Available online at www.sciencedirect.com
SCIENCE DIRECT®
Int. J. Human-Computer Studies 64 (2006) 36–42
International Journal of Human-Computer Studies
www.elsevier.com/locate/ijhcs

Constructing computer-based tutors that are socially sensitive: Politeness in educational software

Richard E. Mayer[a,*], W. Lewis Johnson[b], Erin Shaw[b], Sahiba Sandhu[b]

[a]*Department of Psychology, University of California, Santa Barbara, CA 93106, USA*
[b]*University of Southern California, USA*

Received 20 November 2004; received in revised form 7 June 2005; accepted 24 July 2005
Available online 12 September 2005
Communicated by S. Brave

Abstract

Students rated 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 an adaptation of Brown and Levinson's [1987. Politeness: Some Universals in Language Use. Cambridge University Press, New York] politeness theory, (a) students rated direct commands and commands attributed to machines as lowest in negative and positive politeness, (b) students rated guarded suggestions and guarded questions as highest in negative politeness, and guarded suggestions and statements expressing a common goal as highest in positive politeness, and (c) the pattern of results was stronger for students with low rather than high computing experience. Results have implications for designing polite conversational agents in educational software.
© 2005 Elsevier Ltd. All rights reserved.

Keywords: Pedagogical agents; Educational technology; Computer-based learning; Information and communication technology

1. Introduction

Advanced educational software often includes an on-screen tutor—generally in the guise of an animated pedagogical agent (APA)—that provides guidance to the learner including making suggestions for what to do, correcting errors, and providing explanations (Cassell et al., 2000; Moreno, 2005). Although intelligent tutoring systems usually focus on cognitive considerations for promoting learning (Mayer, 2001), educational researchers have increasingly called attention to the role of motivational and social considerations (Lepper et al., 1993; Reeves and Nass, 1996; Sansone and Harackiewicz, 2000; Johnson et al., 2004b; Mayer, 2005). In a conversational dialogue between a tutor and a learner, cognitive considerations inform what the tutor says (e.g., a suggestion to press a certain key), but social and motivational considerations inform how the tutor says it. Our goal is to develop research-based principles for the design of computer-based tutors that are socially sensitive and motivating for learners, i.e., principles for creating polite tutors.

We begin with the classic work of Brown and Levinson (1987) on *politeness theory*. Based on analyses of conversational dialogs in various cultures with various languages, Brown and Levinson concluded that communicative acts such as suggestions and requests always take into account the positive and negative face of the people engaged in the conversation. Positive face refers to the want to be desirable to others, including being appreciated, approved, and respected by the other party in the conversation. Negative face refers to the want to be unimpeded by others, including not having one's freedom of action controlled by the other party in the conversation.

Tutorial dialogs between a tutor and a learner consist of communicative acts such as suggestions and requests that can threaten the learner's positive face, negative face, or both. For example, a threat to positive face can occur when a tutor criticizes what a learner has done, because the learner may feel that the tutor doesn't appreciate or

*Corresponding author. Tel.: +1 805 893 2472; fax: +1 805 893 4303.
E-mail address: mayer@psych.ucsb.edu (R.E. Mayer).

1071-5819/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ijhcs.2005.07.001

approve of the learner. Similarly, a threat to negative face can occur when a tutor provides advice for what to do, because the learner may feel the tutor is restricting the learner's freedom to decide what to do.

Brown and Levinson showed that face-threatening acts could be mitigated through the use of several types of politeness strategies. We have adapted Brown and Levinson's classification of politeness strategies into eight types of suggestions or requests observed in tutorial dialog transcripts (Johnson et al., 2004b): (1) *bald on record* (i.e., direct commands) such as, "Click the ENTER button"; (2) *conventional indirectness* (i.e., commands attributed to machines) such as, "The system is asking you to click the ENTER button"; (3) *request* (i.e., a statement of the tutor's desires) such as, "I would like you to click the ENTER button"; (4) *tutor goal* (i.e., a statement of what the tutor's goal would be in the learner's situation) such as, "I would now click the ENTER button", (5) *joint goal* (i.e., a statement of what the tutor and learner's common goal should be) such as, "Let's click the ENTER button", (6) *question* (i.e., an indirect question about a possible action) such as "And what about the ENTER button?", (7) *student goal* (i.e., a guarded suggestion of the learner's goal) such as "You may want to click the ENTER button" and (8) *Socratic hint* (i.e., a guarded suggestion of the learner's goal in the form of a question) such as, "Do you want to click the ENTER button?"

A first step in developing polite tutors for educational software is to determine whether human learners are sensitive to the politeness tone of the tutor's conversational statements. We base our predictions on the conversational politeness hypothesis—the idea that learners can accept computer tutors as social partners and apply the same norms of social interaction as they would in human conversational interactions (Reeves and Nass, 1996; Mayer, 2005). According to the conversational politeness hypothesis, people will see certain ways of wording suggestions and requests as polite and others as impolite.

First, concerning negative politeness, direct commands (#1) and commands attributed to machines (#2) should be seen as relatively disrespectful of the learner's freedom to make decisions, whereas guarded suggestions including "could" and "may" (#7) or guarded suggestions in the form of questions (#8) should be seen as relatively respectful. Second, concerning positive politeness, direct commands (#1) and commands attributed to machines (#2) should be seen as relatively contrary to being cooperative with the learner, whereas guarded suggestions involving "could" or "may" (#7) and "we" or "let's" constructions involving a common goal (#5) should be seen as consistent with being cooperative with the learner.

Third, according to the conversational politeness hypothesis, people who are used to working together do not need to couch their statements in overly polite ways, so we predict that people who are experienced in working with computers will be less offended by impolite statements and less impressed by polite statements than will people who are inexperienced in interacting with computers. We test these three predictions by asking students to rate each of the 8 types of statements listed above in terms of positive face and negative face.

This project involves an important extension of Brown and Levinson's politeness theory from human–human communication to human–computer communication. It is important to test whether politeness theory applies to various HCI situations because a number of researchers have argued that interacting with a computer is different from interacting with a human. For example, prior research has shown that politeness does not enhance performance in some HCI situations such as computer-initiated interruptions in a human–computer telephone dialogue (Wilkie et al., 2005).

2. Method

2.1. Participants and design

The participants were 47 college students recruited from the Psychology Subject Pool at the University of California, Santa Barbara. The mean age was 19.2 years (SD = 1.0). There were 17 women and 30 men; 46 of the 47 participants reported English as the language they were most comfortable with. On a survey of computer usage: 0 reported using a computer less than 1 h per week, 7 reported using a computer 1–5 h per week, 18 reported using a computer 5–10 h per week, 15 reported using a computer 10–20 h per week, and 7 reported using a computer more than 20 h per week. All participants completed the same task so comparisons concerning types of statements are within subject comparisons.

2.2. Materials

The materials consisted of a participant questionnaire sheet and two 16-item politeness rating sheets. The participant questionnaire asked for the participant's age and gender; asked the participant to answer a language familiarity question, "The language that I am most comfortable with is: _____ English, _____ Other (Please specify: _____)"; and asked the participant to complete a computer usage question, "How many hours per week do you normally use a computer: _____ less than 1 h per week, _____ 1–5 h per week, _____ 5–10 h per week, _____10–20 h per week, _____ more than 20 h per week." Instructions for the two politeness rating sheets asked participants to assume they were using a computer simulation game in which a cartoon character occasionally came on the screen to give hints or comments. The first politeness rating sheet (on negative politeness) asked participants to rate each of 16 sentences on a 7-point scale with 1 indicating that the

Table 1
Mean rating and standard deviation on negative politeness (“allows my freedom “) for 16 statements

M	s.d.	Statement	
1.745	1.073	A1	Click the ENTER button.
2.723	1.440	A2	The system is asking you to click the ENTER button.
2.894	1.220	A3	I would like you to click the ENTER button.
3.170	1.204	A4	I would now click the ENTER button.
3.340	1.592	A5	Let’s click the ENTER button.
4.277	1.410	A6	And what about the ENTER button?
4.511	1.458	A7	You may want to click the ENTER button.
5.851	1.233	A8	Do you want to click the ENTER button?
1.787	1.215	B1	Now use the quadratic formula to solve this equation.
2.745	1.206	B2	The machine wants you to use the quadratic formula to solve this equation.
3.255	1.581	B5	We should use the quadratic formula to solve this equation.
3.319	1.181	B4	I would use the quadratic formula to solve this equation.
3.787	1.517	B3	I suggest that you use the quadratic formula to solve this equation.
4.106	1.684	B8	Did you use the quadratic formula to solve this equation?
4.702	1.488	B6	What about using the quadratic formula to solve this equation?
4.830	1.356	B7	You could use the quadratic formula to solve this equation.

on-screen character who made the statement “strongly disallows my freedom to make my own decisions” and 7 indicating that the character “strongly allows my freedom to make my own decisions.” Participants were instructed to base their ratings on the degree to which the statement “respects your freedom to decide what to do.” The first set of 8 statements offered 8 different ways of suggesting that the participant might want to click the ENTER button, whereas the second set of 8 statements offered 8 different ways of suggesting that the participant use the quadratic formula to solve a math problem. The second politeness rating sheet (on positive politeness) asked participants to rate each of the same 16 sentences on a 7-point scale with 1 indicating that the on-screen character who made the statement is “strongly not working with me” and 7 indicating that the character is “strongly working with me.” Participants were instructed to rate the degree to which the statement “makes you feel that the character wants to work with you and appreciates you.” The same 16 statements—arranged in random order—were used in both rating sheets, and are listed in the rightmost column of Table 1.

2.3. Procedure

Participants were tested in groups of one to four per session, and were seated at individual cubicles. Then, the experimenter gave oral instructions and handed out a booklet consisting of the participant questionnaire sheet, the negative politeness-rating sheet, and the positive politeness-rating sheet, respectively. Participants were allowed to work at their own rates. Upon completion, participants were debriefed and excused. We complied with APA standards for research with human participants.

3. Results

3.1. Prediction 1: Do the statements differ in evoking feelings that the computer-based character respects the learner’s freedom to make decisions?

According to the conversational politeness hypothesis, direct commands and commands attributed to machines (listed as #1and #2, respectively, in Table 1) should be seen as relatively disrespectful of the learner’s freedom to make decisions, whereas guarded suggestions involving “could” or “may” and guarded questions (listed as #7 and #8 in Table 1) should be seen as relatively respectful. Table 1 gives the mean rating for each of the 16 sentences on the rating scale for negative politeness, i.e., concerning the degree to which the character “allows my freedom to make my own decisions”. The statements are listed in order of negative politeness for the first set of items concerning the ENTER button (A1 through A8) and the second set of items concerning the quadratic formula (B1 through B8). Consistent with the hypothesis, the most impolite statements are direct commands such as, “Click the ENTER button” and “Now use the quadratic formula to solve this equation” and commands attributed to the machine such as, “The system is asking you to click the ENTER button” or “The machine wants you to use the quadratic formula to solve this equation”; whereas the most polite statements are guarded suggestions such as, “You might want to click the ENTER button” or “You could use the quadratic formula to solve this equation” or guarded questions such as, “Do you want to click the ENTER button?” or “What about using the quadratic formula to solve this equation?”

We conducted analyses of variance on these data to determine whether the observed pattern was statistically significant. An analysis of variance conducted on the 8 items in set A revealed that the ratings differed significantly

Table 2
Mean rating and standard deviation on positive politeness (“working with me”) for 16 statements

M	s.d.	Statement	
2.532	1.804	A1	Click the ENTER button.
2.936	1.451	A2	The system is asking you to click the ENTER button.
3.319	1.181	A4	I would now click the ENTER button.
3.851	1.694	A3	I would like you to click the ENTER button.
4.085	1.213	A6	And what about the ENTER button?
4.106	1.684	A8	Do you want to click the ENTER button?
4.830	1.356	A7	You may want to click the ENTER button.
5.170	1.659	A5	Let’s click the ENTER button.
3.064	1.509	B2	The machine wants you to use the quadratic equation.
3.085	1.863	B1	Now use the quadratic formula to solve this equation.
4.043	1.398	B4	I would use the quadratic formula to solve this equation.
4.426	1.211	B8	Did you use the quadratic formula to solve this equation?
4.787	1.559	B3	I suggest that you use the quadratic formula to solve this equation.
4.894	1.309	B6	What about using the quadratic formula to solve this equation?
4.936	1.309	B7	You could use the quadratic formula to solve this equation.
5.255	1.553	B5	We should use the quadratic formula to solve this equation.

from each other, $F(7,46) = 53.763$, $MSE = 1.412$, $p < .0001$; an analysis of variance conducted on the 8 items in set B revealed that the ratings differed significantly from each other, $F(7,46) = 32.741$, $MSE = 1.488$, $p < .0001$. These results show that students are sensitive to differences in the politeness tone of statements that express the same idea.

3.2. Prediction 2: Do the statements differ in evoking feelings that the computer-based character wants to work with the learner?

According to the conversational politeness hypothesis, direct commands and commands attributed to machines (listed as #1 and #2, respectively, in Table 2) should be seen as relatively contrary to being cooperative with the learner, whereas guarded suggestions involving “could” or “may” and statements about a common goal using “we” constructions (listed as #7 and #5, respectively, in Table 2) should be seen as consistent with being cooperative with the learner. Table 2 gives the mean rating for each of the 16 sentences for positive politeness, i.e., the degree to which the computer-based character is “working with me”. The statements are listed in order of positive politeness for the first set of items concerning the “ENTER button” (A1 through A8) and the second set of items concerning the “quadratic formula” (B1 through B8). Consistent with the hypothesis, the most impolite statements are direct commands such as, “Click the ENTER button” and “Now use the quadratic formula to solve this equation” and commands attributed to the machine such as, “The system is asking you to click the ENTER button” or “The machine wants you to use the quadratic formula to solve this equation”; whereas the most polite statements are “we” constructions such as “Let’s click the ENTER button” or “We should use the quadratic formula to solve this equation,” or guarded questions such as, “Do you want to click the ENTER button?” or “What about using the quadratic formula to solve this equation?” Interestingly, “I” constructions are seen as moderately hostile to cooperation.

An analysis of variance conducted on the 8 items in set A revealed that the ratings differed significantly from each other, $F(7,46) = 23.218$, $MSE = 1.689$, $p < .0001$; an analysis of variance conducted on the 8 items in set B revealed that the ratings differed significantly from each other, $F(7,46) = 19.019$, $MSE = 1.762$, $p < .0001$. Again, these results show that students are sensitive to differences in the politeness tone of statements that make the same request or suggestion.

3.3. Do the two kinds of politeness ratings correspond?

The two rating scales were intended to assess two different kinds of politeness—respecting the learner’s freedom of action (i.e., negative politeness) and showing appreciation for working cooperatively with the learner (i.e., positive politeness), respectively. In comparing Tables 1 and 2, it can be seen that the pattern of ratings for the two rating scales is generally quite similar. The Pearson correlation between the mean ratings on the 16 statements for the two different rating scales is $r = .747$, which is statistically significant at $p < .001$, and practically significant in that 50% of the variance is shared.

However, there are important differences between the scales as well. When we computed Pearson correlations on the 47 students’ ratings on the same statement on the two scales, the majority of correlations failed to reach statistical significance at the .05 level. In contrast, statement B2 showed the strongest correlation between the two scales ($r = .558$) and statement A2 showed the next strongest ($r = .543$). Thus, there is some indication that commands attributed to a machine are seen as equally impolite across both scales.

3.4. Do the two forms of the sentences correspond?

Corresponding forms of statements were constructed, such that A1 was intended to convey the same politeness tone as B1, A2 was intended to convey the same politeness tone as B2, and so on. In comparing form A to form B across both rating scales, you can see that there appears to be correspondence between the matched items in the two forms. The Pearson correlation between the mean ratings on the corresponding 16 statements in form A and form B across the two rating scales is $r = .808$, which is statistically significant at $p < .001$, and practically significant in that approximately 65% of the variance is shared.

As a further validity check we computed Pearson correlations among the ratings of the 47 students on each pair of corresponding items (e.g., A1 and B1, A2 and B2, etc.) on each scale. Among the items on the first rating scale, A8 and B8 showed the poorest correspondence. This is the only pair of corresponding items that did not correlate significantly at the .05 level ($r = -.128$) and this is the only pair of corresponding items that differed by more than 1 standard deviation. Similarly, among the items on the second rating scale, A8 and B8 again showed the poorest correspondence. This is the only pair of corresponding items that did not correlate significantly at the .05 level ($r = .064$), although the difference in mean ratings did not exceed 1 standard deviation. Overall, students found the wording "Do you want to [do something]?" to be far more polite than "Did you [do something]?" even though these were intended to express similar levels of politeness. A practical implication of this finding is that the criteria for equivalent wording of questions must be tightened to distinguish between these "do-you-want" and "did-you" forms of questions.

3.5. Prediction 3: Do the patterns of ratings differ between students with low and high computing experience?

According to the conversational politeness hypothesis, people who are used to working together may not be as offended by some conversational statements that other people find impolite. To explore this idea, we classified students as high experience if they indicated normally spending more than 20 h per week using a computer ($n = 7$) and we classified students as low experience if they indicated normally spending less than 5 h per week using a computer ($n = 7$). Table 3 shows the comparisons between high and low-experience students on mean ratings for negative politeness: the first column of Table 3 shows which group (i.e., "H" for high and "L" for low) gave the higher rating for negative politeness, the second column shows the effect size based on Cohen's d, and the third column lists the statement. Consistent with the hypothesis, the high experience students were less offended by direct commands and commands attributed to machines than were low experience students (as indicated by high experience students giving higher ratings on #1 and #2, respectively, than low experience students), and high experience students were less impressed with polite statements than were low experience students (as indicated by high experience students giving lower ratings on all other statements than low experience students). t-tests conducted on all 16 statements indicated that differences for A1, B2, and B3 were statistically significant at $p < .05$; in addition, each of these comparisons produced effect sizes greater than 1.

Table 4 shows the comparisons between high and low-experience students on mean ratings for positive politeness: the first column of Table 4 shows which group (i.e., "H"

Table 3
Comparison between high-experience and low-experience students on mean ratings for negative politeness ("allows my freedom") for 16 statements

H/L	ES	Statement	
H*	1.32	A1	Click the ENTER button.
H	0.39	A2	The system is asking you to click the ENTER button.
L	0.08	A3	I would like you to click the ENTER button.
L	0.20	A4	I would now click the ENTER button.
L	0.21	A5	Let's click the ENTER button.
L	0.25	A6	And what about the ENTER button?
L	0.10	A7	You may want to click the ENTER button.
L	0.34	A8	Do you want to click the ENTER button?
H	0.73	B1	Now use the quadratic formula to solve this equation.
H*	1.09	B2	The machine wants you to use the quadratic formula to solve this equation.
L	0.22	B5	We should use the quadratic formula to solve this equation.
L	0.25	B4	I would use the quadratic formula to solve this equation.
L*	1.32	B3	I suggest that you use the quadratic formula to solve this equation.
L	0.08	B8	Did you use the quadratic formula to solve this equation?
L	0.17	B6	What about using the quadratic formula to solve this equation?
L	0.41	B7	You could use the quadratic formula to solve this equation.

Note: H/L refers to whether high- or low-experience group gave a higher mean rating of politeness. ES refers to effect size, which is the difference in means between the high and low-experience groups divided by the standard deviation of the low-experience group. An asterisk (*) indicates that the difference is statistically significant at $p < .05$ based on a t-test.

Table 4
Comparison between high-experience and low-experience students on mean ratings for positive politeness ("works with me") for 16 statements

H/L	ES	Statement	
H*	3.61	A1	Click the ENTER button.
H	0.31	A2	The system is asking you to click the ENTER button.
L	0.16	A4	I would now click the ENTER button.
H	0.10	A3	I would like you to click the ENTER button.
L	0.10	A6	And what about the ENTER button?
L*	1.22	A8	Do you want to click the ENTER button?
L	0.27	A7	You may want to click the ENTER button.
L	0.47	A5	Let's click the ENTER button.
H*	1.28	B2	The machine wants you to use the quadratic equation.
H*	1.15	B1	Now use the quadratic formula to solve this equation.
H	0.62	B4	I would use the quadratic formula to solve this equation.
L	0.40	B8	Did you use the quadratic formula to solve this equation?
L/H	0.00	B3	I suggest that you use the quadratic formula to solve this equation.
L*	1.03	B6	What about using the quadratic formula to solve this equation?
L*	1.66	B7	You could use the quadratic formula to solve this equation.
L	0.70	B5	We should use the quadratic formula to solve this equation.

Note: H/L refers to whether high- or low-experience group gave a higher mean rating of politeness. ES refers to effect size, which is the difference in means between the high and low-experience groups divided by the standard deviation of the low-experience group. An asterisk (*) indicates that the difference is statistically significant at $p < .05$ based on a t-test.

for high and "L" for low) gave the higher rating for positive politeness, the second column shows the effect size based on Cohen's d, and the third column lists the statement. Consistent with the hypothesis, the high experience students were less offended by direct commands and commands attributed to machines than were low experience students (as indicated by high experience students giving higher ratings on #1 and #2, respectively, than low experience students), and high experience students were generally less impressed with polite statements than were low experience students (as indicated by high experience students generally giving lower ratings on all other statements than low experience students). t-tests conducted on all 16 statements indicated that differences for A1, B1, B2, A8, B6, and B7 were statistically significant at $p < .05$; in addition, each of these comparisons produced effect sizes greater than 1.

Overall, consistent with the prediction of the conversational politeness hypothesis, the low-experience students were more sensitive to the politeness tone of statements than were the high-experience students. The effects of framing computer-based requests and suggestions in polite or impolite ways appear to be stronger for people with low rather than high amounts of experience interacting with computers. However, the conclusion should be tempered by acknowledging the low number of participants in each group and that only some of the comparisons reached statistical significance. These results should not be interpreted to mean that interacting with computers might render humans less able to distinguish the spectrum of social norms. Instead, as with human interaction, people may adjust their level of politeness in a conversation based on how well they know the other party.

4. Discussion

4.1. Summary of results

Overall, this study provides support for the idea that learners are able to discriminate the level of politeness of suggestions and requests in tutorial dialogs, and that the politeness of a computer tutor's suggestion or request is more salient for learners with less computer experience.

4.2. Theoretical implications

On the theoretical side, this study provides support for the conversational politeness hypothesis and the politeness theory of Brown and Levinson (1987) from which it is derived. This work highlights the potential role of social and motivational aspects of computer-based learning. Although cognitive aspects of instructional design help determine what the tutor should say, social and motivational aspects of instructional design help determine how the tutor says it. The finding that learners are sensitive to the politeness tone of statements from computer-based tutors is consistent with the idea that people can accept a computer as a social partner (Reeves and Nass, 1996). This work contributes to the development of dialogue processing models relevant to managing computer-based tutorial dialogues (Zinn et al., 2005). However, we note that further work is needed to determine any possible modifications that might be needed in extending politeness theory from human–human communication to human–computer communication.

4.3. Practical implications

On the practical side, this study contributes to the empirical base for developing conversational agents in educational software that are socially sensitive. When the goal is to create conversations that are perceived as polite, direct commands and commands attributed to machines should be avoided. This suggestion reflects an extension of politeness theory from human–human communication to human–computer communication.

4.4. Limitations and future directions

Previous research has shown than students learn more deeply from a computer-based lesson when the narration is in conversational style rather than formal style (Moreno and Mayer, 2000, 2004; Mayer et al., 2004). The current study encourages the idea that politeness may serve as another kind of social cue that can influence the amount of effort learners exert during a computer-based lesson (Mayer, 2005). In subsequent research, we plan to compare the learning outcomes of students who learn with a polite or impolite conversational agent. We also note that the eight statements we tested differ along several dimensions—such as style and modality—that should be teased apart in future research.

Research is needed to determine how the computer's politeness affects human–computer interaction in a variety of tasks. For example, Wilkie et al. (2005) found that users were just as frustrated with computer-initiated interruptions in a human–computer telephone dialogue when the computer was polite as when it was direct. In a study of cross-aged tutoring dialogues, Person et al. (1995) suggest that politeness could inhibit effective tutoring in some domains.

Research is needed to determine how politeness affects human–computer interaction in an actual educational scenario rather than simply on a static paper questionnaire. For example, although politeness was not tested, Johnson et al. (2004a) found people responded to flattery from computers similarly to flattery from humans and that experience with computers moderated the effects of how people reacted to flattery from the computer during an educational game.

Acknowledgement

This research was supported by a grant from the National Science Foundation, entitled "Social Intelligence in Interfaces in Educational Software." Correspondence concerning this article should be sent by electronic mail to mayer@psych.ucsb.edu or by postal mail to Richard E. Mayer, Department of Psychology, University of California, Santa Barbara, CA 93106-9660.

References

Brown, P., Levinson, S.C., 1987. Politeness: Some Universals in Language Use. Cambridge University Press, New York.

Cassell, J., Sullivan, J., Prevost, S., Churchill, E. (Eds.), 2000. Embodied Conversational Agents. MIT Press, Cambridge, MA.

Johnson, D., Gardner, J., Wiles, J., 2004a. Experience as a moderator of the media equation: the impact of flattery and praise. International Journal of Human–Computer Studies 61, 237–258.

Johnson, W.L., Rizzo, P., Lee, H., Wang, N., Shaw, E., 2004b. 7th International Conference on Intelligent Tutoring Systems. Maceio, Brazil.

Lepper, M.R., Woolverton, M., Mumme, D., Gurtner, J., 1993. Motivational techniques of expert human tutors: lessons for the design of computer-based tutors. In: Lajoie, S.P., Derry, S.J. (Eds.), Computers as Cognitive Tools. Erlbaum, Hillsdale, NJ, pp. 75–105.

Mayer, R.E., 2001. Multimedia Learning. Cambridge University Press, New York.

Mayer, R.E., 2005. Principles based on social cues: personalization, voice, and presence principles. In: Mayer, R.E. (Ed.), Cambridge Handbook of Multimedia Learning. Cambridge University Press, New York, pp. 201–212.

Mayer, R.E., Fennell, S., Farmer, L., Campbell, J., 2004. A personalization effect in multimedia learning: students learn better when words are in conversational style rather than formal style. Journal of Educational Psychology 96, 389–395.

Moreno, R., 2005. Multimedia learning with animated pedagogical agents. In: Mayer, R.E. (Ed.), Cambridge Handbook of Multimedia Learning. Cambridge University Press, New York, pp. 507–524.

Moreno, R., Mayer, R.E., 2000. Engaging students in active learning: the case for personalized multimedia messages. Journal of Educational Psychology 92, 724–733.

Moreno, R., Mayer, R.E., 2004. Personalized messages that promote science learning in virtual environments. Journal of Educational Psychology 96, 165–173.

Person, N.K., Kreuz, R.J., Zwaan, R.A., Graesser, A.C., 1995. Pragmatics and pedagogy: conversational rules and politeness strategies may inhibit effective tutoring. Cognition and Instruction 13, 161–188.

Reeves, B., Nass, C., 1996. The Media Equation. Cambridge University Press, New York.

Sansone, C., Harackiewicz, J.M., 2000. Intrinsic and Extrinsic Motivation: the Search for Optimal Motivation and Performance. Academic Press, San Diego.

Wilkie, J., Jack, M.A., Littlewood, P.J., 2005. System-initiated digressive proposals in automated human–computer telephone dialogues: the use of contrasting politeness strategies. International Journal of Human–computer Studies 62, 41–71.

Zinn, C., Moore, J.D., Core, M.G., 2005. Intelligent information presentation for tutoring systems. In: Stock, O., Zancanaro, M. (Eds.), Multimodal Intelligent Information Presentation. Springer, Berlin, pp. 227–252.