! Tell me . . . !	

- Of these, one consistently used high politeness and the other consistently used low politeness in the directives given.
- One was neutral in familiarity (from same park but different team, with neutral prior working experiences).
- This neutral DG always used nominal politeness levels.

To aid participants in remembering which DG occupied which relationship, DGs were named and given icons that reinforced both their individual identity and their role. Icons and text were used to indicate the DGs rather than photos and voice or live video to reduce age, gender, and cultural associations and so that the tone of voice would not confound the designed level of politeness. This attenuated the range of cues available for participants to infer relationships but allowed controlled variability in those interpretations. Such restricted interactions might be expected to also *reduce* the effects of perceived politeness—thus making this a conservative test of perceived politeness effects. The set of icons used in this experiment is presented in Figure 3, and this figure was also used in participant training materials and was attached to the wall of the cubicle where participants used the PAMMI test bed. The hummingbird icon (the middle of the three icons for Team Bird, shown in Figure 3) was also enlarged and used as a laminated badge, which was given to the participant prior to the experiment as a reminder of his or her "call sign" and membership in Team Bird.

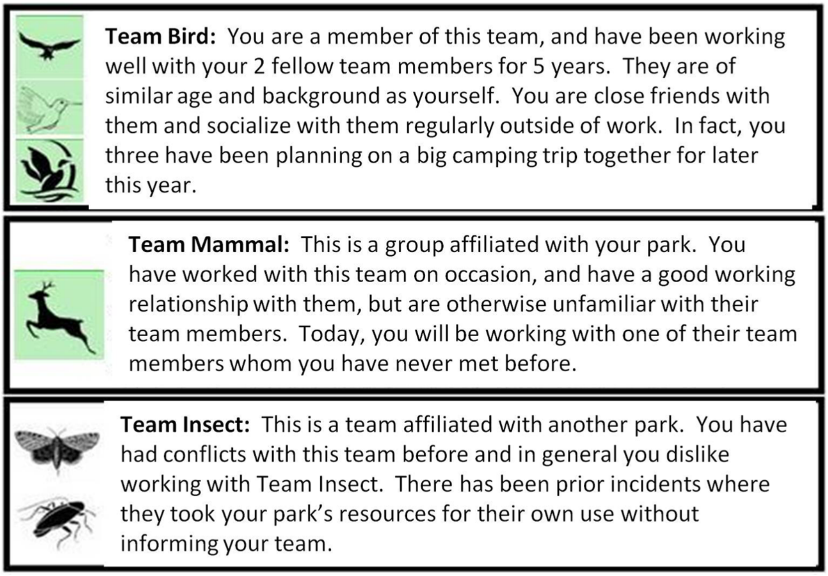

Figure 3. *Example background information given to participant in training to facilitate team identifications, illustrating the icon used for team membership.*

To induce variations in the social distance between the participant and the DGs, a backstory was introduced during test bed familiarization (via the slide and wall chart illustrated in Figure 3) and reinforced in icon design. The backstory description (cf. Figure 3) stated that relationships, based on past history, with the other members of Team Bird were well established as close, warm, and efficient, whereas those with Team Mammal were described as less close (they were from the participant's park but not on the same team) and less well established but not antagonistic. Relationships with Team Insect were described as socially distant: Members were from a different park, and prior history had led to a relationship of distrust. Although the backstory represented a comingling of team affiliation and likeability or affect relationships, which should be teased apart in future experiments, both are important to establishing social distance in Brown and Levinson's (1987) terms, and the goal was to establish roughly low, neutral, and high levels of social distance relationships between the participant and the DGs to use in the evaluation of directive compliance behaviors.

Interaction with the PAMMI test bed was conducted in a quiet cubicle with a Windows PC with a 19-in. monitor. Initial training and posttest questions were administered on a separate laptop PC in a different room.

Participants

Participants for the first experiment consisted of 20 individuals from two midwestern universities (5 men, 15 women) whose ages ranged from 19 to 55 (M = 27, SD = 8.4392). International student organizations and locations were targeted during recruitment (because of an interest in cultural differences); participants were not otherwise selected on the basis of ethnic background. Participants' self-identified ethnicities broke down as follows:

- Eight countries were represented by country of birth (United States, India, China, Uganda, Mauritius, Peru, Bosnia and Herzegovina, and Taiwan).
- Ten participants (50%) identified themselves as having a non-U.S. background by country of origin, country of birth, and country in which raised.
- The average amount of time spent in the United States by those identifying themselves as raised other than in the United States was 3 years.

Participants in the second experiment were Air National Guard reservists from the 133rd Air Control Squadron based in Ft. Dodge, Iowa, who were trained as combat air controllers. The experiment was conducted during a National Guard training weekend. These professionals supported the investigation of expert–novice differences and were included to test an occasional objection that trained professionals were immune to politeness effects in their professional behaviors.

All participants in the second experiment were trained as combat air controllers for the U.S. Air Force and had experience performing that role in domestic exercises. Participants in this experimental condition consisted of 8 individuals (6 men, 2 women) whose ages ranged from 23 to 49 (M = 34, SD = 7.8909). All participants reported their ethnicity as American on all measures. These professional participants were selected because they had relevant training for the simulated dispatcher task that formed the basis of the experimental test bed.

Procedure

The general procedure for both experimental conditions (after recruitment, introductions, and obtaining informed consent) was as follows:

1. Demographic data survey and pretest questionnaires
2. Training and test bed familiarization
3. Test bed usage (a single 45-min trial)
4. Posttest questionnaire

We used the demographic survey to collect data on ethnicity and identified culture reported earlier. The pretest questionnaires consisted of a set of three surveys primarily focused on assessing cultural attitudes (e.g., Hofstede, 2001) as well as attitudes toward politeness and its dimensions as a part of a broader research effort and will not be considered further in this article. The college students involved in the first experimental condition took the initial survey and pretests through a website and at their leisure; training and test bed usage were scheduled after the pretest was complete and took place days or weeks after the pretest data had been collected. For the soldiers involved in the second condition, the same materials were administered online but immediately prior to their training and use of the test bed.

Each of the experimental conditions with the PAMMI test bed began with a session of training and test bed familiarization. The materials used during this session consisted of a set of 38 PowerPoint slides and a short video that described the participant's role, the virtual characters, and the test bed. The familiarization materials and procedures used were identical for both novice and expert participants.

During this initial PowerPoint training session, participants were introduced to the backstory via the slide illustrated in Figure 3. This story was designed to convey team membership and relationships of the various DGs and therefore to vary social distance. Participants were told that they were from a specified park and were a member of Team Bird. They were given a physical badge that, through colors and animal icons (a hummingbird icon), signified the same team affiliation with some of the DGs (bird icons in green-shaded backgrounds), close affiliation with another team from the same park (team mammal, also in green), and more distant affiliation (Team Insect, in white) with others "from another park." Relationships with these DGs were described in terms intended to vary their social distance from the participant, as described earlier and illustrated in Figure 3.

Each participant was given 20 min to review the slides independently and a 10-min practice session with the test bed simulation. During the practice session, participants were first encouraged to independently explore the functions within the test bed. The experiment conductor then verbally asked the participant questions similar to those that would be asked by virtual characters later during the simulation run (using a neutral or nominal politeness level). Last was a practice session during which virtual characters asked sample questions and the participant had to respond to the requests using the mechanisms in the test bed. In this trial period, the characters were identified by icons that were unlike those used later in the experiment (cf. Figures 2 and 3) and, again, used neutral or nominal levels of politeness. Participants were allowed to request more practice or clarification of instructions, but all expressed and appeared to be proficient with the test bed at the end of this familiarization session.

Following test bed familiarization, each participant played the role of a dispatcher using the PAMMI interfaces to respond to DGs "in the field" for 45 min. The test bed, icons, interactions screens, general nature of the messages, and levels of politeness were as described earlier. Of the five DGs each participant interacted with, each always used the same name and icon, and messages from that DG always appeared in the same location in the grid for that participant, although these locations were varied between participants. Incoming message events occurred once per minute during test bed use. Of the 45 incoming message events, some were single directives (one field agent making a request), and some were paired directives (two field agents simultaneously issuing directives) and required the participant to choose which DG to respond to. In paired directives, one of the two DGs always had neutral social distance and used neutral politeness, and the other was one of the remaining four DGs described earlier. Single and paired directives were randomly interspersed for each participant.

Immediately following participation in the test bed simulation, participants completed a posttest questionnaire. Participants were given a visual reminder (in the form of a paper printout with attached icons in the appropriate grid squares for that participant) of the icon depictions and the screen location of each DG they interacted with to use as an aid when answering the posttest questions. Measures collected on this questionnaire included perceived politeness, likeability, trust, and workload of each of the five DGs on a Likert-type scale. Following these subjective rating questions, each participant was given a series of 20 memory questions about the directives they received during the course of the test bed experiment. Each question asked the participant to identify which of the five DGs had given a directive with specific content, for example, "Which of the following people asked you to provide them with information regarding the vehicle targeted to the Main Entrance?" Note, however, that the questions did not restate the politeness behaviors from the directives. To rule out mere exposure effects, each DG within the scenario asked the same number of questions and asked about each vehicle or location only once. The posttest concluded with a set of five open-ended questions that allowed participants to respond in their own words to questions about how they had made their decisions, including how they selected a DG when there were multiple requests, whether they were aware of who was making requests, whether the DG's politeness affected their responses and willingness to provide subsequent responses, and whether the DG's team affiliation affected participant responses.

Experimental Design

Each experimental condition was set up as a within-subjects design with all participants receiving directives from each of the five DGs. Nevertheless, since the materials and protocols used for the college students and the combat air controllers were virtually identical, results can be compared between them as a between-subjects design.

One difference between the two experimental conditions was the number of paired versus single directives used. In Experiment 1, involving college students, of the 45 directive-giving events, 25 were single (5 for each of the five DGs), 20 were paired (5 for each of the 4 non-neutral DGs). In Experiment 2, involving the combat air controllers, of the 45 directive giving events, 5 were single (1 for each of the five DGs), 40 were paired (10 for each of the four non-neutral DGs). We made this shift in the experimental procedure to increase the statistical power for detecting differences in compliance with the smaller set of participants available in the second experiment.

Independent Variables

Within-subject variables. The primary within-subject variables considered in these experiments were the social distance and politeness level of the DGs. Three levels of DG social distance were established via the backstory illustrated in Figure 3: low, termed "near" (same team and same park, good relationship); nominal (same park but different team, neutral prior working relationship); and "far" or high (different team, different park, problematic prior working relationship). We established three levels of politeness behaviors by manipulating the wording associated with a core directive (as described earlier): low ("rude"), nominal, and high ("polite"). These manipulations produced five DGs with whom each participant interacted: one low social distance + low politeness, one low social distance + high politeness, one nominal social distance + nominal politeness, one high social distance + low politeness, and one high social distance + high politeness. In these analyses, however, only comparisons between high and low levels of social distance and politeness were examined.

Between-subject variables. The only between-subject variable examined was the level of participant expertise: expert (Air National Guard reservists with combat air controller training from Ft. Dodge, Iowa) and novice (college students from two midwestern universities).

Dependent Measures

A total of 11 dependent measures were analyzed from the data. These fall into two groups: objective, measured data obtained during test bed performance or immediately thereafter and subjective ratings data in which the participants themselves reported their perceptions about the DGs. From test bed performance, we obtained compliance-rate data (proportion of participants who chose to respond to a DG when that DG appeared in a paired directive event divided by the total number of directives presented with that character), accuracy rates (proportion of participants who provided the correct factual response to the single directives for each DG), and reaction times (time participants took to provide responses to single directives). (Reaction times were also collected for paired directives but were confounded by participants' potentially differing reading and selection strategies.) The amount of time taken to respond to a directive was measured in four predetermined components. Timing began when the directive(s) appeared in the chat window. "Incoming" reaction time was defined as the time between when the directive first appeared and when the participant selected the DG to answer (by clicking on the character icon). The time spent in the status window, which was required to search for the information needed to respond to the directive if it was not immediately in the participant's memory, was defined as "status" reaction time. Finally, "outgoing" reaction time was defined as the amount of time spent in the outgoing chat window, essentially the time taken to type and send the answer. The aggregate of these three components provided the "total" reaction time. An additional objective measure, memorability for which DG gave which request, was collected during the posttest by means of the series of factual memory questions described earlier. Memorability was defined as the proportion of correct answers to the memory questions and was subdivided into proportion of correct answers about each of the four non-neutral DGs.

Subjective measures were assessed via 9-point Likert-type scale ratings for each DG during the posttest. These were perceived politeness (how polite did participants rate each DG?), perceived likability, perceived trustworthiness, and perceived competency. In addition, participants were asked to rate the perceived degree of workload they experienced working with each DG. Finally, in free-text response questions asked at the end of the posttest, participants were asked whether they believed their responses had been affected by, first, the politeness level of the DGs and, second, by the team affiliation of the DGs. Participants' responses to these questions were coded as positive, negative, or not applicable.

Analyses

To evaluate the relationships between the politeness level and social distance of a DG and the expertise level of the directive recipient and their impact on a variety of directive compliance behaviors and related perceptions, a series of 2 × 2 × 2 mixed ANOVAs were completed with DG politeness level (rude vs. polite), DG social distance (near vs. far), and participant expertise level (expert vs. novice) as factors. All significant interactions were broken down with pairwise comparisons with a Bonferroni correction. The Bonferroni correction was used to maintain the familywise error rate and to control for the probability of false positives. Data from the free-response questions asked at the end of the posttest were analyzed with an exact binomial sign test since, as coded, they were binary.

Results

Directive Compliance

A significant main effect of social distance on directive compliance was observed, $F(1, 26) = 12.851$, $p < .001$, partial $\eta^2 = .331$, with both novices and experts complying with socially near team members 20% more than socially far nonteam members (team members, $M = .552$, $SE = .041$; nonteam members, $M = .349$, $SE = .033$). A significant interaction between DG politeness level and participant expertise level was also observed, $F(1, 26) = 12.319$, $p < .01$, partial $\eta^2 = .321$. Further analyses indicated that novices complied more than experts when the directive giver was polite, $p < .025$; however novices complied less than experts when the directive giver was rude, $p < .025$ (see Figure 4).

Directive Accuracy

The only significant effect on directive accuracy we observed was a main effect of participant expertise level $F(1, 26) = 62.165$, $p < .001$, partial $\eta^2 = .705$. As might be expected, experts were significantly better at answering all DGs' questions than novices were (experts, $M = 1.00$, $SE = 0.27$; novices, $M = 0.747$, $SE = 0.017$; see Figure 5). In fact, experts performed perfectly in providing all responses, thus creating a ceiling effect that obscured any possible effects of DG politeness or social distance level. Novices were slightly more accurate in responding to rude DGs, but this effect was not significant.

Reaction Time to Directives

Similar interactions between DG social distance and participant expertise level were found for incoming, $F(1, 26) = 6.692$, $p < .05$, partial $\eta^2 = .205$; outgoing, $F(1, 26) = 4.391$, $p < .05$, partial $\eta^2 = .144$; and total reaction time,

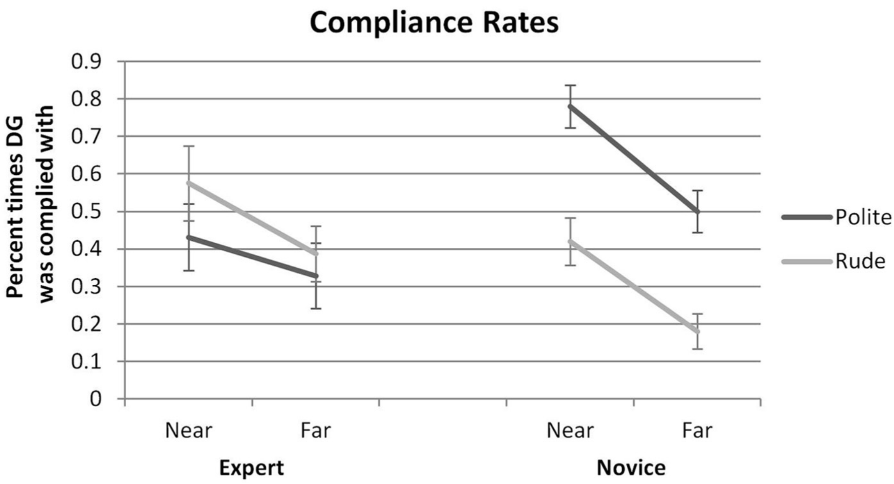

Figure 4. *Interaction between directive giver politeness level and participant expertise level for directive compliance.*

$F(1, 26) = 7.517$, $p < .05$, partial $\eta^2 = .224$. For all three time components, experts were slower at responding to a socially near team member compared with a socially distant nonteam member; however, this difference was significant only for outgoing and total reaction time, $p < .025$ (see Figure 6), whereas novices exhibited no significant difference in reaction time based on social distance. Status reaction times showed no significant differences for either social distance or participant expertise.

There was also a significant interaction between DG politeness and participant expertise level for status reaction time, $F(1, 26) = 5.104$, $p < .05$, partial $\eta^2 = .164$. Experts were slightly faster at finding the required information when the directive giver was polite, $p < .08$ (see Figure 7), whereas the opposite trend was true for novices. A similar trend was apparent in the data for total reaction time, although it was not statistically significant.

Memorability

Performance by all participants in all conditions on the posttest memory questions were near chance and showed no significant effects, implying that these questions were too difficult.

Perceptions of DGs

Similar main effects of DG social distance and politeness were found for all subjective effects except workload, for which no significant results were found. On the basis of subjective rating questions asked about each DG as a part of the posttest, socially near team members were rated as more polite, $F(1, 26) = 10.210$,

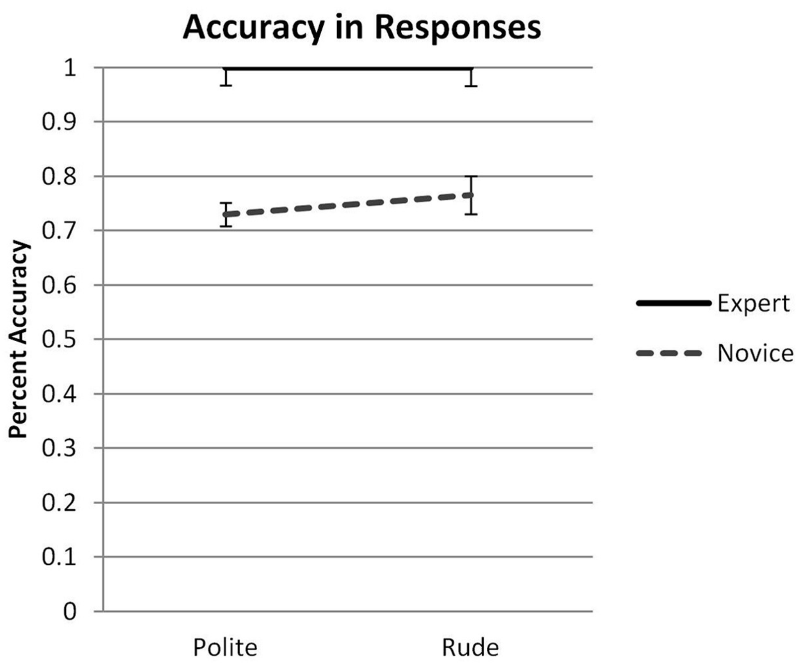

Figure 5. Interaction between directive giver politeness level and participant expertise level for directive accuracy.

$p < .01$, partial $\eta^2 = .282$; more likeable, $F(1, 26) = 7.845$, $p < .01$, partial $\eta^2 = .232$; more trustworthy, $F(1, 26) = 13.354$, $p < .01$, partial $\eta^2 = .339$; and more competent, $F(1, 26) = 13.995$, $p < .01$, partial $\eta^2 =.350$, than nonteam members. Polite DGs were also perceived as more polite than rude ones, $F(1, 26) = 24.549$, $p < .05$, partial $\eta^2 = .486$, thereby indicating that participants perceived the implemented manipulation of politeness levels as intended. Polite DGs were also seen as more likeable, $F(1, 26) = 17.380$, $p < .05$, partial $\eta^2 = .401$; trustworthy, $F(1, 26) = 15.152$, $p < .05$, partial $\eta^2 = .368$; and competent, $F(1, 26) = 9.688$, $p < .05$, partial $\eta^2 = 271$, than rude DGs. Therefore, politeness and team membership or familiarity (inverse social distance) both improved perceptions of DGs and did so similarly for both novices and experts, although there were no significant interaction effects. Both polite DGs and those that were socially near tended to produce lower workload ratings from both novices and experts, but these trends were nonsignificant.

Free-Response Questions

The two free-response questions focusing on team membership and politeness are reported because they speak to the participants' awareness of the impact of these parameters on their compliance behaviors. First, 85% of novices

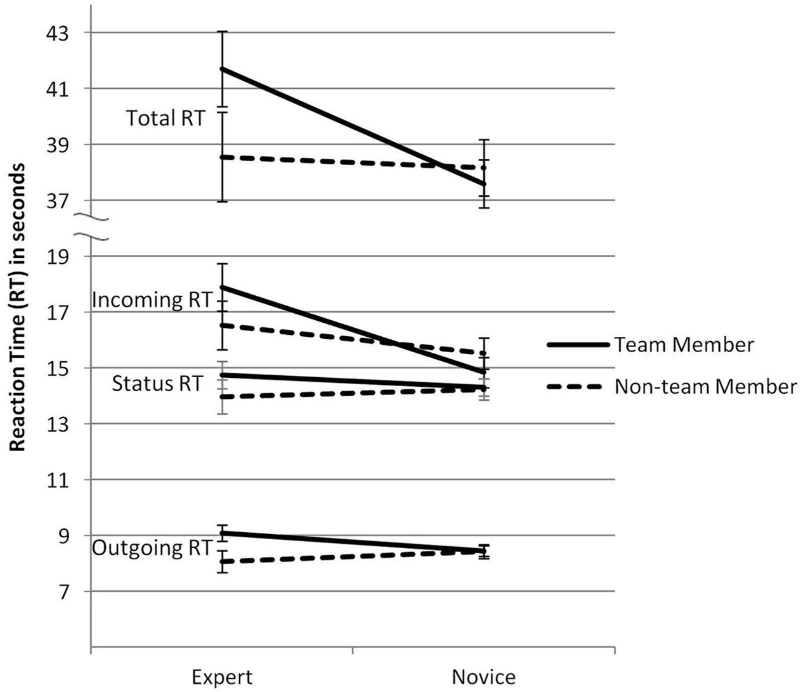

Figure 6. Interaction between directive giver social distance and participant expertise level for total reaction time, incoming reaction time, and outgoing reaction time.

thought DG politeness affected their willingness to provide answers to that DG on subsequent questions (17/20, $p < .003$), whereas only 37.5% professionals thought the same (3/8, $p < .73$). Second, 60% of novices thought team affiliation of the DG affected their willingness to respond to that DG (12/20, $p < .51$), whereas only 12.5% of professionals thought the same (1/8, $p < .08$).

In short, professionals seemed less willing than novices to acknowledge the effects of politeness on their compliance behaviors, and neither group was overly willing to acknowledged the effects of team membership on their compliance behaviors. Whether this is the result of lack of awareness or unwillingness to acknowledge those impacts is uncertain.

Discussion

For convenience in discussion, the direction and significance of the findings from these experiments along politeness, social distance and expertise dimensions are summarized in Figure 8.

The most obvious conclusion from this study is that both politeness and social distance affect the directive compliance behaviors of both novices and experts

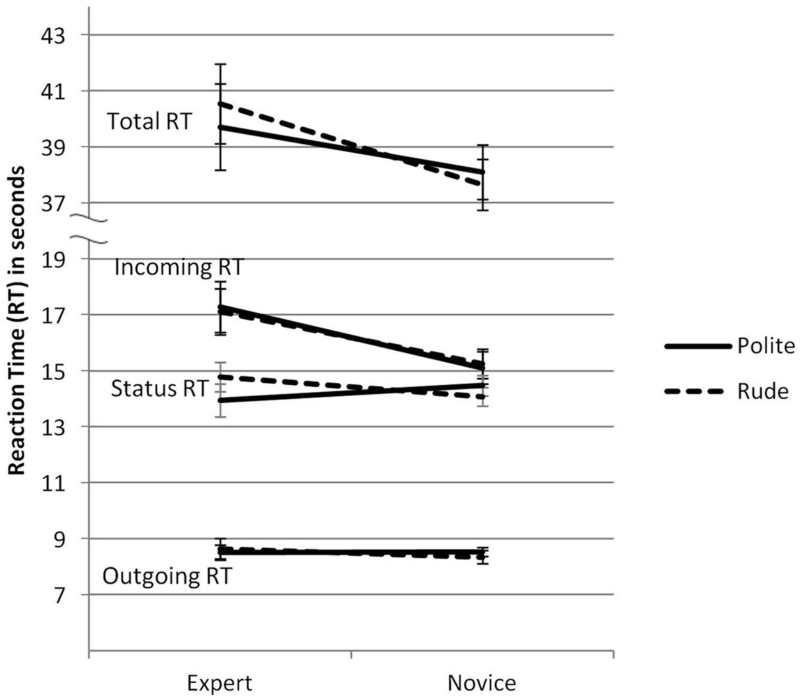

Figure 7. Interactions between directive giver politeness level and participant expertise level for status reaction time, along with similar trend for total reaction time.

but that experts' behaviors in response to perceived politeness can differ in significant ways from that of novices, as will be discussed in more depth next.

Social Distance

Social distance had the effect of reducing compliance with directives for both groups: They complied significantly more frequently with socially near DGs (arbitrary agents designated as team members with a positive relationship) and less frequently with those with increased social distance (nonteam members with a negative relationship). Accuracy, on the other hand, was unaffected by social distance. Experts seemed to take social distance into account more in their reaction time to a request than novices did. For experts, social distance decreased reaction time, whereas for novices, social distance made little difference. In short, with regard to objective performance criteria, having an arbitrarily designated socially distant individual (that is, a nonteam member with a reported past history of negative interactions) give a directive to a participant had the negative effect of reducing compliance by more than 20% when participants had a choice about whom to comply with (in paired directive conditions). For expert participants,

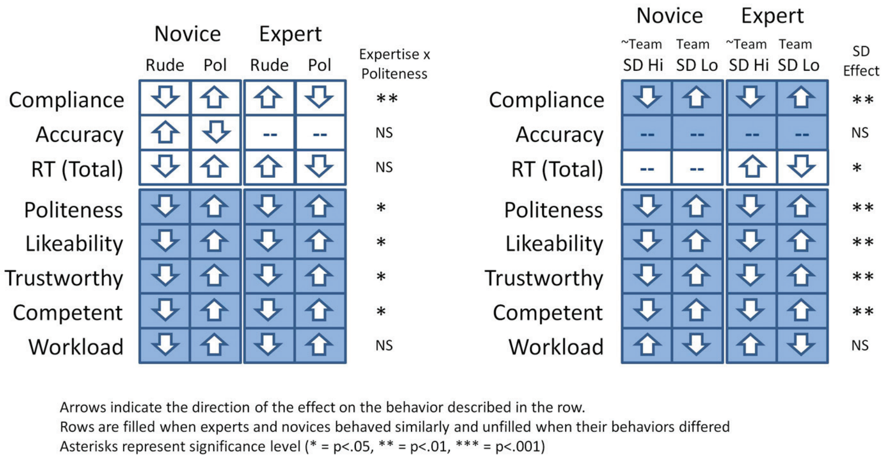

Figure 8. *Summary of the direction and significance of findings in the study.*

being directed to do something by a socially distant DG (in single directive conditions) had the added positive effect of reducing overall reaction time by approximately 3 s, although social distance made little difference to novices' reaction time.

With regard to subjective assessments, though, the effects of social distance were universally negative. Both novices and experts rated socially distant DGs to be, on average, less likable, less trustworthy, and less competent and said they experienced greater workload in interacting with them. Perhaps most interesting as a confirmation of a portion of the Brown and Levinson (1987) theory is that participants saw DGs with greater social distance as also less polite than those who were more socially near. This finding was in spite of the fact that the utterances delivered by polite DGs were randomly switched between the socially near and far DG across participants. In other words, the difference in politeness that the participants perceived can be attributed not to any variation in the wording (or appearance or delivery) of the utterances but only to the fact that participants were told during the familiarization session that the utterances were coming either from a socially near team member or a socially distant nonteam member.

Politeness and Expertise

Politeness affected both novices and experts, although it sometimes did so in different and opposite directions. A polite DG tended to be complied with significantly more frequently by novices, but professionals complied with rude DGs significantly more frequently. In addition, at least the status component of reaction time behaved similarly, although this trend did not reach significance for the combined total reaction time data. For status reaction time, rude DGs were complied with more promptly by novices and less promptly by experts, whereas reaction times were reversed for polite DGs—although the differences were never more than approximately 1 s in duration in all cases.

The effects of rudeness on the subjective parameters evaluated were universally negative, however, and showed no difference in behavior between novices and experts. All participants rated rude DGs as being significantly less polite, likable, and trustworthy and tended (although nonsignificantly) to rate them as producing more workload.

The Brown and Levinson (1987) Model and Directive Compliance With Experts Versus Novices

The Brown and Levinson (1987) model of politeness seems to have provided a good prediction and explanation of these results, with one important modification. As discussed earlier, the relationship between social distance and perceived politeness in the Brown and Levinson model is one of negative correlation: The model predicts that the same utterance given by a socially distant individual should be perceived as more face threatening and, therefore, less polite or more rude than if it came from a socially near person, all other things being equal. In the present study, those DGs who were socially near and used polite utterance forms should have been perceived as even more polite than those who were socially distant and polite, and those who were socially near and rude should be seen as less rude (more polite) than those who were socially distant and rude. This is exactly what happened for both novices and experts in the subjective rating data of DG politeness collected as a part of the posttest (cf. "Perceptions of Directive Givers"). This resulted in significant main effects for both social distance (team membership) and politeness level on the perceived politeness of the DGs. It did not produce a significant interaction between those factors, but then that was not expected, given the hypothesized effects from the Brown and Levinson model. One implication of these findings is not only that the Brown and Levinson model did a good job of predicting perceived politeness but also that novices and experts perceived the politeness of the DGs in similar ways in this study—or, more specifically, that their ratings of character politeness did not differ significantly.

Although politeness perceptions of DGs were similar between experts and novices, their compliance behaviors in response to the directives given by those DGs did, frequently, differ. Results suggest a similar effect may be present for reaction time as well. Specifically, although politeness made less difference in compliance rates for professionals compared with novices (10% vs. 34%; see Figure 4), both differences were significant. Politeness made a marginal, and roughly equal, small difference in status response time for both groups, albeit in opposite directions (see Figure 7).

This finding is not one that is obviously predicted by the Brown and Levinson (1987) model, and thus, it requires further explanation. Increasing perceived politeness was hypothesized to accompany increased directive compliance and increased (i.e., longer) reaction times. Although there were no specific predictions about accuracy effects associated with politeness, there was no reason to expect that experts and novices would behave differently on this parameter.

We can attest, on the basis of many presentations and discussions of this politeness work and theory, that some professional military and commercial operators are resistant to the idea that politeness plays a role in their day-to-day activities. A common attitude seems to be that when it comes to performing high-criticality work, trained operators "dispense with protocol" and "get down to business." In fact, many of the professional combat air controllers who participated in this experiment had said (informally, in postexperiment discussions) that they were trained to ignore politeness in their interaction—to "have a thick skin and a short memory," as one operator put it. The expert responses to the posttest questions in this study showed that the majority of expert participants shared this opinion, to at least some degree: 62.5% stated that the politeness of a DG had no impact on their willingness to give answers to that DG.

Yet these data show that expert combat air controllers were not immune to the effects of politeness in their compliance rates, at least in a segment of their response times and in many of their subjective ratings of the DGs—although, again, their reactions to politeness were sometimes the opposite of novices' reactions. Another comment received from several of the experts in postexperiment interviews may provide a clue as to why. Several participants said that they were trained to view indications of pilot stress in communicating with the combat air controllers as evidence of criticality or urgency of that pilot's need for support. There might well be a correlation between stress indicators and the verbal behaviors included to convey rudeness. In fact, Brown and Levinson (1987) identify "imposition" as one of the dimensions that enhance perceived face threat and, conversely, they posit that increased threat (from unredressed or rude language) can be interpreted as signaling increased imposition. Miller (2009) argued that using "impolite" behaviors (such as bursting into one's office and yelling, "Get out now!") is a characteristic of alarm behaviors—which use enhanced "rudeness" to call attention to (and increase the imposition of) a state that is in the hearer's best interest—and that some accidents can be traced to a lack of imposition conveyed by the speaker or inferred by the hearer. Since it was the air controllers' duty to assist the pilots in their operations, it seems reasonable and adaptive that rudeness be interpreted in this way. For example, at least one of the informants mentioned that a pilot's "cursing me out" would be taken as a sign of stress and, therefore, of that pilot's need for greater attention and support.

This finding implies that the underlying perception of politeness versus rudeness would be similar for both novices and experts in this experiment (as was found) but that experts have been trained to use politeness and rudeness cues for different ends. Instead of taking them as personal attacks on their "face" or attempts to assert dominance or unfriendliness (as Brown and Levinson's [1987] model would suggest are alternate explanations), they instead take them as evidence of urgency or importance of the need. This urgency, in turn, results in differences in response behavior. Instead of being less likely to comply, experts instead (and in keeping with their role as support agents for pilots) offer significantly higher rates of compliance.

The data seem to bear this explanation out, at least with regard to compliance. For perceived politeness of DGs, and for all the subjective parameters, there was both a significant main effect of social distance and a significant main effect of politeness but no interaction with participant expertise. In other words, for both novices and experts, using polite language enhanced a DG's perceived politeness, as did the social nearness of the DG. Furthermore, both politeness and social nearness had a positive effect on all of the subjective parameters for both novices and experts: increasing ratings of likability, trustworthiness, and competency and (nonsignificantly) reducing perceived workload.

When it came to the objective performance parameters, however, the main effect of social distance continued to operate similarly on compliance for novices and experts: Increasing social distance reduced compliance for both groups. But the politeness of the DG affected experts differently than novices—and differently than might have been expected from the generally positive effects of increased perceived politeness on the subjective parameters described earlier. For novices, increased politeness from the DGs resulted in significantly increased compliance, as might be expected for a stimulus that produces positive affect and enhances likeability. Experts were clearly perceiving politeness similarly to novices (both groups saw DGs intended to be more polite as being more polite, and both groups saw teammates as being more polite than nonteam members, with no expertise effects or interactions in perceived politeness). But experts reacted to the rude DGs with significantly *increased* compliance, a somewhat unusual response for an aversive stimulus but in keeping with one that signals increased importance, priority, or urgency.

Reaction times offered ambiguous data for this explanation. Experts tended to take longer when responding to rude DGs than to polite ones, whereas novices behaved in the opposite fashion. This was true only at the status reaction time level, and the effect diminished and did not reach significance at the total reaction time level. One interpretation could be that experts were intentionally being more careful in responding to the more important, urgent, or "needy" rude DGs, whereas novices spent more effort and time responding to the more pleasant, polite DGs. Alternatively, experts could have been less responsive to unpleasant, rude DGs. In either event, this finding serves as another example, albeit a weak one, whereby experts have inverted their responses to politeness cues.

Group Composition and Attitude Differences

It should be noted that participant pools differed in dimensions other than strictly their expertise levels. Particularly, the novices involved in the first experiment were drawn from a college population with an emphasis on attracting culturally and ethnically diverse individuals (although 50% were American by background on all dimensions measured), although there was no single, dominant pool of non-American participants, and those recruited differed in cultural dimensions (Hofstede, 2001). The combat air controllers used in the second condition, by contrast, universally identified themselves as American on all dimensions. These differences in the sample groups cannot be ruled out as possible alternate or contributing explanations for the differences observed, but there is also no a priori reason to believe that they should have contributed to them. In particular, the use of varied ethnicities among a novice population might be expected either to produce diverse politeness effects associated with their various native cultures or to diminish the effects of American English politeness usage. In either case, this variable would weigh *against* finding an effect in the novice data examined and, thus, represents a conservative bias in the study.

Finally, participants' answers to the free-response questions provide interesting data about the perceptions both groups have of their directive response behaviors. Whereas novices were generally very aware and willing to admit that politeness and, to a lesser degree, team membership influenced whom they chose to respond to, professional participants were much less so. And yet, as seen earlier, both groups were affected by both dimensions, and professionals were frequently more strongly affected. Whether this result was because of a lack of awareness of these effects on the part of professionals or of a lack of willingness to acknowledge their influence, in either event, experts were not acknowledging effects that politeness and social distance clearly had on them.

Summary and Conclusions

The results of this experiment show that at least in the paradigm developed using the PAMMI test bed, politeness clearly does influence the directive response and compliance behaviors of both experts and novices. Furthermore, it shows that the Brown and Levinson (1987) model does a reasonable job of qualitatively predicting the effects of social distance and the use of polite, redressive behaviors in a directive on the perception of the politeness of that directive and on the likability, competence, and trustworthiness of the DG. Both experts and novices were affected similarly in their subjective perceptions of these dimensions.

With regard to objective response behaviors, however, experts and novices differed. It seems reasonable to believe, as experts themselves claimed, that this difference is attributable to a conscious effect on the part of experts, perhaps produced in training or perhaps as a part of the culture in combat air operations, to interpret rude behaviors as a sign of increased need or urgency rather than as a sign of power assertion or social distancing.

It should perhaps not be remarkable that such a deeply embedded social signaling system as politeness in language should be difficult to eradicate from discourse—even highly critical, work-related discourse—between social actors and agents. To find that experts are not as successful as, perhaps, they would like to believe at suppressing the use of politeness, but instead have focused its usage in a way that is adaptive and useful in their work domain, is in keeping with the successful performance of the complex and demanding job of combat air control.

Of course, this simple, lab-based test bed is not an adequate test of the behavior of well-trained expert performance in a real-world, high-criticality task. Participants were not really engaged in fire control in a national park, and they were well aware of that. Moreover, the DGs were simulated and highly constrained in their verbal interactions with the study's participants. No overt attempt was made to convince participants that they were interacting with anything other than simulated agents, and it is highly unlikely that they believed they were interacting with real humans. Thus, it is likely that they were adopting a role in their relationships with the DGs and that real behaviors might well differ. On the other hand, it may well be that the richness and multimodal nature of real human-human communication (even when mediated by chat, e-mail, or radio communication media) will serve to enhance these interpersonal effects.

Similarly, no confident predictions can be made about whether these effects will hold for human-machine communication and interactions on the basis of these results. Although the agents in this study were only minimally personified and were, in fact, very mechanical in their generation of requests with accompanying politeness behaviors, they were presented as actual human actors, and participants' response to true machines may be different.

But at a minimum, these results show the importance of considering the social relationships between actors and the methods (such as politeness) by which those relationships are signaled and controlled in the design and analysis of technical and sociotechnical systems for human interaction. Politeness relationships do have a measurable, practical impact on human interactions in and with such systems and, therefore, must be regarded as a legitimate concern of human factors engineers and researchers. Practical applications of these results may include the design of social interaction protocols in work settings—either between humans or between humans and automation—so as to take advantage of innate politeness reactions (e.g., enhanced compliance rates and speeds, trust, liking, and reduced perceived workload) and the selective use of rudeness to achieve equally desirable behaviors (e.g., increased compliance accuracy or even reduced trust). Alternatively, these results also suggest that training (whether explicit or implicit) can have an impact on what people do with their politeness perceptions. Thus, explicit training in perceiving and interpreting politeness cues, along with desirable responses customized to the work setting, may also represent a practical application of these results.

Acknowledgments

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