Media Differences in Communication

Roxanne B. Raine[1,2]

[1] Universiteit Twente,
Human Media Interaction Group,
Department of Mathematics, Engineering and Computer Science,
7500AE Enschede, The Netherlands
[2] University of Memphis,
Institute for Intelligent Systems,
FedEx Institute of Technology (FIT), rm. 410
365 Innovation Drive,
Memphis, TN 38152, USA
roxi.benoit@gmail.com

Abstract. With the ever-growing ubiquity of computer-mediated communication, the application of language research to computer-mediated environments becomes increasingly relevant. How do overhearer effects, discourse markers, differences for monologues and dialogues, and other verbal findings transmute in the transition from face-to-face to computer-mediated communication (CMC)? Which of these factors have an impact on CMC? Furthermore, how can computer interfaces alleviate these potential shortcomings? When is CMC the preferred communicative medium? These questions are explored in this paper.

Keywords: communication; media differences; computer-mediated communication; face-to-face communication.

1 Introduction

The *bandwith hypothesis* claims that the more analogous to face-to-face (FtF) a communicative medium is, the more effective it should be. However, numerous empirical studies have shown that modes of communication other than FtF can be more useful than FtF depending on environmental constraints, user goals, and measures of success (for discussion see [1] and [2]). The bandwidth hypothesis fails to take into account a number of considerations. First, the availability of conversational tools varies with communicative medium, meaning non-FtF media can be more effective than FtF. Second, exploitation of available resources will vary between and within media depending on goals [3]. Third, different measures of success (e.g., number of items correct in task-oriented conversations or amicability of partner) can yield different results. Finally, whether interlocutors actually use their available resources will also impact performance. In this paper, examples of media similarities and differences will

A. Esposito et al. (Eds.): COST 2102 Int. Training School 2009, LNCS 5967, pp. 102–112, 2010.

be explored to elaborate on Whittaker's [1] rejection of the bandwidth hypothesis[1]. It will become evident that sometimes human interaction is enhanced by the use of computer interfaces.

Indeed, there is a vast amount of variability in computer-mediated communication (CMC) environments. For example, email, instant messaging, and message-posting sites have many components that can potentially impact a conversational setting in a variety of ways. Furthermore, these three examples of CMC will not only vary between each other, but also within one framework to another [4]. For example, Google, AOL and Yahoo email accounts differ in communicative tools (such as organization of archives, searchability of messages, and organization of threads) available to users. Skype, AIM and MSN instant messengers differ in verbal or physical feedback allowances. Posting sites can also differ in community membership, interfaces, and levels of interaction available.

2 Interpersonal Judgments

The degree to which interlocutors can relate to each other, the amount they like each other, and how much they allow their interaction to shape their beliefs about each other varies between media. How, to what degree, and in what situations these variations occur remains uncertain. According to Joseph Walther's (1992) *hyperpersonal model* of communication, cue lean media (with fewer communicative tools) promote the belief that someone's interlocutors are like him/herself, and consequently produce higher interlocutor amicability [5]. Walther claims that users of context-scant media perceive each other in high regards because they have fewer disconfirming cues than users of context-rich media.

However, I propose that the hyperpersonal model may be inaccurate on two accounts. First, it presumes that interlocutors enter into communicative settings expecting to like each other or be similar to one another. Second, the assumption that costly communicative media induce higher interpersonal involvement seems unjustified. When interlocutors enter into conversations with agreeable expectations, it is likely that these will be confirmed, and they are [6], [7], [8]. However, negative affectations, prejudices, and stereotypes have also been shown to endure in low-cue media [9], [10]. For example, coworkers were found to band together in IM communications if they were already somewhat close, whereas they distanced themselves further from those who they likely had not viewed as amicably before the IM communications [11]. On such grounds, it seems incorrect to say that low bandwidth correlates with high affiliation.

As an alternative to the hyperpersonal model, I suggest a *preconception hypersensitization*, whereby interlocutors' lack of disconfirming evidence in lower-cue media reinforces *whatever* preconceptions they originally had about each other, whether these preconceptions are positive or negative. According to this view, the less interaction

[1] This paper in the COST 2102 Proceedings gives an overview of the current state of CMC research as it relates to this conference. Instead of describing one study in detail, it overviews many studies and relates them to each other. In this process, new theories are introduced to explain the variety of results in the studies overviewed.

conversational partners are allowed, the more likely they are to hold to their initial presuppositions, regardless of affectations or personal experience [12]. Epley and Kruger manipulated participants' beliefs about their interlocutors before a communication by telling the partners false characteristics about each other [9]. The participants either communicated via computer or telephone. In post-test questionnaires, the CMC participants' beliefs about their partners were most similar to the information they were given before the task (as opposed to those who communicated verbally, whose preconceptions had less influence on their post-test opinions). This result complements the proposed preconception hypersensitization hypothesis, but not the hyperpersonal model. Their preconceptions had a stronger influence on their eventual post-test beliefs in lower-cue mediated communications.

3 Costs and Constraints

A number of constraints may affect the grounding process between speakers and addresses in any interaction. These include: copresence, visibility, audibility, cotemporality (one receives messages at roughly the same time as they are produced), simultaneity (partners can send and receive messages simultaneously), sequentiality of turns, and reviewability and revisability of utterances [13], [14].

As different media allow different resources, which medium (or CMC interface) is preferable will depend on the task. If a reviewable, revisable record is desired, interlocutors should use Gmail (an email client that allows large, long-term archives with an easy search feature). Interlocutors who want immediate feedback will prefer FtF or an audio-visual correspondence such as Skype. Hearing-impaired (and other) users benefit from adding avatars to Skype [15], [16], [17]. It has also been shown that in therapy sessions, the degree of synchrony between therapist and client is a good indicator of therapeutic success [18], [19]. Thus, for intimate disclosure, one might prefer higher bandwidth. For these later purposes, it is true that the communicative settings closer to FtF turn out to be the most effective. However, it is also true that this is not always the case.

There are various costs related to media differences: Participants "balance the perceived costs for formulation, production, reception, understanding, start-up, delay, speaker change, display, faults, and repair" [13], (p. 132). Whether a certain medium is effective will depend on how much the participants exploit the particular resources provided, whether these resources are relevant to the purpose of the conversation, and how much cost is associated with using the resources in question. People prefer FtF for reprimanding, but telephone or letter correspondence for refusing unusual requests [20]. It could be argued that one chooses the cue-enriched medium (in this case, FtF) when it is important or desirable to alter a previous perception (here, the behavior that required reprimanding). Again, this can be explained by the proposed presupposition hypersensitization hypothesis.

Self-reported lying rates tended to be higher for telephone than email communication. In contrast, lying rates in FtF and instant messaging interactions are approximately equal [21]. Cotemporality of media seems to be the factor correlated with changes in lying behavior. Perhaps when given enough time to formulate utterances, the participants are more capable of creatively stretching the truth without explicitly lying.

There also tends to be a loss of temporal flexibility (evident in subjects' poor time management strategies over meetings) in video-mediated meetings as compared to FtF [22], which relates to Clark and Brennan's designation of copresence as a factor in communication. It is possible that the loss of physical copresence caused the users to become distracted by the novelty of their audio-visual medium or less capable of detecting each other's physical cues regarding turn-taking structure. The loss of temporal flexibility in the transition to video-mediated communication could be an advantage or disadvantage to the users, depending on their intentions and goals. These are just a few examples of variations within and between media.

4 Discourse Markers

Discourse markers have a profound effect on communicative effectiveness. So much so that they are even used as dependent variables in some conversation studies. In FtF communication, certain types of discourse markers are useful in signaling speaker certainty. Fox Tree and Schrock note that an oh in "prepared text… is likely to be used for some purpose that differs substantially from its use in spontaneous speech" [23].

Some discourse markers, however, retain their functions across media, such as *ok*, which seems to serve the same purpose in FtF, telephone, and CMC [24], [25]. It appears in close proximity to management of and transition between decision-making sequences [24], [25]. *Okay* and *all right* mark a return from a digression in the conversational topic, as a link between different levels of discourse organization, or to start or end interactions [26]. Discourse markers associated with argumentative convergence are also used similarly in instant messaging and FtF conversations [27]. However, 'statements of disagreement-relevant intrusions' are more common in instant messaging than FtF. This finding may be an artifact of IM's lower bandwidth, which requires users to negotiate more than FtF.

Although some discourse markers (like *ok*) prevail in CMC settings, there tends to be a substantial decrease in such devices when transitioning from FtF to CMC [28]. Thus, deficient performance in CMC settings relative to FtF might be due to the differential use of discourse markers. Fox Tree suggests that a loss of discourse markers could cause the discrepancy she found between monologue and dialogue performance (overhearers to verbal monologues performed worse than overhearers to dialogues) [29]. It is possible that this discrepancy could be a handicap for CMC.

However, computer interface designers have a number of options for enhancing CMC environments. It is certainly possible to create an interface that can overcome many, if not all, of these communicative obstacles. For example, the use of discourse markers often provides information about turn relevant transition places in conversations [30], and one can certainly design an interface to facilitate the use of this type of signal between interlocutors.

5 Turn Taking

Many of the differences between CMC and FtF are predicted by Clark and Brennan's costs [13], [31]. First, CMC speakers may try to be more accurate because mistakes

tend to be more expensive in CMC (formulation costs, production costs, repair costs). This could possibly cause speakers to provide shorter messages but spend more time planning utterances. Second, a pause in CMC is not as interpretable as in FtF (reception costs, understanding costs, delay costs) [32]. Third, responses to messages will sometimes become scrambled (reception costs, understanding costs, delay costs, asynchrony costs). This may cause confusion in a CMC environment. Looking at Clark and Brennan's constraints on grounding, it is clear that FtF is not always the preferred medium [13].

However, CMC interlocutors also have advantages that are unavailable in FtF. Although CMC settings can lack copresence, visibility, audibility, cotemporality, simultaneity or absolute sequentiality, they also usually have the advantages of reviewability and revisability that typical FtF communication does not. A CMC user does not necessarily have to listen, understand, contemplate, and plan next turns simultaneously with the speaker's utterance delivery due to a leniency in CMC synchronization. This is in sharp contrast to FtF [33]. CMC users have fewer processes to juggle at one time.

Lack of simultaneity and synchronization also decrease one's tendency to use fillers (words strategically placed in pauses, such as *um,* possibly to hold the floor). These types of discourse markers are often helpful to listeners, so their absence could impede listener understanding [34], [35], [36]. Additionally, speakers' turns can become disordered when one party does not know what the other party is doing in real-time [31], [32]. Because these discontinuities are so different between media, it is expected that they will affect comprehension differently in different media, at least to some degree. However, CMC interfaces can be designed to overcome this potential problem.

For example, Garcia and Jacobs used a computer-mediated environment whereby users posted to a message board [38]. This is not entirely asynchronous like email, or completely synchronous like verbal communication, so they call it "quasi-synchronous" (QS-CMC). The location of transition-relevant places was different for QS-CMC than verbal conversations. Participants tended to begin typing messages after they saw a posted message from another participant. Thus, the speaker always determined relevant transition locations. Self-repair of messages in progress were different as well, because in QS-CMC, the 'listener' is not able to observe repairs or definitively interpret speaker pauses. In most CMC settings, pauses can be difficult to interpret. They may be artifacts of computer lag, network problems, the interlocutor's trip to the restroom, or a number of other factors [31]. Thus, the phenomena that arise during pauses are also missing in CMC.

For example, in CMC, a listener would be unlikely to include the continuer *uh huh* during a pause, which establishes he/she understands and the speaker can continue speaking [36]. When users have no tools to indicate that they are done with their turns (e.g., a post to the message board in Garcia and Jacobs' study), task-oriented conversations can suffer. Hancock and Dunham compared two entirely synchronous (What-You-See-Is-What-I-See, or WYSIWIS) interfaces in a study about turn markers [37]. Users who were provided turn taking coordination devices made fewer errors. Thus, even when CMC interlocutors have information about speaker pauses (in WYSIWIS), they benefit from having knowledge of their partners' conversational plans and strategies. Clearly, interface modifications can substantially improve the grounding process. Garcia and Jacobs point out that calling QS-CMC a "flawed form of interaction

compared to oral conversation" or "impaired" would assume that verbal communication was the standard by which to measure communication. They propose the term "differently-abled" instead, to emphasize the possibility that QS-CMC can provide other advantages not available in verbal communication [32], (p. 361).

In addition to the differences they found, Garcia and Jacobs also found similarities between their QS-CMC environment and FtF communications. Interlocutors rarely responded to two separate postings in one post, as would be expected in FtF communications. Participants tended to treat transitionrelevant places in QS-CMC similarly to verbal communication (except for the difference mentioned above that the speaker was the sole designator of such locations) [31]. Even though CMC interlocutors can deliver utterances simultaneously, they tend to wait for their turns as in FtF.

CMC interlocutors also tend to entrain on turn taking strategies [38]. Participants' turn sizes tend to mirror each other, as in verbal communication [35]. If one person takes long turns, their partner also tends to take long turns, and vice versa. In synchronous CMC, interface constraints can also influence interlocutor turn sizes [38]. Larger message boxes tend to correlate with longer messages. Thus, CMC design can add constraints to communication that are not factors in FtF communication.

6 Coordinating Representations

CMC has a great advantage of design versatility. As exemplified throughout this paper, there are a number of interfaces and tools available to CMC interlocutors [31], [39], [40]. Depending on which of these tools are available and which are used, communicative effectiveness in CMC can vary. In this section, various uses of coordinating representations in CMC will be explored that can augment cognition in computer-based interactions.

Although coordination devices in WYSIWIS increase communicative effectiveness, the fact remains that no matter how helpful a communicative tool could be, it may not be used. Based on post-test questionnaires, participants in one study said they did not think it would be worth the trouble to use the coordination devices featured in their interfaces [41]. Interestingly, these unused devices would have helped with the exact problems the participants had on the task.

Again, this reiterates Clark and Brennan's costs and constraints on grounding [13]. Apparently, users thought the tool would require too much effort for too little payoff. In the same vein, some CMC modifications may provide little benefit to users, thus proving to be superfluous efforts to programmers. Although the use of avatars is often an advantageous addition to communicative software [15], [16], [17], [42], this is not always the case. Adding pedagogical agents to intelligent tutoring systems does not always improve student performance, even with knowledge of the avatar's facial expressions, gaze and gestures [43]. This could be due to the artificiality of the computational agent, or may indicate that the simulated expressions are unnecessary for certain tasks.

Eye gaze awareness varies drastically between FtF and CMC settings [44], [45], [46]. In their "A look is worth a thousand words" paper, Monk and Gale found that a look actually was worth (almost) a thousand words (949 words, to be exact) [45]. Full

gaze awareness drastically reduces the number of words needed to complete a task (as compared to verbal-only communications). When users had information about their interlocutors' eye gaze, turns were reduced by 55% and accuracy was increased by 80%. Moreover, Richardson and Dale [46] found that overhearers to prior conversations did better on comprehension tests of the conversational material if their eye gaze positions were manipulated to match the speakers' eye movements.

CMC can enhance communication with copresence and covisibility. Intelligibility and word-duration are the same for FtF and CMC when CMC environments include verbal and visual copresence [48]. Math students retain more information if instructors use visual gestures [49]. Alone, this result would support the bandwidth hypothesis. However, there is also evidence that interface design could overcome the handicap caused by CMC environments' lack of gesture. When people communicate in a virtual environment, they prefer virtual gesture, even if they share physical copresence [50]. Only when deprived of parallel action in the virtual environment will they revert to physical gesturing. design can add constraints to communication that are not factors in FtF communication.

7 Overhearer Effects

Overhearer effects do occur in CMC environments, but they are not as strong as in verbal communications [51], [52]. Overhearers might perform better in CMC because CMC communication is more public. Speakers may try to be better at communicating in their initial utterances to avoid miscommunications (which are more costly in CMC). Thus, their initial messages are easier to understand, and this is reflected in overhearers' performance and understanding.

There are a number of other differences Čech and I found depending on exactly how overhearers are presented information. We found that matchers, who were allowed to provide the director feedback performed better than other groups of listeners who were not allowed to communicate with their directors. Overhearers who read messages from the matcher and director were next in rank (if they were *not* allowed to communicate with fellow overhearers), and the overhearers who could chat with each other performed worst. This is likely due to attention limitations [53].

We added two more conditions with a new group of participants to investigate the chatters' poor performance compared to the matchers and regular overhearers. In one of these, the chatters communicated with each other over the computer (as before), but were allowed to go through the director and matcher messages at their own leisure, to alleviate the time constraint. These chatters did better than the earlier chatters, but no better than the original overhearers. The additional perspectives in a conversation are not necessarily advantageous, as Fox Tree [29] had suggested might be possible.

In the second replication of the chatter condition, chatterers sat side-by-side and exchanged their opinions and ideas about the original director/matcher dialogues. Like the other chatters, they read the director/matcher messages over the computer and performed the task over the computer. However, they conversed with each other verbally. This caused a large positive effect in their performance. Additional post-tests showed that this result was not solely due to the change of medium (the effect diminished when they faced separate screens). Thus, copresence and covisibility were important factors for engaging the participants in this picture-placing task.

8 Conclusions

CMC offers a number of tools such as reviewability and revisability that are not available in FtF. Some discourse markers are the same in CMC and FtF (such as *okay* and *alright*), but most are not (e.g., *oh*, *umm*, and *uh-huh*). Although the lack of some of these discourse markers may decrease the listener's understanding, computer interfaces are capable of compensating for this discrepancy between media. This will not only require knowledge about which discourse markers would be needed in CMC interfaces, but it would also require knowledge about how to get users to take advantage of such tools provided in the interface design. Whether the cuerichness of FtF offers interlocutors an advantage depends on whether they utilize the tools provided. It also depends on the particular task being performed.

Acknowledgments. Many thanks are owed to Anton Nijholt of the University of Twente, Claude G. Čech of the University of Louisiana at Lafayette, and Danielle McNamara at the University of Memphis, as well as the AMIDA traineeship program. Each of these mentors and this program helped me continue to learn about mediated communication.

References

1. Whittaker, S.: Theories and methods in mediated communication. In: Graesser, A., Gernsbacher, M., Goldman, S. (eds.) The Handbook of Discourse Processes, Erlbaum, NJ (2003)
2. Fox Tree, J., Mayer, S., Betts, T.: At the crossroads of speaking and writing. Presented at the Society for Text and Discourse annual meeting, Rotterdam, the Netherlands (July 2009)
3. Walker, M., Whittaker, S.: Mixed initiative in dialogue: An investigation into discourse segmentation. In: Proceedings of the Association of Computational Linguistics ACL (1990)
4. Herring, S.C.: Introduction. In: Herring, S.C. (ed.) Computer-Mediated Communication: Linguisitc, social, and crosscultural perspectives, pp. 1–10. John Benjamins Publishing Company, Amsterdam (1996)
5. Walther, J.B.: Interpersonal effects in computer-mediated interaction: A relational perspective. Communication Research 19, 52–90 (1992)
6. Rabby, M.K., Walther, J.B.: Computer-mediated communication effects in relationship formation and maintenance. In: Canary, D.J., Dainton, M. (eds.) Maintaining relationships through communication, pp. 141–162. Lawrence Erlbaum and Associates, Mahwah (2003)
7. Rodgers, S., Chen, Q.: Internet community group participation: Psychosocial benefits for women with breast cancer. Journal of Computer-Mediated Communication 10(4) (2005)
8. Walther, J.B., Boyd, S.: Attraction to computer-mediated social support. In: Lin, C.A., Atkin, D. (eds.) Communication technology and society: Audience adoption and uses, pp. 153–188. Hampton Press, Cresskill (2002)
9. Epley, N., Kruger, J.: When what you type isn't what they read: The perseverance of stereotypes and expectancies over email. Journal of Experimental Social Psychology 41, 414–422 (2005)
10. Mensink, M., Rapp, D.: Evil geniuses: Inferences from mismatches between trait descriptions and reader preferences. Presented at the Society for Text and Discourse annual meeting, Rotterdam, the Netherlands (July 2009)

11. Quan-Haase, A., Cothrel, J., Wellman, B.: Instant messaging for collaboration: A case study of a high-tech firm. Journal of Computer-Mediated Communication 10(4) (2005) Article 13
12. Raine, R.: Who dat and where y'at? Acadians and their conventions for consideration of intercultural interlocutors: Towards a disambiguation of perspective taking in communication research. PhD dissertation, the University of Louisiana at Lafayette (2008)
13. Clark, H.H., Brennan, S.A.: Grounding in communication. In: Resnick, L.B., Levine, J.M., Teasley, S.D. (eds.) Perspectives on socially shared cognition, pp. 127–149. APA Books, Washington (1991)
14. Clark, H.H.: Using language. Cambridge University Press, Cambridge (1996)
15. Granstrom, B.: Modelling Listener Reactions to a Conversation – practical exercises. Paper presented at COST conference and winter school in Dublin, Ireland (March 2009)
16. Al Moubayed, S., Beskow, J., Öster, A.-M., Salvi, G., Granström, B., van Son, N., Ormel, E., Herzke, T.: Studies on Using the SynFace Talking Head for the Hearing Impaired. In: Proceedings of Fonetik 2009. Dept. of Linguistics, Stockholm University, Sweden (2009)
17. Al Moubayed, S., Beskow, J.: Effects of Visual Prominence Cues on Speech Intelligibility. To be published in Proceedings of Auditory-Visual Speech Processing AVSP 2009, Norwich, England (2009) (in press)
18. Ramseyer, F., Tschacher, W.: Synchrony: A Core Concept for a Constructivist Approach to Psychotherapy. Constructivism in the Human Sciences 11(1-2), 150–171 (2006)
19. Ramseyer, F., Tschacher, W.: Synchrony in Dyadic Psychotherapy Sessions. In: Vrobel, S., Rössler, O.E., Marks-Tarlow, T. (eds.) Simultaneity: Temporal Structures and Observer Perspectives, pp. 329–347. World Scientific, Singapore (2008)
20. Furnham, A.: The message the context and the medium. Language and Communication 2, 33–47 (1982)
21. Hancock, J.T., Thom-Santelli, J., Ritchie, T.: Deception and design: The impact of communication technology on lying behavior. In: Proceedings of the SIGCHI conference on human factors in computing systems, pp. 129–134. Addison Wesley, Vienna (2004)
22. Kane, B.: What can vocalization patterns tell us about the content of meetings? Paper presented at COST conference and winter school in Dublin, Ireland (March 2009)
23. Fox Tree, J.E., Schrock, J.C.: Discourse markers in spontaneous speech: Oh what a difference an "oh" makes. Journal of Memory and Language 40, 294 (1999)
24. Bangerter, A., Clark, H.H., Katz, A.R.: Navigating joint projects in telephone conversations. Discourse Processes 37(1), 1–23 (2004)
25. Condon, S.L., Čech, C.G.: Ok, next one: Discourse markers of common ground. In: Fetzer, A., Fischer, K. (eds.) Lexical markers of common ground, pp. 17–45. Elsevier, Oxford (2007)
26. Bangerter, A., Clark, H.H.: Navigating joint projects with dialogue. Cognitive Science 27, 195–225 (2003)
27. Stewart, C.O., Setlock, L.D., Fusselll, S.R.: Conversational argumentation in decision making: Chinese and U.S. participants in face-to-face and instantmessaging interactions. Discourse Processes 44, 113–139 (2004)
28. Wilkes-Gibbs, D., Clark, H.H.: Coordinating beliefs in conversation. Journal of Memory and Language 31(2), 183–194 (1992)
29. Fox Tree, J.E.: Listening in on monologues and dialogues. Discourse Processes 27, 35–53 (1999)
30. Schiffrin, D.: Discourse markers. Cambridge University Press, NY (1996) (original work published 1987)

31. Davis, B.H., Brewer, J.P.: Electronic discourse: Linguistic individuals in virtual space. State University Press, Albany (1997)
32. Garcia, A.C., Jacobs, J.B.: The eyes of the beholder: understanding the turn taking system in quasi-synchronous computermediated communication. Research on Language and Social Interaction 32, 337–367 (1999)
33. Clark, H.H., Wilkes-Gibbs, D.: Referring as a collaborative process. Cognition 22, 1–39 (1996)
34. Clark, H.H., Wasow, T.: Repeating words in spontaneous speech. Cognitive Psychology 37, 201–242 (1998)
35. Sacks, H., Schegloff, E., Jefferson, G.: A simplest systematics for the organization of turn taking in conversation. Language 50, 696–735 (1974)
36. Schegloff, E.A.: Discourse as an interactional achievement: Some uses of 'uh huh' and other things that come between sentences. In: Tannen, D. (ed.) Georgetown University roundtable on languages and linguistics 1981: Analyzing discourse: Text and talk, pp. 71–93. Georgetown University Press, Washington (1982)
37. Hancock, J.T., Dunham, P.J.: Language use in computer-mediated communication: The role of coordination devices. Discourse Processes 31, 91–110 (2001)
38. Čech, C.G., Condon, S.L.: Message size constraints on discourse planning in synchronous computer-mediated communication. Behavior Research Methods, Instruments, & Computers 30, 255–263 (1998)
39. Brugnoli, M.C., Morabito, F., Walker, R., Davide, F.: The PASION project: Psychologically augmented social interaction over networks. Psychology Journal 4(1), 103–116 (2006)
40. Rosenberg, D., Foley, S., Lievonen, M., Kammas, S., Crisp, M.J.: Interaction spaces in computer-mediated communication. AI &. AI & Society 19, 22–33 (2005)
41. Alterman, R., Feinman, A., Introne, J., Landsman, S.: Coordinating representations in computer-mediated joint activities. In: Moore, J.D., Stenning, K. (eds.) Proceedings of 23rd Annual Conference of the Cognitive Science Society, pp. 15–20. Lawrence Erlbaum Associates, Inc., Mahwah (2001)
42. Karlsson, I., Faulkner, A., Salvi, G.: SYNFACE—A talking face telephone. In: Eurospeech 2003, pp. 1297–3000 (2003)
43. Craig, S.D., Driscoll, D.M., Gholson, B.: Constructing knowledge from dialogue in an intelligent tutoring system: Interactive learning, vicarious learning, and pedagogical agents. Journal of Educational Multimedia and Hypermedia 13, 163–183 (2004)
44. Hanna, J.E., Brennan, S.E.: Speakers' eye gaze disambiguates referring expressions early during face-to-face conversation. Journal of Memory and Language 57, 596–615 (2007)
45. Monk, A.F., Gale, C.: A look is worth a thousand words: Full gaze awareness in videomediated conversation. Discourse Processes 33, 257–278 (2002)
46. Richardson, D.C., Dale, R.: Looking to understand: The coupling between speakers' and listeners' eye movements and its relationship to discourse comprehension. Cognitive Science 29, 1045–1060 (2005)
47. Tanenhaus, M., Spivey-Knowlton, M., Eberhard, K., Sedivy, J.: The interaction of visual and linguistic information in spoken language comprehension. Science 268, 1632–1634 (1995)
48. Anderson, A.H., Howarth, B.: Referential form and word duration in videomediated and face-to-face dialogues. In: Bos, J., Foster, M., Matheson, C. (eds.) Proceedings of the sixth workshop on the semantics and pragmatics of dialogue, vol. 13, pp. 13–20. University of Edinburgh Press, Edinburgh (2002)

49. Goldin-Meadow, S., Nusbaum, H., Kelly, S., Wagner, S.: Explaining math: Gesturing lightens the load. Psychological Science 12, 516–522 (2001)
50. Gill, S.P., Sethi, R., Martin, S.: The engagement space and gesteral coordination. In: Cave, C., Guaitella, I., Santi, S. (eds.) Oralite et Gestualite: Interactions et Comportements Multimodaux dans la Communication (Proceedings of ORAGE 2001, International Conference on Speech and Gesture). L'Harmattan, Paris (2001)
51. Čech, C.G., Benoit, R.B.: Are two heads better than one (Listening in on overhearer collaboration). Paper presented at the 44th annual meeting of the Psychonomic Society, Vancouver (November 2003)
52. Raine, R.B., Čech, C.G.: Overhearers in CMC: Deficient or advantageous? Paper presented at COST conference and winter school in Dublin, Ireland (March 2009)
53. Clark, H.H.: How do real people communicate with virtual partners? Paper presented at AAAI Fall Symposium: Psychological Models of Communication in Collaborative Systemsm North Falmouth, MA (November 1999)