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Dedication

To my father, my mother,
and my husband…
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Abstract

For over a decade, researchers have been investigating the potential of pedagogical agents to promote learning. Most of the research in this area has focused on addressing students’ cognitive needs at the expense of affective needs. Intelligent tutoring systems designed following this philosophy have been very effective compared to traditional methods of tutoring (Ritter, Anderson, Koedinger, & Corbett, 2007; VanLehn et al., 2005). However, in recent years, pedagogical agent researchers have begun to appreciate that ignoring student’s affective needs can potentially diminish the effect of cognitive tutorial strategies. To address students’ affective needs, some pedagogical agent researchers (Lester et al., 1997a; Johnson, Rickel, & Lester, 2000; Moreno, Mayer, Spires, & Lester, 2001) began to exploit Reeves and Nass’ (1996) Media Equation, which holds that users respond to interactive media as if they were social actors. Investigations following the Media Equation have tended to focus on the media used to realize the pedagogical agent, e.g., the use of animated talking heads and voices, and the results have been mixed. In my thesis, I focus instead on the manner in which a pedagogical agent communicates with students, i.e., the extent to which it exhibits social intelligence. I propose the hypothesis that pedagogical agents with socially intelligent strategies
can affect learning outcomes. I investigated this hypothesis by studying the effect of politeness tactics in two different learning environments, across two different domains: industrial engineering and language learning. Results from these studies support this hypothesis, demonstrating the effect of socially intelligent tactics on learning outcomes. Comparison of results across studies helps to clarify our understanding of the processes whereby tactics employed by pedagogical agents can affect learning outcomes.
Chapter One

Introduction

1.1 Motivation

In recent years there has been significant progress in the development of advanced computer-based learning environments that can interact with learners, monitor their progress, and provide individualized guidance and feedback. Historically speaking, intelligent tutoring systems (ITSs) have focused on attending to students’ cognitive needs — suggesting actions to perform, correcting mistakes, and explaining concepts— and have tended to ignore students’ affective needs such as self-efficacy and interest. ITSs that do not attend to student motivational states can inadvertently undermine them, for instance when the system says “Your answer is wrong” (affecting learner self-confidence), or “Now execute this action” (affecting learner initiative). However, educational researchers increasingly recognize the importance of affective factors and their contribution to learner intrinsic motivation (Sansone & Harackiewicz, 2000) and hence to learning outcomes.
Researchers have, for several years, been investigating the potential of pedagogical agents to promote learning. Pedagogical agents are defined as “lifelike agents that facilitates learning” (Johnson et al., 2000). One of the most influential papers in pedagogical agents was the study by Lester et al. (1997a) that demonstrated a Persona Effect. In their paper, Lester et al. reported a study in which an animated pedagogical agent named Herman the Bug facilitated learning in an intelligent learning environment named Design-a-Plant. They posited the Persona Effect, that an animated pedagogical agent with a life-like persona and expressed affect could facilitate learning.

The rationale for this research has been the media equation hypothesis proposed by Reeves and Nass (1996). Byron Reeves and Cliff Nass, with their colleagues, have been investigating how results from social science research can also apply to human-computer interaction research. In their Media Equation hypothesis, they propose that people respond to media, including computer-based media, as they do to other people. They argue that designers of computer systems should take this similarity into account, and be prepared for the possibility that users will attribute human-like attributes, such as personality, to their designs. For example, studies show that people tend to respond positively to other people that flatter them, and so likewise designers of computers systems should choose messages that flatter their users.

Soon after Reeves and Nass began publishing their work on human-computer interaction, researchers in intelligent learning environments began to investigate how
the Media Equation might apply to educational software, such as the studies by Lester et al. (1997a). The idea was that if users tend to attribute human-like characteristics to computer systems, this effect might be accentuated in an on-screen character that assumes human-like form. An animated persona could emulate other aspects of human-human interaction, such as emotion and empathy, which have a role in tutorial interaction (Cooper, Brna, & Martins, 2000).

A number of pedagogical agent investigations have been conducted, seeking to understand the Persona Effect in more detail, and replicate it in a range of learning domains (Johnson et al., 2000; Moreno, Mayer, Spires, & Lester, 2001). The results of these studies have been mixed. André, Rist, and Müller (1998) demonstrated that an animated agent could help reduce the perceived difficulty of instructional material, and Bickmore (2003) reported that subjects liked an animated agent that responded socially to them. But in neither study did the agent yield differences in learning gains. Further studies (Atkinson, Mayer, & Merrill, 2005; Graesser et al., 2003; Mayer, Fennell, Farmer, & Campbell, 2004; Mayer, Sobko, & Mautone, 2003; Moreno & Mayer, 2000, 2004) suggested that it was the voice of the animated agent that influenced learning, not the animated persona at all.

The animated persona itself may not be the primary cause of the learning effects of animated agents. Rather, if, as Reeves and Nass suggest, learners respond to pedagogical agents as if they are social actors, the agents’ effectiveness should depend upon whether or not they behave like social actors. To design pedagogical
agents following the “social actors” hypothesis of the Media Equation, we must first understand how real-life social actors –human tutors – behave. In particular, how human tutors address student’s affective as well as cognitive needs.

Human tutors make extensive use of social intelligence when they motivate and support learners (Lepper, Woolverton, Mumme, & Gurtner, 1993). One way to study how human tutors address both a student’s cognitive and affective needs is when there is a conflict in addressing these two needs at the same time, such as when criticizing the student. Porayska-Pomsta (2004) studied how human tutors deliver criticism to students. She observed that expert human tutors use a wide range of strategies to phrase criticism so that it can indirectly “get the message through” without “hurting student’s motivation”. She linked the “indirectness” in the feedback to the notion of politeness. She tried to use the politeness theory (Brown & Levinson, 1987) to explain the various strategies used by the tutor to phrase the tutorial feedback.

How does politeness help promote motivation in tutorial feedback? Let’s first look at two examples. The human tutor notices that the student made a mistake and decides now is the best time to point out the mistake to the student. The tutor could simply say, “You did it wrong.” In extreme cases, this feedback could be disruptive or jarring for the student. Used repeatedly, this type of feedback could leave the student with low self-efficacy and no desire to continue learning. Instead, the tutor could phrase the feedback as, “We didn’t get this one right.” In this version of the
feedback, by replacing “I” with “we”, the tutor shares the responsibility of making the mistake with the student. It assigns less responsibility and casts less blame to the student. In this example, the tutor told the student that there is a mistake without discouraging them. In other words, the feedback addresses both the student’s cognitive and affective needs.

Now that the tutor has told the student that a mistake was made and wants to suggest the student make another attempt, the tutor could simply say “Try it again.” Or the tutor could rephrase it as “How about we try it again?” The first form of feedback is very direct. With the second phrasing, the tutor presents the feedback as a question, which gives the student the option of not following the suggestion. In this way, the tutor gives the control of “when to learn what” back to the student. Later, we will discuss how giving students the sense of control can motivate them to spend more effort in learning and achieve better learning outcomes.

In both examples, politeness strategies are used to rephrase the feedback. The strategy used in the first example is described as “establish common ground”. The strategy used in the second example is called “question”. Both strategies are described as face-threat mitigating strategies in the politeness theory proposed by Brown and Levinson (1987). In their book, Brown and Levinson argue that people in all cultures have face wants. They have a desire for positive face and negative face. Positive face is the want of one’s wants to be desirable to others. Negative face is the want of one’s actions to be unimpeded by others. Many interactions between people,
such as requests or instructions, potentially threaten face, and so people employ a range of politeness strategies to mitigate face threat and lessen an utterance’s impact on positive or negative face.

As we have seen in the earlier examples, tutorial interactions can involve face threat. When tutors give instructions to learners, they potentially threaten the learners’ negative face and want for autonomy. When tutors tell learners what they did wrong, they potentially threaten learners’ positive face and want for approval. In our series of studies to investigate how human tutors interact with learners (Johnson, Kole, Shaw, & Pain, 2003a; Johnson, Wu, & Nouhi, 2004c), we found that human tutors use a range of tactics to redress students’ face across different domains.

Could the politeness theory of Brown and Levinson (1987) be used to explain the observed tutorial tactics as pointed out by Porayska-Pomsta (2004)? Is there more to tutorial interaction than face threat mitigation? Good tutors may not simply phrase their comments to avoid negative impact on learner face, they may also actively seek to influence learners’ underlying wants for autonomy and approval. This could be part of tutors’ overall objective of motivating learners and encouraging them to devote effort to learning. If pedagogical agents adopt these politeness strategies used by human tutors, would the agents be as effective as human tutors in promoting learning and motivation?
1.2 Objective and Approach

In this thesis, I examine a different approach to applying the media equation hypothesis to intelligent tutoring, which focuses on socially intelligent behavior of the pedagogical agent, in particular the use of politeness strategies. The main question I am investigating is:

“How does politeness influence learning?”

To answer this question, I break down the investigation into three stages:

Stage 1: How to integrate politeness into tutorial feedback?

Stage 2: What effect would polite tutorial feedback have on learning?

Stage 3: How would polite tutorial feedback affect learning?

My hypothesis is:

H1: Pedagogical agents that use appropriate politeness strategies can improve learning outcomes.

I further propose the sub-hypothesis:

H2: Pedagogical agents with appropriate politeness strategies improve learning outcomes by promoting learner motivation.

In the chapters that follow, I will review the literature on politeness tactics and examine how politeness affects learning and motivation. I will then propose a model of how socially intelligent interaction can influence motivation and thereby learning outcomes. The proposed model will predict the extent to which socially intelligent tactics can affect learning outcomes in a learning environment. However, the effect
of politeness depends upon the extent to which the environment allows for the possibility of affecting learner motivational factors. For example, if a learning environment affords learner choice and control, then tactics that promote the learner’s sense of autonomy and sense of control can have a positive effect. This depends in part on the design of the learning environment, and in part on the nature of the subject matter being learned (Person et al., 1995). I will present my investigation of this hypothesis by studying the effect of politeness tactics in two different learning environments, in two different domains: industrial engineering and language learning. Comparison of results across studies helps to clarify our understanding of the processes whereby tactics employed by pedagogical agents can affect learning outcomes.

1.3 Major Contribution

The thesis has the following major contributions:

1. There are no formal studies on the effect of politeness on learning. The thesis is the first comprehensive effort to study this effect.

2. In pedagogical agent research, most of the work focuses on the Persona Effect, which emphasizes making the agent look like human. The thesis uses a different approach to apply the Mediate Equation by making pedagogical agents behave like humans so that they exhibit social intelligence, and studies
their influence on learning. The work in the thesis would contribute to the research on intelligent pedagogical agents.

1.4 Thesis Outline

- Chapter 2 discusses related work.
- Chapter 3 discusses the politeness effect model.
- Chapter 4 discusses the first of the series of studies carried out in an industrial engineering domain.
- Chapter 5 discusses the second of the series of studies carried out in a language learning domain.
- Chapter 6 provides discussions and conclusions.
Chapter Two

Related Work

2.1 Pedagogical Agents

In 1984, Bloom presented a series studies of learning involving one-on-one interaction with tutors and suggested that learners who receive individual tutoring perform two standard deviations ($2\sigma$) better on average than learners who receive classroom instruction. Since then, researchers of intelligent tutoring systems (ITS) have sought to develop intelligent learning environments that can demonstrate learning gains approaching what human tutors are able to achieve.

State of the art ITSs have been focused on inferring the cognitive states of the learner and addressing cognitive needs. Techniques such as knowledge tracing have been widely integrated into ITSs like Andes (Conati, Gertner, & VanLehn, 2002), Algebra Tutor (Aleven, McLaren, Roll, & Koedinger, 2004), etc. Although addressing students’ cognitive needs is fundamental in tutoring systems, students’ affective needs shouldn’t be ignored. For those $2\sigma$ learning gains to be realized, it is important that the learning system promotes learner interest and motivation. If learners are not
motivated to continue working with a learning system, and cease using it, the
learning system cannot be effective.

Creating an embodied tutoring agent that plays the roles of a human tutor in ITS has
attracted considerable research effort (Figure 2.1). Earlier work on pedagogical agents
includes Cosmo (Lester, Voerman, Towns, & Callaway, 1997c) and Herman the Bug
(Lester, Converse, Stone, Kahler, & Barlow, 1997b). Cosmo is an agent who hovers
about in a virtual world of routers and networks and provides advice to students on
Internet packet routing. The work on Cosmo presented the research community with a
framework for achieving deictic believability in animated agents. Cosmo has a
behaviour planner that exploits a world model and an evolving explanation plan as it
selects and coordinates locomotive, gestural and speech behaviours. Several other
pedagogical agents similar to Cosmo were developed for various learning domains, such
as Steve (Rickel & Johnson, 1998), who assists user in operating the engines aboard US
Navy surface ships, and Adele (Johnson, Shaw, Marshall, & LaBore, 2003b), who helps
medical students examine a simulated patient, order and interpret diagnostic tests, make
diagnoses, and create treatment plans. As a relatively domain independent pedagogical
agent, the AutoTutor (Graesser et al., 2003) is created in a tutoring system that helps
students construct answers to deep-reasoning questions by holding a conversation in
natural language. Up until this point, pedagogical agents acted as guidebots in a virtual
learning environment. Marsella, Johnson and LaBore (2003; Johnson, LaBore, & Chiu,
2004a) explored creating tutoring agents such as Gina in an interactive drama to teach coping strategies for parents with children diagnosed with cancer.

Figure 2.1. Previous work on pedagogical agents.

In recent years, greater recognition of the importance of affect and motivation in learning has led increasingly to the development of socially-aware pedagogical agents as reflected in the work of Del Soldato and du Boulay (1995), De Vicente and Pain (2002) and Craig, Graesser, Sullins, & Gholson (2004). Heylen, Nijholt, op den Akker and Vissers (2003) highlight the importance of these factors in tutors, and examine the interpersonal factors that should be taken into account when creating socially intelligent computer tutors. Cooper (2003) has shown that profound empathy in teaching
relationships is important because it stimulates positive emotions and interactions that favor learning. Baylor and Ebbers (2003) have conducted experiments in which learners interact with multiple pedagogical agents, one of which seeks to motivate the learner. In her paper, Baylor (2005) summarized the series of studies on the impact of pedagogical agents’ appearances on students’ motivational and affective outcomes. Other researchers, such as Kort et al. (Aist, Kort, Reilly, Mostow, & Picard, 2002; Kort, Reilly, & Picard, 2001) and Zhou and Conati (2003) have been addressing the problem of detecting learner affect and motivation, and influencing it. Bickmore (2003) created a virtual fitness trainer called Laura who tries to address the trainee’s motivation and affect to establish a long term relationship with the trainee.

User interface and agent researchers are also beginning to apply the Brown and Levinson model of politeness to human-computer interaction in other contexts (Andre, Rist, & Muller, 1998; Cassell & Bickmore, 2003; Miller, 2002). Porayska-Pomsta (2004) used the Brown and Levinson model of politeness to analyse teacher communications in classroom settings. Her work demonstrated that politeness-based natural language generation in the context of teachers’ corrective responses can be used to model linguistic variation and that the resulting language is not significantly different from that produced by a human in identical situations. Although there are similarities between her approach and the approach described in this thesis, her model makes relatively less use of face threat mitigating strategies. This may be due to the differences in the social contexts being modelled. Also, her thesis mainly focuses on modelling the
situational factors that affect the generation of polite tutorial dialogue, with less focus on the effect of politeness tactics in tutorial feedback.

2.2 Politeness Theory

Brown and Levinson (1987) have devised a cross-cultural theory of politeness, according to which everyone has a positive and negative “face”. In their book, Brown and Levinson claim that “face” is associated with the notion of being embarrassed or humiliated. It is something in which people are emotionally invested and that can be lost, maintained or enhanced, and must be constantly attended to in an interaction. Face can be related to the notion of “want”: positive face is the want of one’s wants to be approved of by others (approval) and negative face is the want of one’s action to be unimpeded by others (autonomy). Some communicative acts, such as requests and instructions, can threaten the hearer’s negative face, positive face, or both, and therefore are referred to as Face Threatening Acts (FTAs). Tutorial interactions are examples of interactions that can involve face threat. When tutors give instructions to learners, or tell them the right way to solve problems, they can threaten the learners’ negative face or want for autonomy. When tutors tell learners what they did wrong, they can threaten learners’ positive face or want for approval. Consider a critique from a tutor to a learner: “You did not save the file. Save it now.” There are two types of face threat in this example; the criticism of the learner’s action is a threat to positive face, and the instruction of what to do is a threat to negative face.
In the Brown and Levinson model, evaluation of face threat depends upon several factors. First, the relative weight of different face threats is culturally dependent. This culture dependency is defined as the ranking of impositions by the degree to which they are considered to be interfering with one’s want of autonomy and approval. For the FTAs against positive face, the ranking involves evaluating the weights of different aspect of positive face such as “success”, “niceness”, “beauty”, “generosity” in a particular culture. For the FTAs against negative face, the ranking involves evaluation of rights and obligations in that particular culture. The weight of a face-threatening act also depends upon the relative power between the speaker and the listener. Tutors generally have power relative to learners, so we would generally expect tutors to make use of weaker politeness strategies when speaking to learners than the learners use in reverse. Finally, the weightiness of a face threat depends upon the social distance between the two parties. As two people interact over time, their social distance often decreases, reducing the severity of face threatening acts and increasing the likelihood of actions such as direct requests that lack face-saving features.

Speakers use various politeness strategies to mitigate face threats, according to the severity, or “weightiness”, of the FTA. In the above case (“You did not save the file. Save them now.”), the tutor could omit the criticism of the learner and focus on the suggested action, to save the file. Alternatively the tutor could perform the face-threatening act off record, so as to avoid assigning responsibility to the student. An
example of this would be “The file needs to be saved.” The face threat of the instruction can be mitigated using negative politeness tactics, such as with phrasing that gives the hearer the option of not following the advice, e.g., “Do you want to save the file now?” Positive politeness strategies can also be employed that emphasize common ground and cooperation between the tutor and learner, e.g., “How about if we save our file now?” Other positive politeness strategies include overt expressions of approval, such as, “That is very good”.

### 2.3 Motivation Theory

Motivation is derived from the Latin verb *movere* (to move). In Pintrich and Schunk (2002), motivation is defined as the process whereby goal-directed activity is instigated and sustained. Motivation can influence what, when, and how we learn (Schunk, 1991). Students who are motivated to learn about a topic are apt to engage in activities they believe will help them learn, such as attending carefully to the instruction, mentally organizing and rehearsing the material to be learned, taking notes to facilitate subsequent studying, monitoring their learning progress, evaluating how well they are doing and asking for help when they do not understand the material (Zimmerman & Martinez-Pons, 1992). Collectively, these deep learning activities can improve learning outcomes. Also, motivation bears a reciprocal relation to learning: motivation influences learning and what students learn influences their motivation (Schunk 1991).
Over the years, there has been disagreement about the nature of motivation and the operation of motivational processes. However, researchers agree on the behavioral indexes that indicate the presence of motivation. The commonly used indices are choice of tasks, effort and persistence. Choice of task is a natural indicator of motivation. When students have a choice, what they choose to do indicates where their motivation is. Despite the intuitive appeal of choice of tasks, choice often is not a useful index of motivation in schools or experiment settings because in many classroom and experiments, students typically have few if any choices (Brophy, 1983). Effort becomes the second index since learning often is not easy. Students motivated to learn are apt to expend effort to succeed. Persistence, or time spent on a task, is also commonly used by researchers as a measure of motivation. Students who are motivated to learn tend to persist at the task, especially when they encounter obstacles. Learners who choose to engage in a task, expend effort, and persist are likely to achieve at a higher level (Pintrich & Schrauben, 1992; Schunk, 1991).

Knowing the behavioral indicators of motivation, researchers increasingly are exploring how to structure cognitive and social factors to optimize learner motivation. The work of Lepper on highly effective human tutors (Lepper et al. 1997; Lepper & Woolverton 2002) shows that up to 50% of the human tutor’s interactions with their students are focused on affective elements. This is because learning, especially deep learning, tends to be affiliated with negative emotions, in
the face of cognitive disequilibrium (Piaget, 1952). Cognitive disequilibrium has a high likelihood of activating conscious, effortful cognitive deliberation, questions, and inquiry that aim to restore cognitive equilibrium. The affective states of confusion, and perhaps frustration, are likely to occur during cognitive disequilibrium (Kort, Reilly, & Picard, 2001).

Moreover, Lepper and Hodell (1989) identified several factors that contribute to learner motivation: curiosity, confidence, challenge, and control. If learners are self-confident and optimistic of their abilities to achieve success, they are more likely to devote effort to learning. If learners are curious about the subject matter, or the learning environment instills curiosity, they will pursue learning activities in order to satisfy their curiosity. Learners are motivated by learning experiences that are optimally challenging, neither too easy nor too hard. Finally, learners are more likely to be motivated if they have a sense of being in control of the learning experience, instead of being told what to do.

2.3.1 Sense of Autonomy

Sense of autonomy is a feeling that your actions are unimpeded by others. Sense of autonomy does not directly translate to “control” in educational psychology literature. The notion of “control” has two facets of meaning. The first facet refers to freedom of choice. Students are in control if they are free to choose what they want to learn, set their own learning goals, and make and follow plans to achieve their goals. Even in a classroom or experiment settings, when a learning task is given,
students often are free to choose how they want to carry out the learning task instead of just following the teacher’s instruction. The second facet refers to “locus of control”, which means the learner’s beliefs about the extent to which their behaviors influence outcomes. Students who believe they have control over whether they succeed or fail would be more motivated to engage in academic tasks, expend effort, and persist on difficult material than students who believe their actions have little effect on outcomes. In turn, these motivational effects should improve learning. Sense of autonomy is more in accordance with the first aspect of the notion “control”. Respect of learners’ need for autonomy promotes self-motivated and self-regulated learning. Providing learners with choices and a sense of control over their learning outcomes may enhance intrinsic motivation (de Charms, 1968; Deci, 1975).

deCharms (1968) used the concept of perceived locus of causality to emphasize that, when people feel autonomous, they experience the initiation of their behavior to be within themselves and they become more intrinsically motivated. On the other hand, when the perceived locus of causality is external to themselves, people tend to lose intrinsic motivation because their need for autonomy is not satisfied. Thus any factor that induces an external perceived locus of causality is predicted to diminish intrinsic motivation, and any factor that fosters an internal perceived locus of causality is predicted to enhance intrinsic motivation.

Numerous studies have found that positive performance feedback enhances intrinsic motivation because it supports perceived competence (Deci, 1971), while
negative performance feedback undermines intrinsic motivation because it diminishes perceived competence. Thus, telling people they did well at an activity tends to increase their interest in the activity, but telling them they did badly tends to diminish their interest (Vallerand & Reid, 1984). However, subsequent studies by Fisher (1978) and Ryan (1982) indicated that perceived competence enhances intrinsic motivation only if it is accompanied by support for autonomy. Kast and Connor (1988) did a comparable experiment in which they provided positive feedback in either a controlling or non-controlling style and found that controlling positive feedback undermined intrinsic motivation, whereas positive feedback that was clearly non-controlling enhanced it. This experimental result is consistent with Fisher’s (1978) and Ryan’s (1982) findings about the importance of giving positive feedback in a way that also supports autonomy.

2.3.2 Self-Efficacy

Compared to self-confidence, self-efficacy is subject-specific confidence in one’s ability to perform a task. As Bandura (1986, p. 391) defines it, “self-efficacy is people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances”. A polite tutor, not by simply flattering the student, but offering feedback in a way that meets a learner’s need for approval, can help increase a learner’s self-efficacy. Self-efficacy affects choice of activities, effort, and persistence. People holding low self-efficacy for accomplishing a task may avoid it; those who believe they are capable are more likely to participate.
Especially when they encounter difficulties, efficacious students work harder and persist longer than those with low self-efficacy.

Self-efficacy is strongly related to two of the motivation indices: effort and task persistence (Bandura & Cervone, 1983, 1986; Schunk, 1995). Learners with high self-efficacy are likely to exert effort in the face of difficulty and persist at a task, when they have the requisite skills. Self-efficacy has been linked to not just the quantity of effort, but the quality of effort in terms of the use of deeper processing strategies and general cognitive engagement of learning (Pintrich & Schrauben, 1992). Pintrich and De Groot (1990) found that junior high school students high in efficacy were more likely to report using various cognitive and self-regulatory learning strategies. In a series of experimental studies, Schunk (1982, 1983a, 1983b, 1983c, 1983d, 1984, 1996) found that students with stronger self-efficacy mastered various academic tasks better than did students with weaker self-efficacy. In addition, these studies showed that efficacy was a significant predictor of learning and achievement, even after prior achievement and cognitive skills were taken into consideration.

This pattern could be explained by the interdependent relationship between self-efficacy beliefs and self-regulated learning strategies (Gaskill & Hoy, 2002). Self-regulated learners have been described as individuals who set goals, plan, organize activities, monitor their progress, and evaluate how they are doing (Azevedo & Cromley, 2004; Zimmerman & Schunk, 2001). Level of self-efficacy predicts
student’s use of cognitive strategies and self-regulation. Use of these strategies then predicts academic achievements (Zimmerman, 1995). As students increase their use of learning strategies and their academic performance improves, their academic self-efficacy increases. Both self-regulated learning and self-efficacy judgments require a similar series of cognitive and meta-cognitive process, including self-observation, self-judgment, and self-reaction. In judging the discrepancy between “where I am” and “where I want to be”, the student ascertains whether current efforts have fallen short of the goal. If so, self-regulated learners can exert more effort or even try another strategy. If self-regulated learners see their progress toward a goal as acceptable, not only do they anticipate the satisfaction of reaching the goal, they also feel enhanced self-efficacy and motivation.

2.4 Politeness and Motivation

Although politeness theory describes tutorial interaction at the tactical level, there is much more to tutorial interaction than face threat mitigation. Good tutors do not simply phrase their comments to avoid negative impact on learner face. They may actively seek to influence learners’ underlying wants for autonomy and approval. This is particularly common in the Arabic tutors that we observed in one of our studies. Beginning learners of Arabic often have low self-confidence in their abilities, and so tutors actively seek to boost their self-confidence. This is part of
tutors’ overall objective of motivating learners and encouraging them to devote effort to learning.

Lepper and Woolverton (2002) studied highly effective tutors in remedial mathematics education and found that they employed motivational tactics in their tutorial dialogs that seek to promote and optimize the “4 Cs” that Lepper and Hodell (1989) have identified that promote learner motivation: confidence, curiosity, challenge, and control. There is a close correspondence between the face wants identified by Brown and Levinson and some of these motivational factors. Negative face is related to control, and so tactics that address learner negative face may also influence learner sense of control. Positive face is related to self-confidence; if learners have a sense that others approve of their performance, they are more likely to be more confident of their own performance, which will motivate them to persevere. Thus, the politeness tactics that we observed in our studies of human tutors can be viewed as part of the tactical repertoire that tutors can employ to promote learner motivation.
Chapter Three

Politeness Effect Model

In the literature review, I laid out the connection between politeness and motivation. When tutors attend to learner face and seek to mitigate face threats, it may be a simple matter of common courtesy, as in any polite discourse. I conjecture that there is more to it than that — that tutors employ politeness strategies in order to promote higher motivation and better learning results. I posit there is a relationship between learner face and learner motivational states, and that politeness strategies can affect the impact of tutorial tactics on motivational states. The motivational state of the learner during learning can in turn have an impact on learning outcomes. We call this the Politeness Effect.

If the Media Equation is correct, then the Politeness Effect could also be employed in computer-based learning environments. If the Politeness Effect holds, it could provide another tool to educational technologists to help narrow the $2\sigma$ gap identified by Bloom (1984). It could be used in conjunction with the Persona Effect, and could help explain why the Persona Effect applies for some pedagogical agents and not others.
We therefore propose a Politeness Effect Model (Figure 3.1) that’s based on Brown and Levinson's politeness theory. The Politeness Effect Model aims to help predict how politeness affects learning and what factors can influence the effect.

![Figure 3.1. The Politeness Effect Model](image)

### 3.1 Politeness Effect Model

When providing feedback comments on learner’s action, a tutor has both cognitive and motivational goals. The cognitive goal directly reflects the tutor’s intent to help learners learn better, such as by correcting mistakes, planning on what to learn next. The motivational goal is the tutor’s desire to improve learning by inspiring learners’ interest, maintaining their self-efficacy and control so that learners exert more effort in learning. To achieve the cognitive goal, a tutor typically carries out three types of communicative acts: criticize, suggest action and explain concept. The criticize acts...
aim to provide feedback regarding the learner’s action, e.g. the action is correct or incorrect. Even though some communicative acts, such as explaining concept, have no communicative intent regarding learner’s face, other communicative acts, such as criticizing a learner’s action for being incorrect, can potentially threaten a learner’s positive face. Suggesting action can potentially threaten the learner’s negative face. In addition, carrying out these face threatening acts directly can also conflict with the tutor’s motivational goal. To resolve these conflicts, the tutor weighs the risks and benefits of carrying out the FTA, and chooses the appropriate politeness strategies to alleviate the face threat inherent to their feedback comments.

According to Brown and Levinson, politeness strategies fall into three categories: positive politeness, negative politeness and off-record.

1. Positive politeness is redress directed to the learner’s positive face. Positive politeness is not necessarily redressive to the particular face want infringed by FTA; rather it is redressive to the general sense of being desirable to others. For example, using a positive politeness strategy called “exaggerate”, a tutor can praise learners achievement by saying “That’s incredible!” Mechanisms of positive politeness strategies include the speaker claiming common ground with the hearer by saying that they both belong to the same set of persons who share specific wants, including goals and values. Other mechanisms include conveying that both the speaker and the hearer are cooperators and fulfilling the hearer’s want.
2. Negative politeness is redress directed to the learner’s negative face. Compared to positive politeness, negative politeness is more focused and specific. It seeks to minimize the particular imposition that a FTA effects. Strategies in this category include phrasing requests as a question, impersonalizing by avoiding pronouns, such as “I”, “you”, and etc.

3. A communicative act is done off record if it is done in such a way that it is not possible to attribute only one clear communicative intention to the act. This is in contrast with bald-on-record, which means the communicative act has a clear communicative intent and is delivered without any face redress. A speaker uses off-record strategies when he wants to do a Face Threatening Act, but wants to avoid the responsibility for doing it and leaves it up to the addressee to decide how to interpret it. Off-record strategies can alleviate face threat by saying something that’s either more general or actually different from what one means. In either case, the hearer needs to make an inference to recover what the speaker’s intent was. Using off-record strategies, the speaker can satisfy the hearer’s negative face to a greater degree than that afforded by the negative politeness strategies.

A common tutorial feedback, such as “You didn’t set the parameter. Set it now.”, constitutes a criticism and a suggestion of action. As mentioned earlier, a criticism can create potential threat to learners’ positive face – their need for approval; and a suggestion can potentially threatens learners’ negative face – their need for
autonomy. If the tutor gives the feedback as it is, the feedback would be considered “bald-on-record”. To address the threat to positive face, tutor could apply positive politeness to the criticism (Figure 3.1). For example, the tutor could say “We didn’t set the parameter.” To address the threat to negative face, the tutor could apply negative politeness to the suggestion. For example, the tutor could say “Do you want to set the parameter?” Another way to address the threat to negative face is to use the off-record strategy. For example, the tutor could phrase the suggestion as “It’s important to set the parameter.”

A tutor can weigh the risks and payoffs and decide which strategy is the most advantageous in a particular circumstance. According to politeness theory, a tutor can assess the risk to his own face and the learner’s face through evaluation of the culture, social distance, and relative power as explained in Chapter 2. In terms of payoff, using positive politeness strategies can promote learner’s positive face and using negative politeness can promote learner’s negative face. However, by not using any politeness strategy, the tutor can also get credit for being honest and outspoken and avoid the danger of being misunderstood.

In the learning domain, there are other factors that can affect a tutor’s choice of politeness strategies. For example, research shows that overly praising the learner’s achievements can in fact hurt the learner’s self-efficacy in the end (Graham, 1990). Strategies such as “exaggeration” should be used only when the learner’s overall performance level matches the latest learner action. A tutor should also reconsider
some off-record strategies such as “be vague”, since it’s not always desirable in the learning context.

The Politeness Effect, if it exists, is not likely to apply identically to all learners in all learning environments. There are two main factors that can affect how polite feedback will be interpreted by the learner.

The first factor is the learning environment. The extent to which politeness can affect the learner depends on how much the learning environment allows for influence on self-efficacy and autonomy. For example, in a tutoring system where there is relatively little scope for learners to exercise their autonomy, politeness tactics that focus on learner autonomy may therefore have limited effect. The second factor that can affect interpretation of the feedback is individual difference. For example, for a learner who prefers direct feedback, feedback with positive politeness may seem insincere, and reduce the learner’s trust in the tutor and the effectiveness of the feedback. In other cases, feedback with strategies to redress negative face may seem confusing. There are other individual differences that may also interact with the politeness effect, including the ability to complete tasks, personality traits, such as extroversion, etc.

In general, feedback with proper face redressive strategies can help maintain a learners’ sense of control and promote their self-efficacy. By promoting learner’s self-efficacy, the learner spends more effort on the learning task and is more likely to persist when learning difficult concepts. By maintaining a learner’s sense of control,
the learner believes that he has control over whether he will succeed or fail. He is more motivated to engage in academic tasks, expend effort, and again persist on difficult material than those who believe their actions have little effect on outcomes. All of these motivational effects can in turn improve learning.

There are other factors that can affect the politeness effect such as frequency of feedback and how closely the presentation of the pedagogical agent corresponds to the Media Equation. The influence of these factors is not limited to the Politeness Effect and applies to learning and pedagogical agents in general.

### 3.2 Politeness in Tutorial Interaction

The Politeness Effect Model predicts that tutors will adopt strategies that redress learner face. This is in fact what we observed in our human tutors across different domains.

To investigate the role of politeness in learner-tutor interaction, we videotaped interactions between students and a human tutor while the students were working with a particular on-line learning environment, the Virtual Factory Teaching System (VFTS) (Dessouky et al., 2001). VFTS is a web-based factory modeling and simulation system. Students read through an on-line tutorial in a Web browser, and carried out actions on the VFTS simulation as indicated by the tutorial. Learners were supposed to analyse the history of previous factory orders in order to forecast future demand, develop a production plan, and then schedule the processing of jobs within the factory in
order to meet the demand. In our study, the tutor sat next to the students as they worked, and could interact with them as the student or the tutor felt appropriate. Completing the entire scenario required approximately two hours of work, divided into two sessions of around one hour each.

To analyse the interactions, and use them in designing learner-agent dialog, we transcribed them and annotated them using the DISCOUNT scheme (Pilkington, 1999). DISCOUNT represents the structure of educational dialogs as a series of episodes, each pertaining to a particular topic. Episodes are divided into exchanges between the parties in the dialog, which are composed of a series of turns (e.g., initiate, respond, reinitiate). Each turn consists of one or more dialog moves, classified according to speech act (hint, support, contradict, etc.) and marked with predicate labels that indicate the function of the move in the dialog. DISCOUNT is developed to help describe and evaluate educational discourse and, to mark representational levels of discourse which might be necessary for the generation of natural dialogues by machine.

The politeness theory of Brown and Levinson (1987) proved to be effective in accounting for the tutorial tactics observed in these dialogs. The following patterns of politeness strategies were associated with each type of tutor support (listed from most to least frequent):

- Suggesting actions:
  - To avoid threatening the students’ negative face, the tutor mostly applied negative politeness strategies, e.g.: “You will probably want to
look at the work centres”, or “Want to look at your capacity?” A negative politeness strategy used quite often by the tutor is “conventional indirectness”: a compromise between the desires to be direct and to be indirect, resulting in a communicative act that has a non-literal meaning based on conventions. Examples from our transcripts are: “They are asking you to go back and maybe change it”, or “What they’re telling you is to go and try to get the error terms”. This strategy enables the tutor to deflect to the system or interface the responsibility of requesting the students to perform an action.

- In other cases the tutor chose a positive politeness strategy, by phrasing suggestions as activities to be performed jointly by the tutor and the student, e.g.: “So why don’t we go back to the tutorial factory…”, or emphasize common goals between the tutor and the student, e.g. “Run your factory, that’s what I’d do.”

- Providing feedback:
  - Negative feedback might threaten the student’s positive face, so the tutor mostly used off-record politeness strategies, e.g.: “So the methodology you used for product 1 probably wasn’t that good.” In some cases, the tutor provided feedback by promoting interest and reflection, as well as affecting face, using “Socratic” communicative acts such as: “Well, think about what you did…”
In a preliminary study (Mayer, Johnson, Shaw, & Sandhu, 2006), students were asked to rate 16 tutorial statements on negative politeness (i.e., how much the tutor allows me freedom to make my own decisions”) and positive politeness (i.e., how much the tutor was “working with me”). Consistent with Brown and Levinson’s politeness theory, students rated direct commands and commands attributed to machines as the lowest in negative and positive politeness, rated guarded suggestions and guarded questions as the highest in negative politeness, and rated guarded suggestions and statements expressing a common goal as the highest in positive politeness.

We also studied a tutor in the language learning domain, tutoring Arabic pronunciation, and also found instances of face threat mitigation strategies. The tutor made attempts to avoid giving direct instructions, such as “Could you say that again?” instead of “Say that again.” The tutor also avoided direct criticism of learner mistakes, e.g., “I didn’t hear the H in the word” in place of “You left the H out of the word”, and used tactics to promote a sense of solidarity, e.g., “Good, we’re ready to move on” instead of simply “Move on”. Unlike in the virtual factory domain, however, the Arabic tutor also employed tactics to promote a positive attitude on the part of the learner, countering negative affectivity (e.g., “Don’t worry, you’ll be able to say ‘H’ soon”) and exaggerating positive performance (e.g., “You’re doing great!” and “Are you a native speaker or what?”).

According to the Media Equation proposed by Reeves and Nass, people respond to computer-based media as they do to other people. Following this rationale, the
politeness effect on promoting learning can potentially be applied to computer-based learning systems. To test this hypothesis, we conducted a series of evaluations of the Politeness Effect Model in two different computer-based learning environments: industrial engineering and language learning. Comparison of results across studies in different learning domains can help clarify our understanding of the processes whereby tactics employed by pedagogical agents can affect learning outcomes.
Chapter Four

First Study on Politeness Effect

In summer 2004, we conducted the first study to evaluate the politeness strategies in the context of the Virtual Factory Training System (VFTS) (Dessouky et al., 2001). VFTS is a web-based learning environment for factory modeling and simulation. We augmented the VFTS with a pedagogical agent that could utilize politeness tactics in providing guidance and feedback. An animation engine generated the nonverbal gestures for the agent (Shaw, LaBore, Chui, & Johnson, 2004), and a dialog tactic generator generated the verbal tutorial interventions (Johnson et al., 2004b). The study was conducted as a Wizard-of-Oz study, focusing on the differential effects of polite and direct tutorial interaction. A Wizard-of-Oz experiment system that included a student’s and an experimenter’s interface was created for the study. From the experimenter’s interface, the tutor can choose a student’s action to comment on and the type of tutorial intervention associated with the current pedagogical goal (e.g. “indicate action and explain reason” or “tell how to perform action”). The dialog tactic generator took as input the type of tutorial intervention to be performed, and the desired degree of positive and negative face threat redress, and automatically
generated a tutorial tactic with the appropriate combination of positive and negative politeness. The dialog tactic generator could use politeness tactics to mitigate the face threat inherent in various tutorial dialog moves, and use additional amounts of positive and negative politeness to influence the learner’s sense of confidence and control. The generated feedback is then sent to the agent on the student’s interface. Behind the scenes, Plan Recognizer and Focus of Attention modules monitor the student’s progress and present it on the experimenter’s interface.

4.1 The Student’s and Experimenter’s Interface

The student’s interface is shown in Figure 4.1. The Virtual Factory Teaching System (VFTS) is displayed on the left. The VFTS was developed for industrial systems engineering students for a product inventory and management class. Students model factories by specifying properties of machines and products, forecasting product demand, planning product release, and simulating product production for their factory.

At the top right of the interface is the Agent Window, which contains an agent with synthesized speech and animated gestures and a chat window for communicating with the agent (or human tutor in the current study). On the bottom right is a browser containing the tutorial. Students follow the tutorial on the VFTS using this browser that supports inline questioning, with all questions directed to the
agent (or the human tutor in the current study). The tutorial teaches the concepts and skills needed to understand and use the VFTS.

All student keyboard and mouse inputs are sent back to the server for the Plan Recognizer to analyze. The Plan Recognizer compares the student’s action with the expected action, categorizes the action as 1) progress toward the goal, 2) an error or inappropriate actions, or 3) a step performed in wrong order, and indicates what the next step should be.

Figure 4.1. Student’s screen during the Wizard-of-Oz experiment.

A web camera is placed on top of the monitor to track learner’s gaze. This, combined with keyboard and mouse information, is used by a Focus of Attention model to infer which window is the learner’s current focus (Qu, Johnson, & Wang,
The focus of attention information helps the system to determine the learner’s intended goal.

Figure 4.2. The tutor’s screen during the Wizard-of-Oz experiment.

Figure 4.2 shows the experimenter’s screen. On the bottom right is the Wizard-of-Oz interface, which is an interface to the underlying Dialog Generator. This semi-automated interface enables a human tutor to select tactics and use the politeness model to generate the tutorial dialog for those tactics. The main panel, with its four student activity windows, is on the lower right hand side. The windows display the student’s (a) completed plans (a group of actions that together achieve a specific goal), (b) current action, and (c) the inferred next action from the VFTS Plan
Recognizer. A fourth window displays the paragraph of the tutorial that is currently visible on the student’s interface, to help the tutor infer the learner’s goal.

To communicate with the student, the tutor selects an item in the student activity window (e.g., “copy_factory”) then chooses from among a set of communicative acts associated with the current pedagogical goal (e.g., “indicate action & explain reason” or “tell how to perform action”). The Dialogue Generator then automatically generates a feedback intervention based on the tutor’s selection (e.g., “How about we copy the factory?”). The intervention is sent to the Agent Window on the student interface. An animation engine (Shaw et al., 2004) produces the gestures and a text-to-speech synthesizer generates the spoken feedback.

The window at the top right is the interface for setting the parameters of the politeness model. In the experiment, the parameters are initialized at the beginning of a tutorial session and are not manually modified during the session. The window at the top left shows which area of the screen the student is focusing on, inferred by the Focus of Attention model. This enables the tutor to tell whether the learner is currently reading the tutorial, working on the VFTS or reading/typing in the Agent Window.
4.2 Extend Brown and Levinson’s Politeness Model

To produce a feedback dialog with proper politeness strategies, the first challenge is to determine which tactic to employ in which circumstances. How does the choice of interaction tactic depend upon the learner, the topic being discussed, and the state of the social interaction between the learner and the tutor?

The politeness theory of Brown and Levinson (1987) helps provide a rationale for these decisions. Although the Brown and Levinson model is not specifically aimed at modeling tutorial dialog, it provides a good means of accounting for variability in tutorial dialog. The interaction tactics observed in the recorded dialogs, except *bald-on-record* statements, have the effect of mitigating face threats. Since offers of advice and requests to perform actions are face threatening acts, the theory predicts that tutors will employ face mitigation strategies for these kinds of interactions, but not for other dialog moves such as explanatory comments. This is consistent with the observed data. The theory predicts that the incidences of face threat mitigation strategies will decrease as tutor and learner interact for longer periods of time. This trend is also observable in the data that we have collected; the incidences of *bald-on-record* tactics were greater in the follow-on tutorial sessions than in the initial sessions.
We extended the Brown and Levinson model in certain respects. First, whereas Brown and Levinson’s politeness model assigns a single numeric value to each face threat, we extend their model to consider positive face threat and negative face threat separately. This enables us to select a redressive strategy that is appropriate to the type of face threat. For example, if an FTA threatens negative face but not positive face, then the politeness model should choose a redressive strategy that mitigates negative face threat; in contrast the basic Brown and Levinson politeness model would consider a redressive strategy aimed at positive face to be equally appropriate. Second, we allow for the possibility that the tutor might wish to explicitly enhance the learner’s face, beyond what is required to mitigate immediate face threats. For example, if the tutor judges that the learner needs to feel more in control, he or she will make greater use of redressive strategies that augment negative face.

Altogether, the amount of face threat redress is determined by the following formulas, which are slight elaborations of the weighting formulas proposed by Brown and Levinson:

\[
W_{x+} = D(T,S) - P(T,S) + R_{x+} + \Delta_+
\]
\[
W_{x-} = D(T,S) - P(T,S) + R_{x-} + \Delta_-
\]

Here \(W_{x+}\) and \(W_{x-}\) are the amounts of positive and negative face threat redress, respectively, \(T\) represents the tutor and \(S\) represents the student. \(D(T,S)\) is the social distance between the tutor and the student, and \(P(T,S)\) is the amount of social power that the tutor has over the student. \(R_{x+}\) is the inherent positive face threat of the
communicative act (e.g., advising, critiquing, etc.), $R_{\xi}$ is the inherent negative face threat of the act, $\Delta_+$ is the amount of augmentation of positive face desired by the tutor, and $\Delta_-$ is the desired augmentation of learner negative face.

Additional factors clearly need to be taken into account besides politeness theory in order to fully account for the influence of interaction tactics on learner motivation. For example, politeness theory per se does not explain the relative infrequency in our data of comments aimed solely at positive face, e.g., expressions of praise. In our analyzed dialogs, positive praise is confined to the ends of VFTS sessions, when the learner has completed the assigned tasks. One way to account for this is to note that learners are motivated not just by positive face, i.e., to be approved of by the tutor, but by a desire for self-efficacy, via approval of their own performance. Since VFTS tasks take some time to complete, it is difficult to tell whether the learner is doing well until after the learner has committed a significant portion of the time needed to complete the task. If a learner recognizes this, then frequent praise from the tutor might be regarded as insincere. This is an account that needs to be tested in other domains, where there are more frequent opportunities to evaluate learner work.

### 4.3 Dialogue Tactics Generator

A politeness module that implements the politeness/motivation model described above was developed to interface to the natural language generator (Johnson et al. 2004b). The combined dialog generator takes as input the desired utterance type,
language elements, and a set of parameters governing face threat mitigation (social distance, social power, and motivational support) and generates an utterance with the appropriate degree of face threat redress.

The utterance types are classified in accordance with Bloom’s (1956; Anderson et al., 2001) taxonomy of educational goals. Bloom categorizes instructional actions into three groups: cognitive, concerning the development of intellectual abilities and skills; affective, comprising interests, attitudes, and values; and psycho-motor, regarding the manipulative or motor-skill area. The objectives most relevant to the VFTS are from the cognitive category: Knowledge, as in the recall of specifics, universals, methods and processes – such as mastering the concept of forecast, or the planning process; Application, specifically the use of abstractions in concrete situations – for instance the application of a specific forecasting method to the simulated factory; and Synthesis, the putting together of elements and parts so as to form a whole – such as producing a plan of operations to perform on the VFTS interface.

These cognitive goals, applied to the set of interface objects in the VFTS interface, and to the concepts and tasks described in the tutorial materials for the VFTS, determine the set of possible communicative acts that the dialog generator needs to generate. The repertoire of utterance patterns and language elements was extended as needed in order to cover this set.
To choose the appropriate interaction tactic, the politeness generator first computes target positive and negative politeness values for the desired utterance. The positive and negative politeness values are computed in order to counteract the weightiness of the face threat, as well as to achieve additional motivational influence, as indicated in the formulas in the previous section. Social distance, social power, and motivational influence are all parameters that are supplied to the politeness generator and are potentially adjustable.

Once the target politeness values are chosen, the generator chooses from a library of natural language templates, selecting the one that matches the target politeness values most closely. Each template is a combination of an utterance type and an appropriate politeness strategy. Each template is assigned a positive and negative politeness value. A template is chosen that minimizes the sum of the distances between desired and chosen politeness values, for both positive and negative politeness. When multiple templates have an appropriate politeness value, one is chosen that matches the greatest number of move predicates.

To apply this politeness module, it is necessary to assign politeness values to each template in the library. To assign these values, we grouped templates according to the politeness strategies that they exhibit. These categories were derived from analysis of the background dialog transcripts, and then mapped onto the general strategies identified by Brown and Levinson. We then assumed that all templates employing a given strategy should be assigned the same level of politeness—not
strictly true, since perceived politeness depends upon context, but adequate as a first approximation. We then created a questionnaire containing examples of different politeness strategies, and had subjects evaluate each example in terms of negative and positive politeness. The mean negative and positive politeness scores were then assigned to the templates in the library.

4.4 Operational Hypothesis

Based on Brown and Levinson’s politeness theory, we hypothesize that an intelligent tutor that adopts appropriate politeness strategies can promote a learner’s motivation and in turn improve learning results. Therefore we predict that students who learn to use the Virtual Factory Training System simulation with an on-screen agent who uses polite requests will learn better than students who learn with an on-screen agent who uses direct requests. More specifically, we hypothesize:

**H1:** students who learn to use the Virtual Factory Training System simulation with an on-screen agent who uses polite requests will do better on a post learning test than students who learn with an on-screen agent who uses direct requests.

**H2:** students who learn to use the Virtual Factory Training System simulation with an on-screen agent who uses polite requests will report higher motivational state than students who learn with an on-screen agent who uses direct requests.
4.5 Method

4.5.1 Participants

Forty-three students from the University of Southern California (USC) and University of California, Santa Barbara (UCSB) participated in the study. The students from USC were either engineering graduate or undergraduate students, and all were male. They volunteered to participate in the study. The students from UCSB were mostly undergraduate students from introductory psychology classes. They participated in the study in exchange for extra course credits. Of the 43 students, 25 of them are female and 18 are male.

4.5.2 Design

The experiment system was configured so that the on-screen agent produced polite suggestions (Polite group) or direct suggestions (Direct group) in response to learner queries. In the Polite group, positive and negative politeness values varied randomly in a moderate to high range, causing the tutor to use politeness in a variety of ways both in giving hints and in providing feedback. In the Direct group, positive and negative politeness values were fixed at minimum values, forcing the tutor to communicate directly and not allowing for mitigation of face threat. In all other respects the two groups were identical. Although politeness can manifest itself in other ways, e.g., through small talk (Cassell & Bickmore, 2003) we did not vary the amount of small talk in the two treatments, since that would have also changed the frequency of
interaction between the tutor and the students in the two groups, and would have made it more difficult to assess the cause of any differences between the treatments.

### 4.5.3 Measures

The pre-questionnaire packet includes a background questionnaire and a personality questionnaire. The background questionnaire solicited basic demographic information, including the learner’s age, gender, major, experience with computers, and background in engineering. The personality questionnaire consisted of 70 questions from the International Personality Item Pool (2003), intended to measure self-esteem, need for cognition, extroversion, and optimism. These four personality traits were measured because they could have an interaction with Politeness Effect.

The post-questionnaire packet includes a motivation questionnaire and a learning outcome test. The motivation questionnaire evaluated the learner’s motivation and perception of the tutor. The learning outcome test measured how much students have learned from the Virtual Factory Training System.

*Computer skills, engineering background, preference for indirect help*

All three scales were measured in the pre-questionnaire. Computer skills was measured using a single item, “My level of SKILL in using a computer is: ” with a 5 point metric (1 = Very low; 5 = Very high). Students were asked about their engineering background by answering “Yes” or “No” to the statement “I study/work in an engineering discipline.” To measure students’ preference for indirect help, we asked them to evaluate the statement “I prefer to be told about my mistakes in a DIRECT MANNER
or I prefer to be told about my mistakes in a POLITE / INDIRECT MANNER (e.g. direct: ‘This is wrong’, polite: ‘Perhaps you could try this…’)”. This scale was measured using a 5 point metric (1 = Strongly prefer direct; 5 = Strongly prefer indirect).

Self-esteem, optimism, need for cognition, extroversion

These four scales were measured using items from the International Personality Item Pool (2003) using a 5 point metric (1 = Very Inaccurate; 5 = Very Accurate). These items were issued in the pre-questionnaire packet.

Tutor helpfulness scale

We constructed an 8-item tutor helpfulness scale (coefficient alpha = .73), included in the post-questionnaire (Appendix I). This scale was measured with a 5 point metric (1 = Strongly Disagree; 5 = Strongly Agree). Sample items include: “The tutor made it easier for me to follow each step.” and “The tutor helped me to identify my mistakes.”

Self-efficacy scale

Self-efficacy was measured using a 3-item scale (coefficient alpha = .71) we constructed, presented in the post-questionnaire (Appendix I). This scale was measured with a 5 point metric (1 = Strongly Disagree; 5 = Strongly Agree). Sample items include: “I feel confident of my ability to complete another VFTS problem of the SAME LEVEL.”
Sense-of-Control scale

We constructed a 5-item sense-of-control scale (coefficient alpha = .63), included in the post-questionnaire (Appendix I). This scale was measured with a 5 point metric (1 = Strongly Disagree; 5 = Strongly Agree). Sample items include: “I felt I was given total freedom in making decisions at every step.”

Interest, like/dislike of the tutor, willingness to work with tutor again

We indexed the students’ interest using the item, “I think my interest increased as the tutorial progressed.” Like/dislike of the tutor was indexed using item “I like the tutor.” Willingness to work with tutor again was indexed using item, “I would like to work with the tutor again.” These items were presented to the subjects in the post-questionnaire. All three scales were measured with a 5 point metric (1 = Strongly Disagree; 5 = Strongly Agree).

Learning scale

Students were asked to take a test which contains 35 questions about the Virtual Factory Training System. Sample items include: “What does planning function do?” Within the 35 questions, 17 were easy questions and 18 were difficult questions. Both easy and difficult questions are included because a previous study (Lester et al., 1997b) on pedagogical agents shows that the effect on learning outcome may not be significant on simple questions but could be significant on complex questions. These questions were included in the post-questionnaire packet. Students were presented with the test after filling out the motivation questionnaire from the post-questionnaire packet. All
questions are multiple choice questions. Each question is graded for 1 point. There is a total of 35 points.

*Frequency of tutor intervention*

Frequency of tutor intervention was measured by counting how many times the tutor had intervened, then dividing it by the length of the session.

**4.5.4 Apparatus**

The apparatus consisted of a Dell desktop computer with a 20 inch color monitor at the student end and a Dell desktop computer with dual 20 inch color monitors at the tutor end.

**4.5.5 Procedure**

Students were randomly assigned to either a polite treatment or a direct treatment. Students were seated at a desk with a computer and were tested individually. Two pre-tests were administered: the background questionnaire and the personality questionnaire. To provide experience with the VFTS, the experimenter provided a brief introduction to the VFTS and asked the student to solve a basic assembly-line design problem. The learner then interacted with the VFTS – using either the polite or direct tutor – for approximately 35 minutes. Then, two post-test questionnaires were administered: the motivation questionnaire and the learning outcome test.
4.6 Results

Data from 6 students were excluded due to technical difficulties, early withdrawal or little interaction with the tutor. Of the remaining 37 students, 20 students served in the polite group and 17 served in the direct group. For each group, we calculated the average score of the learning outcomes tests and applied Student’s t-test to analyze the differences between the groups.

4.6.1 Tutor Helpfulness

When we designed the study, we wanted to manipulate the way tutorial feedbacks are delivered while keeping all other aspect of the study constant across conditions. One thing in particular we wanted to keep constant is tutor helpfulness because it can affect students’ learning outcomes. Tutor helpfulness can be affected by tutor attentiveness. In this study, how many times the tutor gave feedback to the students depended on the students’ need. During the experiment, the tutor responded whenever students requested help. When students didn’t ask for help, the tutor intervened whenever he or she saw fit. During the experiment, tutor attentiveness was balanced under both experimental conditions ($M_{polite}=23.80$, $SD_{polite}=8.94$, $M_{direct}=26.59$, $SD_{direct}=13.72$, $t(35)=-.743$, $p=0.462$). The Pearson correlation test did not reveal any significant correlation between frequency of intervention and learning outcomes and motivation. In the post-questionnaire, we asked the students to evaluate how helpful the tutor was. From the post-questionnaire, we found no statistically significant difference between
students from polite and direct group on tutor helpfulness ($M_{\text{polite}}=2.05$, $SD_{\text{polite}}=0.47$, $M_{\text{direct}}=2.45$, $SD_{\text{direct}}=0.56$, $t(35)=-2.25$, $p=0.49$). This indicates that, from students’ point of view, tutor helpfulness was the same across conditions.

### 4.6.2 Learning Results

Overall, students who received the polite treatment scored better than students who received the direct treatment (Table 4.1). A t-test revealed that the difference between the groups was statistically significant ($t(35)=2.14$, $p=0.04$, $d=0.73$). The scores ranged from 7 to 31 with an average of 17.70. We further compared students’ performance on easy and difficult questions. On the easy questions, there is no significant difference between the polite and direct group ($t(35)=1.48$, $p=0.148$). On the difficult questions, there is a significant difference between the polite and direct group ($t(35)=2.35$, $p=0.025$). This is similar to the result from the Persona Effect study (Lester et al. 1997b).

<table>
<thead>
<tr>
<th>Learning Test</th>
<th>Polite</th>
<th>Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>19.45</td>
<td>15.65</td>
</tr>
<tr>
<td>SD</td>
<td>5.61</td>
<td>5.15</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy</td>
<td>9.20</td>
<td>7.35</td>
</tr>
<tr>
<td>SD</td>
<td>3.86</td>
<td>3.69</td>
</tr>
<tr>
<td>Difficult</td>
<td>10.25</td>
<td>8.29</td>
</tr>
<tr>
<td>SD</td>
<td>2.69</td>
<td>2.31</td>
</tr>
</tbody>
</table>

### 4.6.3 Motivation Results

We compared students’ answers to the post-questionnaire and found no significant difference on self-report of self-efficacy ($M_{\text{polite}}=3.97$, $SD_{\text{polite}}=0.76$, $M_{\text{direct}}=3.86$, $SD_{\text{direct}}=0.72$, $t(35)=-0.15$, $p=0.88$).
SD_{direct}=0.61, \ t(35)=0.45, \ p=0.653) \ and \ sense-of-control \ (M_{polite}=3.07, \ SD_{polite}=0.54, \ M_{direct}=2.96, \ SD_{direct}=0.81, \ t(35)=0.47, \ p=0.640) \ between \ Polite \ and \ Direct \ condition.

We didn’t find statistically significant difference between students who received polite and direct treatment on self-reported interest (M_{polite}=3.40, \ SD_{polite}=1.19, \ M_{direct}=3.35, \ SD_{direct}=0.86, \ t(35)=0.14, \ p=0.89).

### 4.6.4 Individual Differences

Since the politeness strategies had a positive impact on student learning overall, we are interested in whether certain subgroups of students were particularly influenced by politeness strategies. To investigate this issue we partitioned students into subgroups based on their responses to the background and personality questionnaires, and then compared the mean score on the learning posttest by polite and direct groups for each subgroup. A two-way between groups analysis of variance (ANOVA) were also conducted to explore the impact of individual differences and polite treatment on learning and motivation.

**Computer Skills**

VFTS is a relatively complicated computer-based teaching system. Better computer skills may help students understand the basic concepts of operations in VFTS better and in turn help them achieve better learning results. From students’ self-ratings of their computer skills, we found that almost all students rated their computer skills either average or above average. We then grouped students into 2 groups, 19 with average computer skills and 17 with above average computer skills (one student with
below average computer skill was not included). The main effect of computer skills on overall learning results is not significant. Neither is the main effect on self-efficacy and autonomy. This means students with above average computer skills did not perform significantly better than students with average computer skills on the learning test. Nor did their self-efficacy and sense of autonomy differ significantly with those of students with average computer skills. The interactions between computer skills and politeness effect on overall learning, self-efficacy and autonomy are also not statistically significant. This means students’ computer skills did not influence how politeness affects learning and motivation. We then compared the difference between polite and direct group within students with average computer skills and students with above average computer skills. For students with average computer skills, those who received polite treatment performed marginally better than those who received direct treatment ($t(17)=1.993$, $p=0.063$). We did not observe this difference within students with above average computer skills.

Table 4.2. Influence of computer skills on politeness effect.

<table>
<thead>
<tr>
<th></th>
<th>Average computer skills</th>
<th>Above average computer skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Polite</td>
<td>Direct</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Learning Test</td>
<td>Overall</td>
<td>18.42</td>
</tr>
<tr>
<td></td>
<td>Easy</td>
<td>8.25</td>
</tr>
<tr>
<td></td>
<td>Difficult</td>
<td>10.17</td>
</tr>
<tr>
<td>Motivation</td>
<td>Self-efficacy</td>
<td>4.05</td>
</tr>
<tr>
<td></td>
<td>Autonomy</td>
<td>2.93</td>
</tr>
<tr>
<td>Learning Test</td>
<td>Overall</td>
<td>21.00</td>
</tr>
<tr>
<td></td>
<td>Easy</td>
<td>10.63</td>
</tr>
<tr>
<td></td>
<td>Difficult</td>
<td>10.38</td>
</tr>
<tr>
<td>Motivation</td>
<td>Self-efficacy</td>
<td>3.83</td>
</tr>
<tr>
<td></td>
<td>Autonomy</td>
<td>3.28</td>
</tr>
</tbody>
</table>
**Engineering Background**

VFTS is a system designed for Industrial Engineering students. For students who do not work or study in an engineering discipline, such as psychology students, performing tasks in the VFTS could be much more challenging. We asked the students whether they work or study in an engineering discipline in the pre-questionnaire. There were 28 students without engineering background and 9 with engineering background. The main effect of engineering background on overall learning result is statistically significant \( F(1, 33)=14.40, p=.001, \eta^2=.304 \). Students with engineering background performed significantly better than students without engineering background. This significant difference is also shown in performance on easy learning questions \( F(1, 33)=33.95, p<.001, \eta^2=.507 \), but not difficult learning questions \( F(1, 33)=.408, p=.572, \eta^2=.012 \). We did not find any significant interaction between engineering background and politeness treatment on learning results. On motivation results, the main effect of engineering background on self-efficacy did not reach statistical significance \( F(1, 33)=1.64, p=.209, \eta^2=.047 \). However the main effect on autonomy did reach statistical significance \( F(1, 33)=.749, p=.01, \eta^2=.185 \). Students with engineering background reported significantly higher sense of autonomy than students without engineering background. However, we did not find any significant interaction between engineering background and politeness treatment on sense of autonomy. We then
compared the difference between polite and direct group within students with engineering background and students without engineering background. Within the students with no engineering background, there is a significant difference between the polite and direct groups on the overall learning result ($t(26)=2.403, p=0.024$). We did not find this difference within engineering students.

Table 4.3. Influence of engineering background on politeness effect.

<table>
<thead>
<tr>
<th>Without Engineering Background</th>
<th>Learning Test</th>
<th>Polite</th>
<th>Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>17.73</td>
<td>14.08</td>
</tr>
<tr>
<td></td>
<td>Easy</td>
<td>7.73</td>
<td>5.85</td>
</tr>
<tr>
<td></td>
<td>Difficult</td>
<td>10.00</td>
<td>8.23</td>
</tr>
<tr>
<td>Motivation</td>
<td>Self-efficacy</td>
<td>3.87</td>
<td>3.80</td>
</tr>
<tr>
<td></td>
<td>Autonomy</td>
<td>2.95</td>
<td>2.77</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>With Engineering Background</th>
<th>Learning Test</th>
<th>Polite</th>
<th>Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>24.60</td>
<td>20.75</td>
</tr>
<tr>
<td></td>
<td>Easy</td>
<td>13.60</td>
<td>12.25</td>
</tr>
<tr>
<td></td>
<td>Difficult</td>
<td>11.00</td>
<td>8.50</td>
</tr>
<tr>
<td>Motivation</td>
<td>Self-efficacy</td>
<td>4.27</td>
<td>3.79</td>
</tr>
<tr>
<td></td>
<td>Autonomy</td>
<td>3.44</td>
<td>3.60</td>
</tr>
</tbody>
</table>

**Preference for Indirect Help**

Direct help consists of tutor feedbacks that are devoid of any politeness strategy, while indirect help consists of feedbacks that are phrased using politeness strategies. For people with preference for indirect help, a polite tutor could be more effective than a direct tutor. Based on students’ preference of direct or indirect help, we grouped them into 3 groups: 15 preferred direct help, 13 preferred indirect and 9 had no preference. The main effect of preference of indirect help on learning results is not significant. Neither is the main effect on self-efficacy and autonomy. This means
that preference for indirect help did not affect students’ learning outcomes and motivation.

We then compared the difference between polite and direct group within students who preferred indirect help, students who preferred direct help and students with no preference. For students who preferred direct help or did not have any preference, we did not observe any difference made by the polite tutor. For students who specifically reported their preference for indirect help, the polite tutor had a significant impact on their overall learning performance ($t(11)=2.550, p=0.027$).

Table 4.4. Influence of preference on indirect help on politeness effect.

<table>
<thead>
<tr>
<th>Preference for Direct Help</th>
<th>Polite</th>
<th>Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Learning Test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>21.00</td>
<td>5.42</td>
</tr>
<tr>
<td>Easy</td>
<td>10.25</td>
<td>4.27</td>
</tr>
<tr>
<td>Difficult</td>
<td>10.75</td>
<td>1.28</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>4.08</td>
<td>.64</td>
</tr>
<tr>
<td>Autonomy</td>
<td>3.00</td>
<td>.55</td>
</tr>
<tr>
<td><strong>Learning Test</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>15.60</td>
<td>4.83</td>
</tr>
<tr>
<td>Easy</td>
<td>6.60</td>
<td>3.65</td>
</tr>
<tr>
<td>Difficult</td>
<td>9.00</td>
<td>1.87</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>3.67</td>
<td>.82</td>
</tr>
<tr>
<td>Autonomy</td>
<td>3.20</td>
<td>.51</td>
</tr>
</tbody>
</table>

**Personality Characteristics**

We measured 4 personality traits: self-esteem, optimism, need for cognition and extroversion. On self-esteem and optimism, we found our sample distribution was
skewed – most subjects had a high self-esteem and were optimistic. We grouped students based on their level of need for cognition and extroversion. Two-way ANOVA did not reveal any significant main effect of any personality scales on learning and motivation.

### 4.6.5 Motivation and Learning Outcomes

**Self-efficacy and Sense of Autonomy**

We conducted a Pearson correlation test between students’ self-report of motivation and their performance on the learning test. We found significant correlations between self-efficacy and overall learning result \( (r=.451, p=.005) \), self-efficacy and performance on easy learning questions \( (r=.376, p=.022) \), and self-efficacy and performance on difficult learning questions \( (r=.413, p=.011) \). This means that self-efficacy is an important predictor of learning outcomes. We also found significant correlations between sense of autonomy and overall learning result \( (r=.466, p=.004) \), sense of autonomy and performance on easy learning questions \( (r=.426, p=.009) \), and sense of autonomy and performance on difficult learning questions \( (r=.373, p=.023) \). The correlation between self-efficacy and sense of autonomy is also significant \( (r=.386, p=.018) \).

**Like/Dislike of the Tutor**

On the post-questionnaire, students were asked whether or not they liked the tutor. We grouped students into 2 groups based on their answers: 20 students liked the tutor and 17 did not, or had no preference. The two-way ANOVA tests did not show any
significant main effect or interaction effect on learning outcomes and motivation. This means that whether students like the tutor or not did not impact their learning outcomes and motivation. We conducted Pearson correlation test between like or dislike the tutor and learning outcome and motivation. None of the correlations are significant except the one with sense of autonomy ($r=.357$, $p=.03$). This shows that in this study sense of autonomy is a good predictor of whether students like the tutor or not. This also shows that whether the student likes the tutor or not is not an accurate predictor of learning performance.

*Want to Work with the Tutor Again*

We asked students in the post-questionnaire whether or not they would like to work with the tutor again. We grouped students into 2 groups based on their answers: 22 students indicated they would like to work with tutor again and 15 did not, or had no preference. The two-way ANOVA tests did not show any significant main effect or interaction effect. We then conducted a Pearson correlation test between whether or not they like to work with the tutor again and learning outcomes and motivation. We found significant correlations between whether or not they like to work with the tutor again and overall learning outcome ($r=.389$, $p=.017$), performance on difficult questions ($r=.411$, $p=.011$), self-efficacy ($r=.512$, $p=.001$) and sense of autonomy ($r=.375$, $p=.022$). This means that students like to work with the tutor again when the tutor increased their self-efficacy and sense of autonomy and helped them learn better, especially on difficult concepts.
4.7 Discussion

In this study, we observed the effect of politeness strategies on students’ learning performance, which we call the Politeness Effect. Across all students, a polite agent, compared to a direct agent, had a positive impact on students’ learning outcomes. For students with a preference for indirect help or who had lower ability for the task, the polite agent was much more effective than the direct agent.

We did not observe any significant effect on student’s motivation. In this study, we used a self-report questionnaire to measure students’ motivation change. Self-report questionnaires are easy to administer and score, but problems often arise when inferences must be drawn about students’ responses. A series of studies on personalized tutors (Moreno & Mayer, 2004) show that students rate a personalized and non-personalized lesson as equal in interest to them but they do better on a cognitive test with the personalized version. Perhaps people are not very good at gauging their level of motivation or interest on a questionnaire.

Students didn’t show a significant preference for polite or direct tutor. However, the study showed that students prefer to work with a tutor who promotes their self-efficacy, respect their sense of control, and help them learn better.

Tutorial advice and feedback are certainly not the only places to apply politeness strategies. In our study, we artificially restricted the use of politeness in tutorial interaction to ensure that the polite condition and the direct condition were as similar as possible. In real human-human interaction, people employ a range of additional
strategies to build rapport and react empathetically. These strategies have been modelled in other learning domains (Bickmore, 2003; Johnson et al., 2004c), and could complement the strategies studied here. In this particular study, these strategies are not included because they would have increased the frequency of tutorial interaction, making it harder to tell whether the politeness effect was really a consequence of the frequency of interaction rather than the politeness strategies themselves.

The study also showed that self-efficacy and sense of autonomy are related to learning outcomes. Higher self-efficacy and sense of autonomy are correlated with better learning outcomes. This supports the some of the theories (Schunk, 1982, 1983a, 1983b, 1983c, 1983d, 1984, 1996) that are the foundations of the secondary hypothesis, which states that motivation is the mediating factor between politeness strategies and learning outcomes. This makes us believe that further study needs to be conducted to test the secondary hypothesis.
Chapter Five

Second Study on Politeness Effect

From the first study, we observed the Politeness Effect on learning outcomes. The study shows that the tutorial messages of intelligent tutors should take politeness into account, as politeness may have an impact on the tutors’ effectiveness. Meanwhile, more research needs to be done to study whether it applies to other learning contexts. Language learning is a domain where motivation and attitude are considered as important as aptitude (Gardner, 1972). Other studies conducted showed that politeness strategies do occur pervasively in second language learning systems (Johnson et al., 2004c). To gain a better understanding of the role of politeness tactics and their effectiveness, we investigated their use in the context of another intelligent learning environment for learning Iraqi Arabic language and culture, Tactical Iraqi\textsuperscript{1} (Johnson, 2007).

\textsuperscript{1} Tactical Iraqi\textsuperscript{TM} is a registered trademark of Alelo Inc. in the United States and other countries.
5.1 Tactical Iraqi

Tactical Iraqi is one of several game-based courses developed by Alelo Inc.’s military products subsidiary, Alelo Tactical Language Training, LLC., based on earlier prototypes developed at the Information Science Institute of the University of Southern California. It is a training system that supports individualized language learning and helps military service members who may have no knowledge of foreign language and culture quickly acquire functional communication skills. Tactical Iraqi has versions specifically tailored to U.S. Marine Corps and U.S. Army personnel. Our study utilized the version developed for the U.S. Marine Corps.

Tactical Iraqi includes three modules: the Skill Builder, the Mission Game and the Arcade Game (Figure 5.1). The Skill Builder consists of interactive lessons and exercises, and interactive game experiences. Learners use headset microphones to interact with the software, along with the keyboard and mouse. Lessons, exercises, and game experiences all involve speaking in the target language; speech recognition software is used to interpret the learner’s speech. Learners also learn non-verbal gestures common to the target culture, and practice them in simulated face-to-face communication.

Learners are introduced to concepts of language and culture in the Skill Builder lessons, and practice and apply them in the Arcade Game and Mission Game. The Arcade Game is an example of a casual but engaging game which encourages repeated practice of selected communication skills. For example, in one of the
Arcade Game levels, the learner gives spoken instructions to his character to navigate through a stylized town, collecting points along the way. The Mission Game gives learners opportunities to practice their communication skills in realistic scenarios. Learners navigate their characters through a 3D game world, speaking with a variety of non-player characters. To play the game successfully one must adhere to social norms of politeness and etiquette when interacting with the characters in the game.

Figure 5.1. The three components of Tactical Iraqi: in the upper right corner is the Skill Builder; in the lower left corner is the Mission Game; in the lower right corner is the Arcade Game.
Politeness and etiquette play multiple roles in Tactical Iraqi and related courses. The Skill Builder gives learners feedback on each spoken input and exercise response, and this feedback can obey principles of polite tutorial dialog. When learners enter the Mission Game scenes they can be accompanied by a virtual aide character, who can make suggestions of what actions to perform and what to say. These suggestions also follow principles of politeness. We therefore undertook experiments to vary the use of politeness tactics (e.g. delivery of feedback in a direct or polite way) in the tutorial interactions in Tactical Iraqi, and investigate whether this has an effect on learner motivation and learning effectiveness. The current investigation focuses on the delivery of feedback in the Skill Builder.

5.2 Feedback in the Skill Builder

To study tutor feedback in Tactical Iraqi, we videotaped sessions of human tutoring in the context of Tactical Iraqi. During the tutoring session, a professional teacher sat beside a student and was free to interrupt the learner while he or she worked with the Tactical Iraqi. Analysis of the videos revealed four different types of tutorial feedback:

- Acknowledgement/Criticize: Acknowledges that the learner action is correct or incorrect. When it’s incorrect, the tutor explicitly points out errors in learner's action.
• Elaborate: Explains a language fact related to the learner’s action, e.g. a common reply to “Ahlan wa sahlan” is “Ahlan biik” where “biik” literally means “in you”. Tutor often impersonalizes the elaboration and uses various strategies to help students memorize the language fact, such as repetition, related to prior knowledge, truncation, etc.

• Suggest Action: Offers hints to the student for the next step, e.g. “How about that if you say “ma-ftihemit?”

• Recast: When the learner makes a mistake, instead of explicitly criticizing the action, the tutor simply demonstrates the correct action, e.g. for a phoneme drop error of “t” in “mit'essif”, the tutor slowly repeated after the learner, "mit'essif”.

From the video, we also noticed that tutor would employ strategies purely for motivational purpose. For example:

• Encourage Effort: Feedback aimed to elicit more effort from learner, e.g. “I’m sure you can make it, keep going.”

• Consolation: Consoles the student by saying his errors are expected, e.g. “This is hard. It takes a little bit more time to get it.”

From the human tutor study, we decided to create a feedback model based on four types of feedback our human tutor gave: acknowledgement/criticize, elaborate, suggest action and recast. Recast as feedback could potentially limit learner’s perceived control when recorded pronunciation is automatically played back without
learner control. We then designed recast as part of suggestion action – suggesting the learner listen to the tutor speech again. Currently in Tactical Iraqi, learner motivational states are not monitored, so tutor strategies purely for motivational purpose are not included in the study.

Based on these observations of a human tutor, we focused on implementing acknowledgement/criticize, elaborate and suggest action in two types of Skill Builder pages: vocabulary pages and exercise pages.

5.2.1 Feedback on Vocabulary Pages

User interaction on a pronunciation page consists of listening to the tutor’s phrase, recording learner’s own speech, playing back the learner’s speech and receiving feedback about the recorded phrase. We designed the feedback on vocabulary pages with the following structure:

- **Judgment of Learner Action**
- **Learner Action**
- **Suggestion**

The learner’s speech is first processed by a speech recognizer. The feedback model receives the recognized phrase from the speech recognizer and compares it to the tutor’s phrase (the correct phrase). If the learner’s phrase matches the tutor’s phrase, then the *Judgment of Learner Action* is “correct”, otherwise it is “incorrect”. The second component of the feedback – *Learner Action* – displays the phrase recognized by the speech recognizer, e.g. “It sounds like you said ‘as-salaamu 9aleykum (Hello)’.” The third component of the feedback offers the learner a
suggestion on what to do next: practicing the utterance more, listening to the tutor speech or moving on for now. The suggestion is selected at random from these three types. An example of the complete feedback could be “Your pronunciation is incorrect. It sounds like you said ‘as-salaamu 9aleykum (Hello)’. Try again.” A pronunciation error detection model (Sethy et al., 2005) detects learner pronunciation errors. The feedback model could use its output to elaborate on pronunciation mistakes and construct more sophisticated suggestions.

5.2.2 Feedback on Exercise Pages

Exercise pages include Utterance Formation pages, Match-Item pages and Multiple-Choice page. User interaction on an utterance formation page consists of recording a response in the foreign language to a question and receiving feedback regarding the answer. On Match-Item pages, users are presented with a list of phrase in foreign language and a list of translations in English. Users match the phrases in the foreign language to the translations. Multiple-Choice pages are pages with multiple-choice exercise. The structure of feedback on exercise pages is shown below.

The first and third components are similar to the ones in feedback on pronunciation pages. The second component – elaboration – presents analysis of the learner’s answer. The lesson XML, which defines the lessons and pages in the Skill Builder, also includes possible correct and likely incorrect answers to exercise
questions. The feedback model retrieves the analysis from the lesson XML based on
the answer recognized. For example, in an Utterance Formation exercise where an
agent introduced himself to the learner and the learner is asked to record his response
to the agent, an appropriate answer could be “tsherrafna (Honored to meet you).”
However, if the learner said “li sh-sharaf”, the feedback model recognizes it as one
of the incorrect answers listed in the lesson XML, retrieves the related analysis and
elaborates on the mistakes. In this case, an example of complete feedback would be
“Incorrect. 'li sh-sharaf' is used to formally accept an invitation, and not to respond
to a new acquaintance. Try again.”

5.3 Politeness Strategies

Feedback like the examples above can create threats to a learner’s face. Judging
learner action, especially in the case of criticism, can threaten the learner’s positive
face. On the other hand, suggesting an action, e.g. “Try again”, can threaten the
learner’s negative face. To mitigate the face threat, we designed a series of politeness
strategies for the feedbacks based on the Politeness Effect Model, as shown in Table
5.1. Examples of these politeness strategies are listed in Table 5.2.

To apply the politeness strategies, a database containing phrase templates for
each feedback component using different politeness strategies is created. A
politeness value is assigned to each template. The feedback model queries the
database with feedback component type and politeness value range. The database
finds all the matches with politeness value within the range, selects one at random
and returns it to the feedback module, e.g. “Great job!” The feedback model
combines the query results and delivers the feedback to the learner by an avatar
(Figure 5.2). Note that the avatar is not animated and no synthesized speech is used.
The feedback is delivered as text.

Table 5.1. Politeness strategies in Skill Builder feedback.

<table>
<thead>
<tr>
<th>Feedback Component</th>
<th>Politeness Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judgment of Learner Action</td>
<td>Exaggerate, Common Ground, Conventionally Indirect, Be Vague, Understate, Impersonalize</td>
</tr>
<tr>
<td>Learner Action or Elaboration</td>
<td>Impersonalize</td>
</tr>
<tr>
<td>Suggestion</td>
<td>Common Ground, Tautology, Question, Impersonalize</td>
</tr>
</tbody>
</table>

Table 5.2. Examples of politeness strategies.

<table>
<thead>
<tr>
<th>Politeness Strategy</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bald on Record</td>
<td>Incorrect. Try again.</td>
</tr>
<tr>
<td>Exaggerate</td>
<td>Great job!</td>
</tr>
<tr>
<td>Common Ground</td>
<td>Let’s practice this a little bit more before we move on.</td>
</tr>
<tr>
<td>Be Vague</td>
<td>Looks like someone got the right answer!</td>
</tr>
<tr>
<td>Understate</td>
<td>This utterance needs a little bit more work.</td>
</tr>
<tr>
<td>Question</td>
<td>How about we listen to the tutor’s speech again?</td>
</tr>
<tr>
<td>Tautology</td>
<td>Practice makes perfect.</td>
</tr>
<tr>
<td>Impersonalize</td>
<td>It might be helpful to listen to the tutor’s speech again.</td>
</tr>
<tr>
<td>Conventionally Indirect</td>
<td>This utterance requires more practice.</td>
</tr>
</tbody>
</table>
5.4 Methods

5.4.1 Participants

Sixty-one people (59% women, 41% men) from the greater Los Angeles area participated in the evaluation study. They were recruited via recruitment notices posted on Craigslist.com and were compensated $40 for three hours of their participation. On average, the participants were 38.4 years old (min = 21, max = 63, std = 11.5), with 1.6% having only a high school diploma, 21.3% with some college education, 50.8% with a college degree, 8.2% with some graduate education and
18% with graduate degrees. For female subjects, the average age is 39.0 (min = 21, max = 63, std = 11.9). For male subjects, the average age is 37.4 (min = 21, max = 55, std = 11.1).

5.4.2 Design

To investigate the effect of politeness strategies in tutorial feedback, we created two types of feedback: a polite feedback which is phrased using various politeness strategies and a direct feedback which is phrased without any politeness strategies. These two types of feedback are implemented in the Skill Builder module of Tactical Iraqi. Participants were divided into two groups. Each group received either polite or direct feedback.

The study design was a between-subjects experiment with two conditions: Polite (n=31) and Direct (n=30), to which participants were randomly assigned.

5.4.3 Procedure

Participants entered the laboratory and were told that they were participating in a study to evaluate foreign language training software. The experimenter informed the participants:

_The study we are going to do today is to evaluate a foreign language training software. The software is called Tactical Language Training System. The particular foreign language you are learning today is Iraqi Arabic. So the version of the software you are using today is called Tactical Iraqi. The software is developed by_
USC for the US Department of Defense to train soldiers before they go to Iraq. The soldiers would learn how to say some basic Iraqi Arabic phrases and how to say them politely, so that they won’t accidentally offend anyone.

After that, participants sat down in front of the notebook computer and were shown a video about the background and components of Tactical Iraqi.

Then participants were presented with the pre-questionnaire packet.

After participants filled out the pre-questionnaire packet, the experimenter launched the Tactical Iraqi software and gave a brief introduction on how to use the Skill Builder component of Tactical Iraqi. Participants learned how to use the headset, navigate in the Skill Builder, listen to a recorded speech and record their own speech. The experimenter informed the subjects:

There are over 80 hours of contents in the system. You only have 2 hours including the session today and the session tomorrow. You don’t have to rush through the system and try to take all the lessons. Instead, you can go through the system at your own pace. We do recommend the participants to take the lessons in order because later lessons may require the knowledge from the previous lessons. There are quizzes in the system. Do not take them. If you come across a quiz, you may click the “Skip Quiz” button to skip it.

Next, participants started training in the Skill Builder in Tactical Iraqi. Participants in the Polite condition received feedback on their performance with politeness strategies while participants in the Direct condition received feedback
without politeness strategies. The experimenter turned on the camcorder and left the room.

One hour later, the experimenter returned to the laboratory and ended session 1. The next day, participants came back to the laboratory and completed another hour of training.

Participants were then presented with a blank sheet to write down the name of the lessons they took in the Skill Builder, as well as the post-questionnaire packet.

When participants finished the post-questionnaire packets, they took the quizzes from the lessons they took in Skill Builder.

Finally, participants were paid $40 as compensation. All questions from the participants were answered at this point.

5.4.4 Apparatus

Two Dell laptop computers installed with Tactical Iraqi were setup in two separate rooms. A headset was connected to each laptop computer. A camcorder was setup in front of each laptop computer to record participants’ behavior.

5.4.5 Measures

Learning Gains

Learning Gains were measured using quizzes at the end of each lesson in the Skill Builder. The quizzes contain three types of questions. The first type of question is *Utterance-Formation* questions, where participants answer questions by recording
their own speech. The second type of question is *Multiple-Choice* questions, where participants answer questions by choosing from a list of answers. The third type of question is the *Match-Item* questions, where participants match phrases in Iraqi Arabic to translations in English. Each correct answer scored 1 point. Participants took quizzes from all the lessons that they took during the 2 hour training.

**Motivation**

Two indices of motivation were measured: self-efficacy and perceived autonomy (Appendix II). Self-efficacy was measured both in the pre-training questionnaire ($\alpha=.829$) and the post-training questionnaire ($\alpha=.713$). Items from the self-efficacy scale are modified from the scales published in Boekaerts (2002). The difference between pre-training and post-training results will allow interpretation of how self-efficacy increased or decreased due to the training. An example from the items used to measure self-efficacy is “Compared to others, I think I'm pretty good at learning Iraqi Arabic.” Sense of autonomy ($\alpha=.885$) was measured only in the post-training questionnaire. Example items from the autonomy measure include “I feel the system was deciding what I should do next for me.”

**Individual Difference**

Individual characteristics were measured in an attempt to address their possible interaction with the Politeness Effect. These individual characteristics include extraversion (Donnellan, Oswald, Baird, & Lucas, 2006), openness (Goldberg, 1999), conscientiousness (Donnellan et al., 2006), preference for indirect help
(α=.286), and attitudes toward foreign language learning (Gardner, 1985). Items from extraversion, openness and conscientiousness scale are developed by SWA Consulting Inc. Items from preference for indirect help scale are listed in Appendix II.

5.5 Results

Data from seven sessions were excluded. Two sessions were excluded because of computer crashes and speech recognizer malfunctions. One session was excluded because of a participant’s hearing and speech impairment. Four other sessions were excluded because participants “cheated” on the post-test. In the Skill Builder of Tactical Iraqi, lessons and quizzes are always accessible to the user. At the beginning of each experiment session, participants were instructed not to take any quizzes. Immediately before the post-test (quizzes), participants were instructed not to review the lessons before or during the quizzes. Log data from Tactical Iraqi showed that participants from the four excluded sessions either took the quizzes before the post-test, or reviewed the lessons during the quizzes. As a result, data from 50 participants was included in the analysis, 25 from the polite condition and 25 from the direct condition.

Student T-test was used to compare results from polite and direct group.
5.5.1 Frequency of Intervention

We designed the first study in the industrial engineering domain following the Wizard-of-Oz paradigm. A human tutor worked behind the scenes to monitor student progress and decide when to give feedback. In this study, we implemented a fully automatic tutor. Feedbacks were provided to all of learners’ practice and exercise. In other words, in the Tactical Iraqi study, the number of tutorial feedback depended on how many actions (e.g. recording speech, answering multiple-choice questions) learner takes. Since each participant interacted with the Tactical Iraqi for 2 hours, we compared the total number of feedbacks each participant received within 2 hours. Student’s t-test showed no significant difference between polite and direct group on the amount of feedbacks received ($F(48)=.584, p=.28$, $M_{Polite}=234.12, SD_{Polite}=.67.13, M_{Direct}=257.60, SD_{Direct}=.83.89$).

5.5.2 Learning Results

Overall, we did not find a statistically significant difference between the polite and direct groups on quiz scores ($t(48)=.491, p=.626$). We broke down the comparison of learning performance to different types of quiz questions. On Utterance-formation question, there is a statistically significant difference between the polite and direct groups ($t(48)=2.14, p=.037$). On the other two types of questions, we did not find any significant difference: multiple choice questions ($t(48)= -1.36, p=.180$), Match-item questions ($t(48)= -1.35, p=.183$).
Table 5.3. Politeness effect on learning and motivation

<table>
<thead>
<tr>
<th></th>
<th>Polite</th>
<th>Direct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Overall</td>
<td>7.08</td>
<td>4.00</td>
</tr>
<tr>
<td>Utterance Formation</td>
<td>5.08</td>
<td>2.66</td>
</tr>
<tr>
<td>Multiple-Choice</td>
<td>1.92</td>
<td>1.78</td>
</tr>
<tr>
<td>Match-Item</td>
<td>.08</td>
<td>.28</td>
</tr>
<tr>
<td>Learning (Quiz Questions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy Change</td>
<td>.97</td>
<td>.911</td>
</tr>
<tr>
<td>Sense of Autonomy</td>
<td>3.04</td>
<td>1.04</td>
</tr>
</tbody>
</table>

5.5.3 Motivation Results

We compared the change of self-efficacy to learn Iraqi Arabic between participants received polite treatment and participants received direct treatment. We found a significant difference on self-efficacy change ($t(48)=2.033, p=.048$) between the polite and the direct group. We did not find significant differences on sense of autonomy between the two groups ($t(48)= -.205, p=.838$).

5.5.4 Individual Differences

A two-way between groups analysis of variance (ANOVA) were conducted to explore the interaction effect of individual differences and polite treatment on learning and motivation. Median splits were conducted on the individual differences variables to divide each variable into two categories.

Motivation to learn foreign language

Participants were divided into two groups according to their self-report of attitudes towards learning foreign language (Group 1: 0-5.1; Group 2: 5.2-6). The main effect
of motivation to learn foreign language on change of self-efficacy to learn foreign language is marginally significant \((F(1, 46)=3.93, p=.053, M_{\text{group1}}=.49, SD_{\text{group1}}=.80, M_{\text{group2}}=.92, SD_{\text{group2}}=.98)\) and the effect size was small \((\eta^2=.079)\). This means that self-efficacy of participants with higher motivation to learn foreign language increased more than those with lower motivation to learn foreign language. The interaction effect \((F(2, 46)=3.30, p=.076)\) did not reach statistical significance. The main and interaction effects for motivation to learn foreign language on learning outcomes and sense of autonomy were not statistically significant.

*Preference for indirect help*

Participants were divided into two groups according to their self-report of preference for indirect help (Group 1: 0-2.83; Group 2: 3-6). The main effect of preference for indirect help on learning outcomes and motivation were not statistically significant. The interaction effect of preference for indirect help and polite treatment on learning outcomes and motivation were not statistically significant.

*Extroversion*

Participants were divided into two groups according to the Big-Five Extroversion measure. The main effect of extroversion on learning outcomes and motivation were not statistically significant. The interaction effect of extroversion and polite treatment on learning outcomes and motivation were not statistically significant.

*Intellect*

Participants were divided into two groups according to the Big-Five Intellect
measure (Group 1: 0-3; Group 2: 3.1-4). There was a statistically significant main effect for intellect on the overall quiz score ($F(1, 46)=11.28$, $p=.002$, $\eta^2=.197$), Utterance-formation question quiz score ($F(1, 46)=6.11$, $p=.017$, $\eta^2=.117$) and Multiple-Choice quiz score ($F(1, 46)=9.15$, $p=.004$, $\eta^2=.166$). This means that participants with higher self-reported intellect performed better on the learning test than participants with lower self-reported intellect. The main effects of intellect and self-efficacy and sense of autonomy were not significant. The interaction effects of intellect and polite treatment on any of the quiz score measures were not significant. The interaction effects of intellect and polite treatment on self-efficacy and sense of autonomy were not significant.

Table 5.4. Effect of intellect scale on learning and motivation

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th></th>
<th>Group 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Learning (Quiz Questions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>5.46</td>
<td>3.26</td>
<td>8.55</td>
<td>3.61</td>
</tr>
<tr>
<td>Utterance Formation</td>
<td>3.82</td>
<td>2.45</td>
<td>5.05</td>
<td>2.36</td>
</tr>
<tr>
<td>Multiple-Choice</td>
<td>1.54</td>
<td>1.67</td>
<td>3.27</td>
<td>1.98</td>
</tr>
</tbody>
</table>

**Education**

Participants were divided into two groups according to their education (Group 1: from some high school education to some college education; Group 2: from college degree to graduate degree). The analysis of variance show that the effect of education on overall quiz scores was significant ($F(1, 46)=5.53$, $p=.023$, $M_{\text{group1}}=6.17$, $SD_{\text{group1}}=3.22$, $M_{\text{group2}}=8.50$, $SD_{\text{group2}}=4.45$) and the effect size was moderate ($\eta^2=.107$). The interaction between education and politeness on overall
quiz score was also statistically significant \((F(2, 46)=4.41, p=.041)\), but the effect size was small \((\eta^2=.087)\). For the participants with lower education, those who received polite treatment did not differ those who received direct treatment on their overall quiz score \((M_{\text{Polite}}=5.89, SD_{\text{Polite}}=2.87, M_{\text{Direct}}=6.47, SD_{\text{Direct}}=3.66)\). For participants with higher education, the difference between those who received polite treatment and those who received direct treatment did not reach statistical significance either \((M_{\text{Polite}}=10.83, SD_{\text{Polite}}=5.00, M_{\text{Direct}}=6.75, SD_{\text{Direct}}=3.29)\). We did not find any significant effect of education on self-efficacy and sense of autonomy. The interactions between education and politeness on self-efficacy and sense of autonomy were not statistically significant.

### 5.6 Discussion

In this chapter, we presented our investigation of Politeness Effect in a foreign language intelligent tutoring system. The results showed that there was no statistically significant difference between polite and direct group on participant’s overall quiz score. However, on the utterance-formation type of questions in the quizzes, those who received polite treatment did significant better than those who received direct tutorial feedback.

In Tactical Iraqi Skill Builder, not all exercises are alike. The exercises in Tactical Iraqi are designed to progressively prepare learners to apply their skills in conversation. The focus of Tactical Iraqi curricula is to develop spoken
communication skills. It provides learners with a progression of exercises that start with basic recognition and recall, and progress toward spoken conversation. Multiple choice and match-item questions are designed to test learners’ ability to recognize and recall basic Iraqi Arabic phrases. The utterance-formation quiz questions are the ones that require learner to answer the question by recording their own speech. They are much more difficult and complex than multiple choice and match-item questions. From the difficulty perspective, the results shown here is, again, similar to the study on Persona Effect (Lester et al., 1997b) in that the polite agent helped learner perform better on only complex problems. However, we consider the utterance-formation questions are more meaningful as a measure because they are the closest to conversational practice in real life, compared to multiple-choice and match-item quiz questions.

The results also show that participants who received polite tutorial feedback increased their self-efficacy more than those who received direct tutorial feedback. This is consistent with our hypothesis. However, we did not observe significant difference between polite and direct group on self-report of sense of autonomy. This is likely to be because the study was carried out in only in the Skill Builder of Tactical Iraqi. The Politeness Effect, if it exists, is not likely to apply identically to all learners in all learning environments. In the Skill Builder, there is relatively little scope for learners to exercise their autonomy. They either speak the language
correctly or they do not. And they can either move on or continue practicing. Politeness tactics that focus on learner autonomy may therefore have limited effect.

Several individual differences showed influence on the learning result, although very few showed interactions with the polite and direct experiment manipulation. It was not surprising that participants with higher motivation to learn foreign language showed higher increase of self-efficacy to learn Iraqi Arabic than those who with lower motivation. The influences of intellect and education are quite interesting, indicating that participants who consider themselves highly intellectual or received higher education learned better. However, there were small to none interaction with the experiment manipulation. Contrary to the findings in the study in VFTS, we did not find preference for indirect help to have much influence on either learning or motivation in this study. This may be because the instrument to measure preference for indirect help has low inter-item reliability ($\alpha=.286$).

There are several limitations to the current study. The learning gains were measured right after the training. Even though the utterance-formation quizzes are close to real-life conversations, measures using a post-test role-playing interview maybe a more comprehensive measure of communication skills. The version of Tactical Iraqi used in the study was in its early development stage. Speech recognizer error could potentially reduce the credibility of the feedback and tutor helpfulness.
Chapter Six

Conclusion and Future Work

Motivated by the Media Equation, we propose to apply social intelligence to pedagogical agent design. In this thesis, we focused on one particular aspect of social intelligence – the use of politeness strategies – and studied its effect on learning and motivation. We now review the contributions and possible areas of future work in the next few sections.

6.1 Politeness and Learning Outcomes

The work in this thesis is one of the first attempts to study the effect of politeness on learning and motivation and apply it in intelligent tutoring systems. While others have considered generally how intelligent tutoring systems can address learner motivation, this work is unique in that it investigates how cognitive strategies and motivational strategies can be integrated by means of politeness tactics. Through our study in the industrial engineering domain, we found that learning can be facilitated by tutorial feedback with proper face redressive strategies. In our study in the language learning domain, we found that even though politeness didn’t have a
significant impact on overall learning result, it did help learners do significantly better on the language test that is closest to conversational practice in real life. This demonstrated that politeness strategies in tutorial feedback can have a positive impact on learning outcomes. It is encouraging to see that how the tutorial feedback is phrased can contribute the overall effectiveness of the pedagogical agents.

6.2 Politeness and Motivation

We probed inside the Politeness Effect to find out if it exists, and why and how it takes effect on learning. We drew the connection between positive politeness and self-efficacy, and negative politeness and sense of control. By promoting learners’ self-efficacy and helping them maintain the sense of control, we hypothesize that feedback with proper politeness strategies can improve learning experience through enhancing learning motivation. In the first study, conducted in an industrial engineering training system, we did not observe any significant influence of politeness strategies on either self-efficacy or sense of control. In the second study, conducted in the language learning domain, we revised the instruments to measure motivation. We observed the politeness effect on self-efficacy but failed to achieve any significant impact on sense of control. Thus the results of the investigation into the mediating factors between politeness strategies and learning outcomes were inconclusive. However, it provided us with some insight on how politeness can be applied in ITS: only in the domains and platforms that allow room for manipulating
the positive and negative face can the politeness strategies take full effect. More research needs to be done on the Politeness Effect with regard to a learner’s sense of autonomy in learning domains that allow for influence on autonomy.

### 6.3 The Use of Politeness Strategies

The essence of Brown and Levinson’s politeness theory is that even though the use of politeness is universal, it depends on the social distance and relative power between the speaker and hearer and the culture they are in. In the studies presented in this thesis, the level of politeness in feedback dialogue is based on ratings from samples from the general population. The judgments from this sample represent what American society as a whole considers the social distance and relative power between a tutor and a student. Thus the politeness tactics presented in this thesis reflect only the social norm and culture in this context. In future politeness research involving other cultures or between parties whose social distance and relative power may be different from this study, the use of politeness strategies must take into account the culture and relationship variables. For example, in an intelligent tutoring system where a pedagogical agent is designed to be a friend to the learner, the politeness level in the agent’s feedback can be much lower due to the shorter social distance between the agent and the learner compared to standard tutor-learner relationship.
In the studies presented in this thesis, the duration of the interaction between the pedagogical agents and the learner is relatively short. So we assumed that the social distance and relative power between the agent and learner didn’t change over the course of the interaction. The level of politeness used in the feedback remained within a certain range during the study. However, for applications where users interact with the system for a longer term, the use of politeness strategies should adapt to the progression of the relationship between the user and the agent. For example, since the real users of Tactical Iraqi interact with the system for weeks and months, the level of politeness in the feedback should gradually decrease over time.

The use of politeness strategies needs to adapt to individual differences as well. For users with relative lower task ability, proper use of politeness can contribute to better learning results. However, for users with relatively high task ability, the effect of politeness strategies may be less prominent. This, perhaps, is because that user with higher task ability values the efficiency of the feedback relatively more. Less use of politeness strategies and more direct feedback can be considered more efficient and preferable. On the other hand, for students with higher task ability, their ability to accurately judge their own performance is higher than those with lower task ability. Hence, some politeness strategies aimed to boost self-efficacy may be less effective for students with higher task ability.
6.4 Design of Pedagogical Agents

There has been considerable effort in the pedagogical agent research on its effect on learning. This is the first series of study that has exhibited limited but significant impact on learning and motivation. This thesis sheds new light on pedagogical agent design. It steers the agent research away from the traditional way of applying the Media Equation, which focuses on making agents look human, to a Media Equation application, which focuses on making agents behave according to the social role of human tutors.

6.5 Where to Go From Here

In this thesis, we hypothesize that motivation is the mediating factor between politeness and learning gains. This hypothesis is mainly based on the “4 Cs” motivation theory proposed by Lepper and Hodell (1989). More research needs to be done to study how the Politeness Effect affects learning; in particular, identification of the mediating factor between politeness and learning gains.

Designers of educational software should consider carefully how politeness strategies apply to their particular application. In interactive applications that provide feedback, there are typically many opportunities to employ politeness tactics. We recommend that developers of intelligent tutors and pedagogical agents examine the tutorial messages that their tutors are generating from a politeness perspective, as politeness may have an impact on the tutors’ effectiveness. Conversely, system
developers and content authors who neglect politeness issues may unintentionally introduce messages that threaten learner face. Attention to politeness issues may result in improved learner performance, as well as improved learner attitudes and motivation.
Reference List


International Personality Item Pool (2003) (http://ipip.ori.org/ipip/)


## Appendix I

### Questionnaires from the Study in VFTS

#### I.I Self-Efficacy

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. I feel confident of my ability to complete another VFTS problem of the SAME LEVEL.
2. I feel MORE confident about my ability to complete a problem on the VFTS NOW, than I did before I started.
3. I think my performance improved as the tutorial progressed.
## I.II  Autonomy

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I felt I was given total freedom in making decisions at every step.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I felt like the tutor was making decisions for me at each step.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tutor respected my decisions and choices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I felt I HAD to follow the instructions of the tutor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tutor made me feel as though I had no choice in making decisions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I.III  Tutor Helpfulness

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The tutor made it easier for me to follow each step.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tutor helped me to identify my mistakes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tutor helped me make correct decisions in selecting methods.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tutor did NOT understand what I wanted to accomplish.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I found working with the tutor to be confusing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think I was able to understand the concepts better with the tutor, than I would have without the tutor.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tutor seemed to be critical of my performance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The tutor worked with me towards a common goal.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix II

Questionnaires from the Study in Tactical Iraqi

II.I Self-Efficacy

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t have any idea about how to learn Iraqi Arabic.</td>
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<tr>
<td>I think learning Iraqi Arabic would be easy to me.</td>
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<td>I think I can learn Iraqi Arabic well.</td>
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<tr>
<td>Compare to others, I think I'm pretty good at learning Iraqi Arabic.</td>
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</tbody>
</table>
## II.II Autonomy

<table>
<thead>
<tr>
<th>In the Skill Builder…</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel like I don't have much power to decide what to learn.</td>
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<tr>
<td>I feel like I am in total control of what and how I learn.</td>
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<td>I feel like I had to follow what the system asks me to do.</td>
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<tr>
<td>I feel I had total freedom in deciding how I want to learn.</td>
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<tr>
<td>I feel the system was deciding what I should do next for me.</td>
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<tr>
<td>I feel like I had no choice in deciding how I want to learn Iraqi.</td>
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</tbody>
</table>
### II.III Preference for Indirect Help

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>When I get stuck on a problem, I'd like my instructor to just show me what to do next.</td>
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<tr>
<td>When I get stuck on a problem, I'd like my instructor to give me hints on what to do next.</td>
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<tr>
<td>When I make a mistake, I'd like my instructor to give me hints on what I did wrong.</td>
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<tr>
<td>When I make a mistake, I'd like my instructor to just tell me what I did wrong.</td>
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<tr>
<td>I feel comfortable when my instructor tells me directly what he/she thinks of what I did.</td>
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<tr>
<td>I appreciate it when my instructor avoids direct criticism of what I did.</td>
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</tbody>
</table>