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Instant messaging with WebWho

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We present a study of how awareness of presence affects content of instant messaging sent between students using *WebWho*, an easily accessible web-based awareness tool. WebWho visualizes where people are located in a large university computer lab and allows students to virtually locate one another and communicate via an instant messaging system. As WebWho is there to be accessed through any web browser, it requires no programming skills or special software. It may also be used from outside the computer lab by students located elsewhere. The sender's user name is normally automatically added to the instant messages, but the messages can also be sent anonymously. We were interested in finding out if the sender's conscious hiding of his or her identity seemed to be reflected in the content of anonymous messages, and how these differed from those with identified senders. Awareness of presence seems to be one of several factors influencing message composition, both content and structural aspects. At this stage, we have primarily focused on examining how different factors affects the content of the messages. We cross-analysed the messages for content in relation to parameters such as sender location (collocated, distributed and distant) and sender status (anonymous vs. identified), in order to find out whether awareness of presence seems to be an influencing factor. Computer-mediated communication (CMC) is often claimed to be a sort of hybrid between spoken and written interaction [c.f. Ferrara, Brunner & Whittemore (1991) and and several others]. We compared the messages that were sent using the instant messaging tool in WebWho with data from other types of CMC (email, chat) and also with corpora of spoken language and traditionally written language. The aim of the study was primarily to investigate awareness of presence affects on instant messaging, and only secondarily to investigate spoken vs. written features of the texts. Results show that awareness of both physical and virtual presence affects the content of the messages, and that these factors affects the text differently. Sender status, the nature of the computer-mediated medium, and the written mode shape the messages as well. Results show that the students use the messaging system to support collaborative work and coordinate social activities, and extensively for playful behaviour.

1. Introduction

WebWho (Ljungstrand, 1999; Ljungstrand & Hård af Segerstad, 2000) is a lightweight, web-based awareness tool that shows a schematic view of the workstations in a large university computer lab, and who is currently logged in and where. As the system is reachable through a web page the ease of deployment is enhanced, as well as the accessibility of the system. WebWho explicitly conveys place information (i.e. real-world user location) and provides a good overview for students to find the whereabouts of each other at-a-glance, as well as to find unoccupied computers in the lab (see Figure 1). In addition to a schematic overview of the lab, WebWho provides simple messaging services: normal email can easily be sent using a shortcut to the user's default email program, directly selectable from a pull-down menu in the web page. In the same way, students can easily look at someone's entry in the on-line student catalog, showing a photo and personal contact information, as well as access that person's home page (see Figure 1). The system also has a function for sending short messages that instantly pop up topmost on the recipient's computer screen. The WebWho system is mainly intended to support collaboration and coordination between distributed users, primarily within different rooms in the lab building but also for people situated elsewhere, such as students with Internet access at home. Though WebWho has a

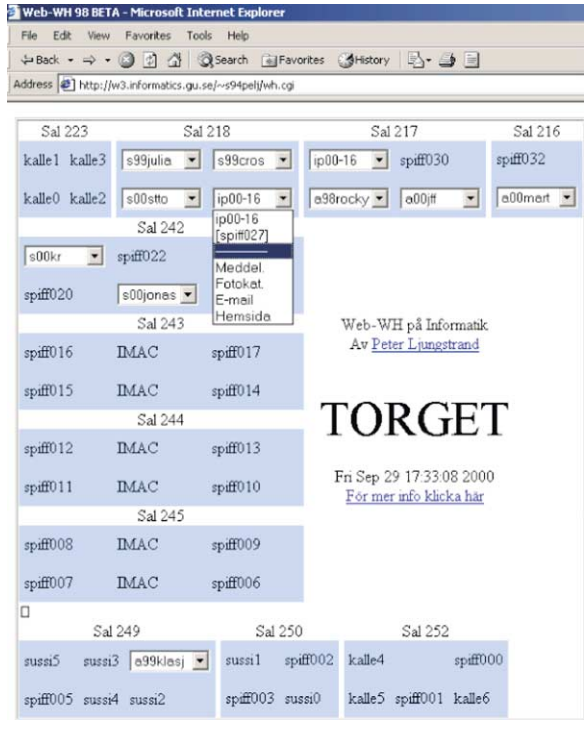

FIGURE 1. A WebWho screenshot with one user's pull-down menu activated. The shaded boxes symbolize different rooms in the lab, each with two, four or six workstations, spatially organized as shown on the screen.

number of different, but related, functions, this paper will primarily examine the instant messaging part, and in particular how different factors affect the content of the instant messages.

We begin by touching briefly on previous studies of other instant messaging systems and introduce how WebWho works. In order to give a background to our study, we bring up assumptions from previous studies of CMC and features of different modes of communication. Method and material are then accounted for, followed by results and a discussion.

1.1. INSTANT MESSAGING AND EDUCATION

WebWho allows for sending instant messages to specific workstations, the identity of the person logged in on which is most probably known to the sender of the message. Instant messaging systems of various forms have gained high popularity during the past few years. Commercial instant messaging systems such as ICQ and AOL Instant Messenger have attracted millions of daily users in recent years, and the instant messaging phenomenon has also recently attracted researchers (e.g. Nardi, Whittaker & Bradner, 2000); Smith, Cadiz & Burkhalter, 2000). In addition to the desktop-based, on-line services, many millions of short messages (SMS) are being sent daily to and from mobile phones throughout the world.

WebWho is deployed at a university, i.e. an educational setting, but it is not designed to specifically support education *per se* in a traditional sense. Research within the field of computer-supported collaborative learning (CSCL) and similar areas have investigated the use of computer-mediated communication (CMC) tools to support for instance distance education (see e.g. Wolz, Palme & Anderson, 1997). This research has not specifically looked at instant messaging systems, perhaps partly because of the somewhat chaotic nature of such systems. CMC systems within CSCL research generally support a learning situation where one or more teachers are "in control of" and directing the learning situation for and with the students, or at least they assume a teacher–student relationship in some fashion. WebWho has no such built-in assumptions; it is being used by the students without any teacher interference or control, for whatever purposes the students might see fit. In this sense, WebWho is more similar to generic communication tools such as email and telephones than to systems specifically designed to support an educational setting.

1.2. AWARENESS SUPPORT AND ACTIVE MAPS

Research related to awareness in one form or another has gained much attention within the CSCW and HCI communities. However, most systems proposed to support awareness have involved quite some overhead in order to work: specific hardware and software to be installed, login procedures, the need to explicitly state one's current activity, etc. (e.g. Dourish & Bellotti, 1992; Tollmar, Sandor & Schömer, 1996; Pedersen & Sokoler, 1997; Erickson, Smith & Kellogg, 1999). This is understandable given the experimental nature of these systems, but most end-users such as students simply want usable systems that work right away, without any hassle. A major requirement when designing WebWho was that it should not use any custom software

at all on the client side, and that the user's explicit involvement should be kept at a minimum, especially in terms of updating profiles, etc.

The system presented in this paper, WebWho, is a lightweight service that relies on readily available server status information, which is refined and visualized in a way that is easily accessible to individuals from any workstation with a web browser. No explicit actions (except the normal log in procedure for Windows or Linux) are needed on behalf of the students to make their on-line status available to others. WebWho can be seen as an extension of the Unix command *who*, with a graphical interface to display location and messaging support, and indeed, the *who* command is one of the sources of information for the WebWho scripts on the server.

There have been other systems designed to support awareness of presence in real time by displaying a map, overlaid with up-to-date location information of people. For instance, ActiveMap (McCarthy & Meidel, 1999) is a system deployed in a large corporate office setting. The system is based on active badges with a supporting infrastructure of beacons spread throughout the office environment. When running a custom application on a desktop PC, one can see a schematic map of the offices with information about who is where in the rooms and corridors. WebWho provides a much more lightweight and simplistic solution, with less location granularity, but much easier to deploy.

Other systems have been created for visualizing the dynamics of electronic communities based on log files (e.g. Donath, 1995) but such systems tend to be less useful for supporting synchronous or semi-synchronous activities. Smith *et al.* (2000) created Threaded Chat, a system for real-time visualizing of threaded chats between multiple distributed users, somewhat similar to how threads in Usenet newsgroups are organized. Threaded Chat was designed to make it easier for its users to follow the otherwise transient nature of chat or instant messaging. Some on-line presence information was presented, but there was no fine-grained cues as to the whereabouts of the users in relation to each other or a local physical area. Both these systems were also intended for geographically dispersed users rather than co-located or almost co-located people.

Churchill and Bly (1999) presented a study of how a text-based virtual environment (such as a MUD) can be used to support communication between non-collocated colleagues, and concluded that text-only communications can offer a high degree of richness of expression, despite the fact that it lacks almost all the visual and auditory cues known to be important in face-to-face collaboration. This suggests that even a very simple instant messaging tool like WebWho still can be used for very expressive communication. Similar results were found by Mitsuoka, Watanabe, Kakuta and Okuyama (2001) in a recent study of i-Mode-based mobile phone services for university students in Japan.

A major difference between WebWho and many other awareness systems is that WebWho is primarily place-centred, and only secondarily person-centred. As the students do not have their personal workstations but rather have to share them with all the other students, they typically sit at different physical locations in the lab from time to time. This is not the case with systems designed to support awareness of people's presence at a typical workplace, no matter if the system is intended to support collocated people, usually in one office (Tollmar *et al.*, 1996; Erickson *et al.*, 1999;

McCarthy & Meidel, 1999) or distributed people at different geographical locations (Dourish & Bellotti, 1992; Smith *et al.*, 2000). With these systems, a person described by the system is generally also associated with only one place (desk, room or cubicle). With the Media Space system (Dourish, 1992), it was possible to sometimes see more than one person at a time, but the system was installed in an environment where people had their own offices and tended to be a relatively low number of places, in case one wanted to find them, rather than moving from place to place all the time. In the university computer lab, students can be logged in virtually anywhere; there are often no "typical" places to look for them, at least not among the workstations. There are far more students than workstations, and the students often have to book a specific computer to use during a specified time slot, and then maybe move to some other place to continue their work. To students wanting to engage in face-to-face interaction with their friends and classmates (as is often the case), it is of utmost importance to find out not only if the person they are looking for is in the lab, but also where he or she is situated. The rooms and the locations of the workstations in the lab are static, but the places where the students log in are not. Therefore, it seemed logical to have a schematic view of the workstations rather than a list of the currently logged-in students (as in the Unix who command) as the basis of the system.

1.3. WEBWHO IN USE

The students are using WebWho (as well as email, ICQ, mobile phones and face-to-face spoken interaction) to communicate and coordinate their actions both for work purposes and for social activities. When using a web browser to display who is in the lab, and where, the system takes a "snapshot" of all users that are currently logged in at that moment. This information is mapped to a schematic view of the lab rooms and displayed in a web browser, arranged as a map of the building (Figure 1). This schematic view allows the students to find out the whereabouts of their friends in the lab, as well as to find unoccupied computers at a glance, without having to physically search through the different rooms and floors in the building. When sending instant messages, the sender can optionally choose to be anonymous to the recipient but this requires that he or she consciously and manually check a box before sending the message. The default case is messages with identified sender, the user name is automatically added to the message if the sender is logged in. The university computer lab in which WebWho is used consists of a large number of rooms in one building, each with approximately six computer workstations. Most rooms are on the ground level in the building but some are located at higher levels. Since there are many more students than workstations—some 700 students share the 120+ workstations—the computer lab tends to be very busy at times and it is not always possible for students who are working together to get computers that are located right next to one another in the lab. WebWho allows for them to easily locate the whereabouts of each other in the computer lab, and to communicate one-to-one in a near-synchronous fashion using the instant messaging system, with the fast network making the transmission time only a fraction of a second. The visualization of the computer lab supports the sender's awareness of the recipient being logged in at a specific workstation prior to sending an instant message.

WebWho has been on-line since November 1997. Even though WebWho has never been publicly advertised, the students have used it extensively. The instant messages sent through WebWho typically have a coordinating nature: they are used to arrange physical meetings (e.g. lunch, breaks for smoking, etc.), and for short questions and answers (e.g. regarding details of how to solve a particular programming assignment).

In contrast to what one might expect, the students do not conceive WebWho as an intrusion of privacy. During the 3 years WebWho has been running, not one single student has complained about the fact that his or her on-line presence and very precise location is available to anyone on the web. Perhaps this is due to the fact that there is an option to block annoying incoming messages (though hardly used at all), and that the system is based on server data that are already publicly available anyway to the students. Also, parts of the system (in particular, the on-line photo catalogue) are unavailable from computers with IP-numbers outside the university network domain. There might be students who dislike the system but who still for some reason have not complained, but we have not found anything that indicated this.

In general, privacy issues are of high concern for awareness systems, and in particular for systems conveying detailed user information to just about anyone who is watching, which is one way to interpret how WebWho works. However, we have considered a detailed discussion of privacy issues to be beyond the scope of this paper. For a more thorough discussion of privacy and awareness of presence as well as a system designed to take this into account, see Godefroidy, Herbsleb, Jagadeesany and Li (2000).

The primary aim of the study reported in this paper was to examine if and how awareness of the recipient's presence affected the content of the instant messages. To facilitate this, logs of instant messaging communication were collected during an extended period of time. The sender's and recipient's true identities were replaced with unique, but untraceable identification codes. We hypothesized that being aware of the recipient's actual and immediate presence would affect the topic of the messages—what people communicate about. The location and identity of the recipient is given through his or her log-in name as visualized through the WebWho web page.

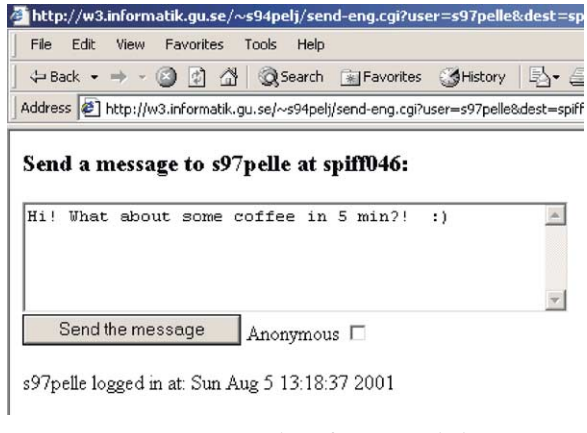

FIGURE 2. Snapshot of message window.

Awareness of presence is one of several possible factors that influence what people write about in their messages, and the one of main concern in this particular study. Other factors that influence the texts of messages are certainly the written mode *per se* (compared to the ease of production, the multimodality and synchronicity of spoken face-to-face interaction), the networked communication which in addition to the written mode gives less obvious clues of identity', as well as shared context and background knowledge. (Figure 2).

2. Features of CMC and influencing factors

In order to give a background to our study and our assumptions for the analyses, we will briefly touch upon some findings of previous studies of CMC.

CMC is the communication produced when human beings interact with one another by transmitting messages via networked computers. Most CMC today is text-based communication, i.e. typed on a computer keyboard and read as text on a computer screen (Herring, forthcoming). Different kinds of CMC set the stage differently for the type of communication to take place; the users communicate either asynchronously, using e.g. email, where the receiver of the message does not have to be on-line in order for the communication to take place, or they communicate synchronously, or to put it more accurately: near- or quasi-synchronously (cf. Ferrara *et al.*, 1991) like in a web chat or IRC, which requires all participants to be logged on at the same time.

Many studies have claimed that different types of CMC, such as chat and email, are hybrids between speech and writing (DuBartell, 1995; several others). Email is said to take on some of the features of spoken interaction because of the speed of message exchange, but employs many features of traditional writing as it is still in fact a written medium (Maynor, 1994).

Studies comparing different kinds of writing techniques have shown that the faster the written medium, the more like spoken language the written messages get (cf. Horowitz & Berkowitz, 1964). That study argued that the language in messages that were steno-typed showed more features that are normally associated with the spoken register, than messages that were hand-written or typed on a typewriter. DuBartell's study of the features of the messages in a mailing list (DuBartell, 1995) suggests that the spoken-and written-like characteristics in a written medium result from the constraints imposed by the computer medium—the machine architecture. The computer medium permits texts, which seem both written-like and spoken-like. Herring (1996) has shown that email messages seem to get more informal in terms of both composition (salutation and closing conventions) and form (spelling, syntax) because most email software automatically prompts information about the user and details of posting.

CMC messages display linguistic characteristics typically associated with spoken language and other forms of written language in addition to linguistic features specific to the medium. Maynor argues that the syntactical features of ''e-style'' sometimes reflect informal habits of speech when pronouns, subject, verbal auxiliary, copula or modal are often omitted (Maynor, 1994, p. 50). DuBartell claims that we expect written language to be edited, planned, articulated without recourse to non-standard constructions, slang and vulgar expressions. From speech we expect more or less the

opposite: we expect slang, the non-standard grammatical constructions, the sudden topic shifts and spontaneity. "CMC gives us these in writing. CMC discourse exhibits the type of grammatical constructions that appear in non-edited non-standard spoken language of face-to-face interaction" (DuBartell, 1995, p. 233). The same kind of arguments is found in Baym (1996), who claims that although CMC is written it is marked by many features typically associated with face-to-face interaction.

Previous research has shown that the purposes of communication, topic and medium of communication play a part in the way messages are formulated DuBartell, 1995; cf. Baym, 1996; Hård af Segerstad, 2000*b*; Hård af Segerstad, 2001). The influence on messages by the relation between sender and recipient whether the sender and receiver know each other and their social status is discussed by Danet (forthcoming).

Partly as a result of having a subject displayed, email messages frequently omit even the typical salutations and farewells associated with other media, regardless of whether the speakers know each other. Email messages do display rather informal register characteristics, even between persons unknown to one another (Danet, forthcoming). Recent research has shown that instant messaging takes this even further, in that much of the context of a short message can be left out from the text (Nardi *et al*., 2000).

In this study, we were interested in finding out whether the sender's awareness of the receiver's presence influenced the content of the messages. Machine architecture, written mode, etc. are factors of interest in our investigation.

2.1. MODES OF COMMUNICATION

Traditional written communication is typically asynchronous, assuming non-presence and a dialogue only with severe time delay. Writing is monomodal, employing vision only, and the production is physically laborious and time consuming. Written communication employs a graphic system for representing only the vocal aspects of spoken interaction, and employs it rather imperfectly at that. For instance, Swedish has about 35 phonemes but employs no more than 28 alphabetic graphemes to represent it, not counting other prosodic phenomena such as emphasis and tone of voice, etc. Handwritten messages give away clues of the sender's identity from the handwriting in itself. Computer written messages give away less clues. The effort of sending traditional mail, "snail mail", involves the trouble of putting a piece of paper in an envelope, addressing it and stamping it, carrying it to the post office, not to mention the time delay of having to wait several days for it to reach its destination (cf. Maynor, 1994).

Email is an asynchronous messaging system without the need for visual confirmation of the receiver's presence at the time of sending. Email communication shares many features of traditional written communication: it is indeed written using the same graphic system and monomodality as traditional writing. The dialogue suffers much less from time delay, and the ease of access for sending messages is considerably greater. The user's relative anonymity of the computer-mediated produciotn and transmission might also play a part in message composition.

Web chat uses a near-synchronous (cf. Ferrara *et al*., 1991) conversational tool by which the participants know that other participants are presently logged on. Web chat participants very often have no personal knowledge of the others, in contrast with WebWho interlocutors who very often are classmates and friends. The time delay is

much less severe compared to email interaction, and in this respect comes closer to spoken communication. Chat systems and instant messaging systems both require synchronous participation. The interaction is only near-synchronous, though, as the messages have to be typed first and then transmitted, whereas telephone and face-to-face interaction are fully synchronous modes of communicating. Chat participants do not share the mutual context of a computer lab, which is the normal case for WebWho communication.

Spoken face-to-face interaction is multimodal, sending and receiving information through both visual and vocal modalities. The effort of production is minimal and the exchanges rapid. Awareness of presence increases the more synchronous the communication gets. It is a matter of discussion whether web chat is more synchronous than instant messaging communication: both modes require both the sending and the receiving party to be logged in simultaneously to succeed. Web chat normally allows both parties to read the conversation in one window on the screen, whereas instant messages come singly. Simply viewing and comparing modes of communication in a linear fashion along the synchronicity continuum does of course not give us the whole picture of what is going on in communicative interaction. As previously mentioned, a whole range of other factors are also important for how we engage in the action, what we talk or write about and how we do it. Level of synchronicity, i.e. how synchronous the participants in the interaction are, is one important aspect influencing the way communication is conducted.

3. The study

In this study, we are primarily interested in finding out whether awareness of presence affects message content, and also interested in finding out what the students are using the instant messaging service for. Does the awareness of the receiver's presence seem to affect the content of the messages? We compared the WebWho message log to corpora of spoken interaction and traditional written language, as well as to other kinds of CMC that are of slightly different settings, namely email and web chat, in order to find out where the instant message type of communication employing WebWho differ and show similarities on a number of aspects. Many aspects of this may be scrutinized, and we judged it to be beyond the scope of this article to deal with more than brief comparisons.

The aim of the study reported in this paper was to examine if and how awareness of the recipient's presence affected the content of the instant messages. We predicted that the WebWho tool would be used by students to coordinate their work for group assignments and to coordinate social activities, such as coffee breaks and activites outside the university. Being aware that the receiver is actually there to read the message at the time that the sender transmits it was taken as a factor that would affect the topic of the message. The identity of the receiver is given through the log in name, which is a student ID and whose referent is most probably known to other students within an assignment group, but not possible to decipher by people outside the university environment.

Our predictions concerning how awareness of presence affects the content of messages had to consider real-world facts, not only the "virtual presence" as visualized

through WebWho, but also physical presence when the recipient is located in the same lab room as the sender. The message logs were divided into the following settings, based on the messages sent between students.

(1) *Collocated*. Both sender and recipient were located in the same lab room at the same time, hence it was possible to have physical awareness of each other's presence, and of course to see one another and talk directly face-to-face (both physical and virtual awareness of presence).
(2) *Distributed*. Sender and recipient were located in different lab rooms in the same building, using the WebWho tool to locate the presence of each other (virtual awareness of presence).
(3) *Distant*. The sender accessed WebWho from outside the building, using a dial-up connection or the like, to locate the recipient (virtual awareness of presence). The system only allows for receiving messages from outside the university building, and not for sending messages outside.

As mentioned above, WebWho allows for messages to be sent anonymously (i.e. the recipient cannot tell who sent the message, and the pop-up window is quite similar to a system error message window), and the log showed messages that were sent with non-identified senders. An analysis of these anonymous messages is especially intriguing: what kind of messages did the senders choose to send anonymously, and why were they sent? A cross analysis of sender location and sender identity (did the sender identify himself or choose to go anonymous?) was made for this purpose.

4. Data collection and analyses

We have gathered different types of logs during several years of WebWho usage, e.g. frequency of use of the overview page visualizing the lab, frequency of use of the instant messaging service, usage from within or without the university network domain, etc. We have also extracted a number of messages from the instant messaging service. The WebWho corpus, the messages log, that we analysed for this study consists of a total number of 8231 logged messages sent during the period September 1, 1998–December 31, 1999 (see below). As mentioned above, WebWho has been on-line since November 1997. The messages have been anonymized during collection so that the original sender cannot be identified, but the logs still contain the essential text of the messages.

4.1. QUANTITATIVE ANALYSES, AUTOMATIC MEASURES

The WebWho corpus was analysed automatically using computer programs† in order to find out the number of messages sent, word frequency (also applies to "word-like" elements like smileys), sender location (in the same lab room, elsewhere in the lab at home or somewhere else away from the lab) and sender status (anonymous vs.

†Thanks to Leif Grönqvist at the Department, of linguistics, Göteborg University.

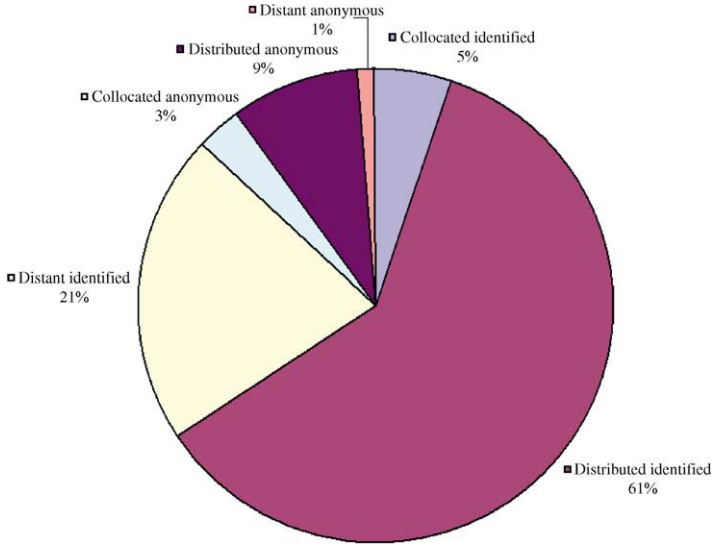

FIGURE 3. An overview of the distribution of the different message categories.

TABLE 1
Topic categories with explication, examples and percentage of sample

Topic category	Comment and/or examples	% of sample
Mischief	Funny comments, e.g. "*Miau*", "*your computer is taken hostage give us girls and money*"	18.2
Task related	"*have you finished task 4 yet*?"	15.8
Social coordination	Coordinate coffee breaks, invitation to parties and games, e.g. "*It's time*"	13.8
Greeting	"*good morning*", "*I just wanted to say hello*"	12.8
Location	Coordination and computer lab bookings: "*the computer next to mine is free now*", "*is X here*", "*who are you*"	7.2
Sexual content	In general friendly messages, but with some sexual allusion, e.g. "*wanna go to the bathroom for some fun*"	6.5
Meta comments	"*just testing the messaging system...*"	5.3
Other	Messages that didn't quite fit any other categories, e.g. "*bläääääääää*", "*glhjghl*"	5.0
Reprimands	"*quit it*", "*get on with it*"	4.5
System imitation	Imitation of system messages: "*your computer is going to reboot in 5 seconds*"	4.3
Activity request	"*what are you doing*"	3.2
Encouragement	"*cheer up, work hard*"	2.5
Awareness comment	"*I can see you*"	0.5
Late hours	"*are you here this late*"	0.3

identified). The texts were searched for occurrences of smileys, in order to get at least one feature to be compared to other CMC corpora.

The WebWho material was compared with respect to word frequency to spoken and traditional written language, as well as with corpora of email and web chat.

4.2. QUALITATIVE, MANUAL ANALYSES

In order to analyse whether awareness of presence seemed to affect message content qualitative, manual analyses of the message topic were carried out by cross-analysing three categories of sender location (Collocated, Distributed and Distant as defined above) and two categories of sender (and receiver) status (Anonymous and Identified). In order to make a closer analysis of each message, a set of 100 messages from a chunk of continuous messages were extracted from each category,† our sample resulting in 600 messages out of the total number of 8231. See Figure 3 for an overview of the distribution of the different message categories.

The messages may in many cases contain several topics, but were categorized for topic by what seemed to be the main content. These categories have been chosen somewhat arbitrarily, but we have tried to find categories that seemed to be clearly representative for almost all analysed messages. Categories for topics were, for example, task related, social coordination,‡ mischief, meta comment, etc. A number of categories emerged, the proportions of which are shown in Table 1.

5. Results

5.1. COMPARISON WITH SPEECH AND TRADITIONALLY WRITTEN LANGUAGE, AND WITH OTHER STUDIES OF CMC

A comparison of the most frequent pairs of words in the WebWho data and corpora of spoken and traditionally written Swedish reflects both the activity in which the linguistic interaction took place (cf. Allwood, 1995), and the medium through which it was sent (DuBartell, 1995). The content of the instant messages sent via WebWho naturally concerns the activities that the students are involved in, and the most frequent words and pairs (two words occurring together) indicate this. The most frequent pairs of the WebWho material reflect that it is written communication including CMC specific features such as smileys, and the semantic content reflects the activity.

Email messages do not require the recipient to be present at the time of posting, but the recipient's presence is of major concern when sending instant messages with WebWho. Awareness of the listener's presence in spoken interaction models both the

†The decision to extract messages in succession was made in order to follow possible dialogs, and thus get some clues to how the content should be interpreted (cf. Nardi *et al.*, 2000).

‡By ''social coordination'' we mean coordinating social activities such as going for lunch together or the like. We do not mean social coordination in the sense of coordinating the social interaction in a communicative situation, in terms of feedback signals (cf. Allwood, 1995) by which speaker and listener monitor each other's involvement in the interaction, and giving information vital to the conversation. A comment such as ''uhu'' or the facial expression may give the receiver information about the sender's attitude and so on.

spoken signal, and a face-to-face situation gives the sender the possibility to monitor the listener's reactions by various feedback signals (Allwood, 2000). Awareness of presence makes WebWho resemble spoken interaction in this sense. Virtual awareness does not allow for easy monitoring of feedback signals from the recipient, but a sender can monitor the recipient's reaction to an instant message when both of them are present in the same room.

The level of synchronicity of the WebWho communication resembles† spoken interaction in that it does not suffer from severe time delay for feedback. The communication in WebWho can be characterized as semi-, or quasi-synchronous CMC (Ferrara *et al*., 1991); the interlocutors are on-line simultaneously even though they are not located face-to-face and unable to take advantage of the multimodality that face-to-face communication allows for. As mentioned above, computer-mediated written messages also require more physical effort and longer time to type and send compared to speaking.

The email, web chat and WebWho data display features that are distinct to written language, such as punctuation marks, among the most frequent tokens, whereas this is not the case in the traditional written data. Naturally, this does not occur in the spoken language data. In addition to written language-specific features, email, web chat and WebWho also show CMC-specific features such as emotions. The frequency list is slightly modified, as digits were found among the 10 most frequent pairs in the email data, which made it difficult to compare with data from the other corpora. The digits appeared in the second, eighth, and tenth place in frequency order. Leaving the digits in the list would be like comparing a particular word which is frequent to a whole class of words (the digits). Traditional written language and spoken language corpora are taken from The Swedish Spoken Language Corpus at Göteborg University ⟨http://www.ling.gu.se/SLSA/SLcorpus.html⟩. The email and web chat corpora are data collected for the purpose of Ylva's ongoing doctoral dissertation project.

The messages we have analysed in the WebWho data are indeed written, and share the mode and production constraints of traditionally written language. It is physically much more of an effort and more time consuming to write than to speak. A sender of written messages also has to consider the monomodality of the medium, and what can be expressed is constrained by the lean writing system, which in this case is alphabetic. Thus, the messages we have analysed contain features with characteristics of written language, punctuation marks, distinction between upper and lower case, etc., see Table 2. With written CMC, the sender can take advantage of the medium and in our data the sender did not explicitly have to state his or her identity just like in email communication, since the system automatically provided this information. On the contrary, the sender has to explicitly hide her identity if she wants to be anonymous.

As the messages were sent through the instant messaging system, they did not suffer as much from the time delay as most traditional written communication does. The sender actually knows that the receiver is logged on, presumably toiling away at the workstation, and that the message will be read within seconds. From the contents of

†The type of feedback possible to give is constrained by the written and visual mode, though. Feedback such as gestures, gaze and vocal signals are not as easily conveyed in written CMC as in spoken interaction.

TABLE 2
A comparison of the 10 most frequent pairs in traditionally written language, email, web chat, WebWho and spoken Swedish

Frequency order	Trad. written	Email	Web chat	WebWho	Spoken language
1	det *är* (*it is*)	i Göteborg (*in Göteborg*)	som vill (*who wants*)	går det (*does it work*)	de e (*it is*)
2	för att (*so that*)	. Jag (. *I*)	är du (*are you*)	. Jag (.*I*)	e de (*is it*)
3	det var (*it was*)	Hej ! (*Hi !*)	? namn (*? name*)	det är (*it is*)	att de (*that it*)
4	att det (*that it*)	! Jag (*! I*)	jag är (*I am*)	är det (*is it*)	de va (*that was*)
5	är det (*is it*)	för att (*so that*)	du ? (*you ?*)	JAVA JAVA	men de (*but it*)
6	i en (*in a*)	. se	, *hallå*) (, *hello*)	-)	e ju (*is but*)
7	att han (*that he*)	på förhand (*in advance*)	det är (*it is*)	:)	så att (*so that*)
8	i den (*in the*)	om de (*if it*/*if they*)	namn, (*name ,*)	, jag (, *I*)	ja de (*yes it*)
9	som en (*as a*)	Tack på (*Thanks in*)	hallå ? (*hello?*)	Hej ! (*Hi!*)	de här (*these*)
10	men det (*but it*)	skulle vilja (*would like*)	har du (*do you have*)	Har du (*Do you have*)	å så (*and so*)

the messages one may deduce that the sender and receiver know each other, and frequently draw upon shared background knowledge, as the contents can only be interpreted if the context is shared (see Section 6). Thus, the content and form are structured for that purpose.

Table 2 shows a comparison of the 10 most frequent pairs in traditionally written language, email, web chat, WebWho and spoken Swedish. The large corpora of spoken language† and traditional written language‡ share five out of 10 most frequent pairs. The most frequent combination is the same in both modes (''de e'' and ''det är'' *(both corresponding to* ''*it is*''*)*, respectively). This combination of words is also found among the 10 most frequent in both the web chat and the WebWho data. Traditional written language shares one item with the email corpus. The WebWho corpus is the only one that contains smileys among the 10 most frequent pairs. Email messages have ''oral'' and ''written'' as well as uniquely digital features (Ferrara *et al*., 1991).

Content, or topic, in the different kinds of data reflect the various activities that the messages have been used for: a large bulk of the messages in the web chat material are of a contact-seeking kind (e.g. ''who wants to chat?'', ''is there someone who

†There are 1.2 million words in the Swedish spoken language corpus at the department of linguistics, Göteborg University, Sweden. http://www.ling.gu.se/SLSA/gbgcorpora.html.

‡Written language corpora used at the same department, http://www.ling.gu.se/SLSA/textcorpora.html

wants...''), and very often concerns what people look like and where they live. Such messages are not found in the WebWho data, for reasons that could be deduced from the fact that most of the students who are using WebWho know each other. There is no need to ask about a person's looks and where he or she lives, as the sender probably already knows this prior to sending a message. It is probable that the anonymity of a web chat calls for explanation of things that are of such importance in young people's world and that the anonymity allows for things to be communicated that would never be verbalized in a face-to-face or a telephone conversation.

None of the messages in the email corpus deal with contact in this personal way, but are of a more business-like matter. The data were taken from a corpus of electronic communications to a city council, and thus concern what can be expected of it: pleas for information and advice in legal matters, messages dealing with the information structure of the web page of the city council, for example.

If we compare the WebWho messages with a Swedish email corpus and a Swedish chat study (Hård af Segerstad, in press), with respect to occurrence of emotions, we find that the proportion of smileys is different in the different settings. For instance, the most ''basic'' emotions :-) and :) appear in the sixth and seventh place, respectively, in frequency order for the WebWho corpus, whereas emotions did not occur until the 461st place in the chat corpus. The email corpus as a whole, only showed two occurrences of smileys. The development of emotions, serves to convey paralinguistic

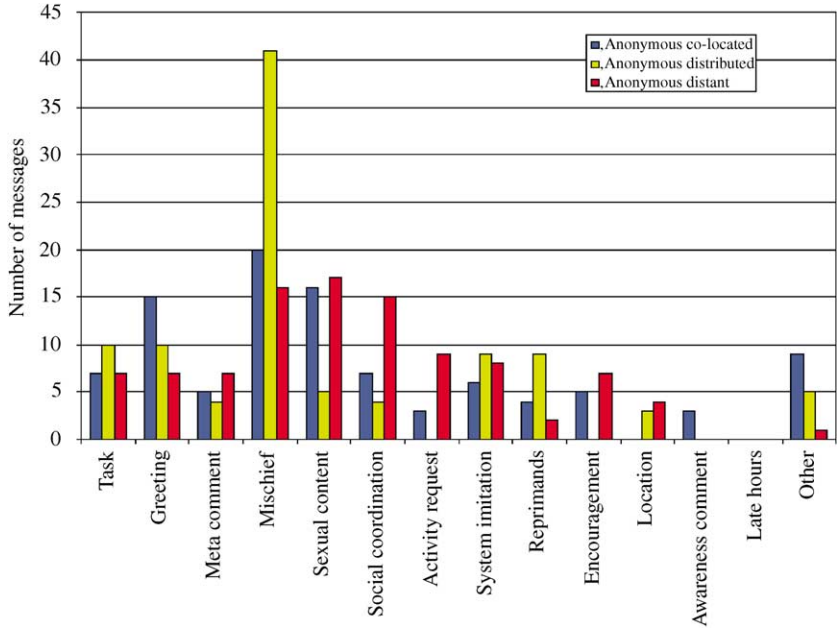

FIGURE 4. Messages with anonymous sender. There is a high proportion of mischievous messages sent within the same lab rooms, in which the sender has physical evidence of the recipient's presence.

information which is specific to CMC to enhance the written mode of communication, by conveying more than traditional written language normally allows for is a well-known feature in CMC (cf. Du Bartell, 1995, among others). Instant messaging, such as communicated via WebWho, is spontaneous and fast, and has a number of features in common with the spoken register; it is playful, dynamic and speech-like (Horowitz & Berkowitz, 1964; cf. Bolter, 1991).

The diagrams in Figures 4–6 show the cross analyses of the various categories of message topic, sender location and sender status. The largest number of messages in both settings of sender status and location (70% of the total number of messages) were, not surprisingly, sent between different lab rooms within the building. This is what we expected, and what the students mainly used the instant messaging service for; to keep in touch and to organize and coordinate their group assignments or to coordinate coffee breaks and such. Eight per cent of the messages were sent between different computers within the same lab room, in which case the students could actually see each other physically. Twenty-two per cent of the messages were sent from outside the building, using a modem for instance. This could be other students contacting the ones that they could perceive being logged in to computers in the lab, or friends and family who knew where to look for a person working in the lab.

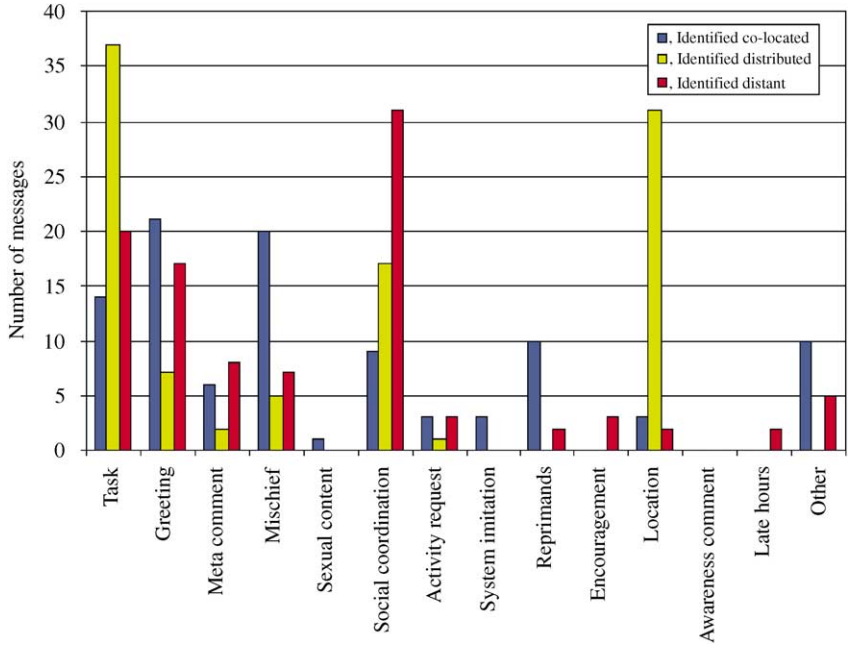

FIGURE 5. Messages with identified sender. We can clearly see that the topics of the messages are different in the three settings. On the whole, messages sent between different lab rooms (Distributed) are more about social coordination, such as coordinating for going to lunch together. This group also contains more work-related messages with assignment coordination content.

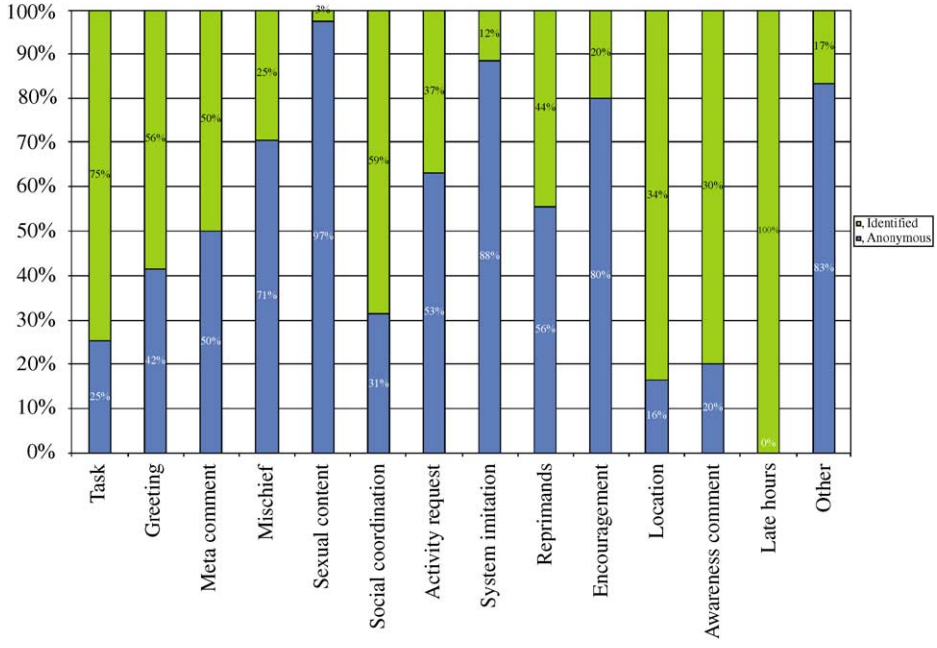

FIGURE 6. Categories with proportion of messages with identified and anonymous senders.

5.2. PHYSICAL AWARENESS OF PRESENCE

Messages from the first group, which we called ''Collocated'', were all sent within the same lab rooms in which the senders of messages could be physically aware of the receiver. Eight per cent of all messages were sent in this setting (692 messages).

5.3. VIRTUAL AWARENESS OF PRESENCE

Two categories are forming the second group: the first one we called ''Distributed''; these messages were sent between different lab rooms (70% of the total number of messages; 5675 messages). Twenty-two per cent of the total number of messages were sent from somewhere outside the university computer lab (1864 messages), and form the second category of the second group. We called this setting ''Distant''. Since these messages were sent using a dial-up connection, for instance, the senders had no physical evidence of the recipients' presence, but were informed of their presence virtually through the WebWho web page.

From the analyses of the messages, we can see that the topics are different in the three settings. On the whole, messages sent between lab rooms (Distributed) are more related to social coordination, such as coordinating for going to lunch together. This group also contains more work-related messages with assignment coordination content. Messages sent within the same rooms tend to be more mischievous in nature. Anonymous messages made up 13% of the sample, Figure 6 shows the proportions of identified and anonymous messages in the topic categories. In the next part, we will describe the categories in the different settings in more detail, comparing with the

diagrams in Figures 5 and 6. Some categories may overlap partly, as for example the case of "sexual content" which indeed also falls into the category of "mischief" at the same time, but stood out so prominently from the other mischievous messages.

5.4. TASK RELATED

The majority of the task-related messages with identified senders were sent in the Identified Distributed category, while the minority was sent within the same lab rooms, in Identified Collocated. This is not particularly strange, rather what can be expected: you communicate about the task you are working on. When there is an opportunity for face-to-face interaction in the same lab room, there is no need to send textual messages: it is faster and easier to talk about it. The majority of the anonymous messages were sent between lab rooms, while the minority was found in Anonymous Collocated. Sending this type of message anonymously seems a strange way to cooperate on group assignments, no matter where you are located; however, some examples of this were found (see Section 6).

5.5. GREETING

The majority of the greetings-messages was sent by identified senders within the same lab room, while the minority was sent between lab rooms. Intuitively, this seems contradictory to what one could expect: why send a computer-mediated message to say hello when you are located in the same room, where you could just turn your head and say hi? As noted by Nardi *et al*. (2000), instant messaging is often used for informal communication; it would be considered lunacy to deliver a "Good morning" message in email—you can never tell when a person is going to check his or her inbox—but that people appreciate a quick instant message greeting. One of their informants explained: "It's a nice way of saying hi without being intrusive" (Nardi *et al*., 2000). The majority of the anonymous greeting-messages were sent between people within the same lab room—perhaps just a way of checking the receiver's reaction, or similar to the type of greeting noted by Nardi *et al*. The minority of the messages were sent as Anonymous Distant, which seems a strange thing to do, as the sender gets no feedback at all of his or her action because neither is it possible to witness the receiver's reaction nor to get a written reply.

5.6. META COMMENT

The majority of the messages with identified senders that commented on the message in itself or the messaging system were sent from outside the building, while the minority was in Identified Distributed. Any is relevant, as the messages concern the messaging system in itself (the messages were of this kind: "*Can you see this*", "*Send me a message if this works*"). The same goes for messages sent anonymously: the majority in Anonymous Distant and the minority in Anonymous Distributed, only it is difficult replying to an anonymous sender and confirming that the system works.

5.7. MISCHIEF AND NONSENSE

The majority of the messages of mischievous content were sent by identified senders within the same room, while the minority was from rooms in the same building. The majority of the anonymous mischievous messages were also sent within the building, and the minority was sent in Anonymous Distant. It does not seem particularly strange to send mischievous messages anonymously, wherever you are located. The number of messages sent anonymously for this purpose is clearly higher than the ones with an identified sender. It seems that, when no one knows who you are or where you are located, it is much easier and perhaps also tempting to be naughty.

5.8. SEXUAL CONTENT

The only messages that concerned sexual insinuations, or downright rude coarse language, in combination with an identified sender, were sent in within the same lab room. None of the messages were of a harassing nature, rather they seemed to have friendly and playful touch. A plausible explanation is that the interlocutors knew each other and also wanted to see or hear the receiver's reaction later to the mischievous messages. It seems that this kind of message is easier to send when you are anonymous: the majority of these were sent from home, or other locations than in the computer lab: in Anonymous Distant, but almost as many were sent Collocated. The minority was sent in the Anonymous Distributed category.

5.9. SOCIAL COORDINATION

Messages sent to coordinate lunch breaks or invitations to go partying and the like were sent in majority in Identified Distant: from home, or other locations than in the computer lab. The minority with identified senders were sent in Identified Collocated, not unexpectedly. In this setting it is easier and more convenient to conduct these matters in spoken face-to-face interaction. Strangely enough, some messages sent for social coordination were sent anonymously. It seems difficult to arrange something when you do not even know who sent the message. The majority was sent from places outside the computer lab, in Anonymous Distant. Messages of this kind sent in Anonymous Collocated are perhaps easier explained by the possibility to check the receiver's reactions. A possible explanation to why people send messages coordinating social activities anonymously, could be that the sender knows that some previous, shared background knowledge is being activated by the message, and thus it is not a complete waste but a funny way of contacting one another, perhaps experimenting with what the messaging system can do.

5.10. ACTIVITY REQUEST

Equally many messages were sent by identified senders in the same lab room from locations outside the building, while the minority were sent from within the building. Messages requesting information about what someone is doing seem to function as a mock "*I can see you*" and to let the receiver believe that he or she is being watched, as the majority were sent from other places than from the computer lab (Anonymous

Distant). Some were sent within the same lab room, perhaps corresponding to the same function as just mentioned, or to something like "quit it", depending on the context. Out of the total number of messages of this kind, most were sent anonymously which seems to confirm this suggestion.

5.11. SYSTEM IMITATION

When sent with an identified sender, the only messages imitating various system directives were found in the in Identified Collocated category. This suggests that the sender wants to witness the receiver's reaction. Most of the messages imitating system directives were sent anonymously, and they were sent either from within the building or from other locations. The minority was found in Anonymous Collocated, which is the category one would have expected to be the most frequent, because it would resemble real system messages insofar as these messages are not sent by some person with a student identity.

5.12. REPRIMANDS

Messages telling people to shut up and get to work were naturally sent most of the time by identified senders within the same lab room, as other people working nearby probably got disturbed sometimes. Equally naturally, none were sent between the lab rooms. Strangely enough, some were also sent from other locations, where no such interference is possible. Perhaps a student who knows from experience that the receiver is likely to be chatty and disturbing, sent a message just to annoy and to keep in touch (with the function "I'm here, I'm working and keeping an eye on you" or the like). Perhaps for the same reason as reprimands with identified senders, the majority of the anonymous messages of this kind were found in the Anonymous Distributed category. Some were sent anonymously within the same lab room, and a few from other locations.

5.13. ENCOURAGEMENT

A few encouraging messages were sent from outside the computer lab, perhaps by some student in the same work group as the receiver. None were sent either within the same lab room, or between rooms. A number of encouraging messages were sent anonymously. Again most of them were sent from other locations outside the lab; Anonymous Distant. Some were sent within the lab rooms, but none at all were sent between rooms.

5.14. LOCATION

The great majority of all messages concerned where people were located, and questions about possible un-occupied computers were sent by identified senders between lab rooms. This is quite what is to be expected; the students coordinate their whereabouts and try to get workstations close to one another if they collaborate on mutual assignments or just like to sit close together. A few messages were sent within the same

rooms, and fewer yet were sent from other locations. Some messages concerning location and computer whereabouts were sent anonymously. These were of the type "who is logged on to this particular computer" (the students' ID may not always give clues to the real person's identity—sometimes a temporary ID (to be used during a certain course) is being used for logging in). Naturally, none were sent within the same lab as there is physical awareness of both fellow students' location, un-occupied computers and who the actual physical person logged on to a particular computer is.

5.15. AWARENESS COMMENT

Messages of the type, which is just stating "I can see you" were not sent by any identified senders at all. The only anonymous messages that concerned this topic were sent within the same lab room, and a few between the lab rooms. This suggests that the sender wanted to see the receiver's reaction or just to keep in touch, or inform the receiver that the sender is on location.

5.16. LATE HOURS

A few messages were sent asking what a person is still doing in the lab, or "go home now", "does your mother let you stay out this late". They all fell into the category Identified Distant—probably, some student checked the lab via the web browser at home. None at all of this type were sent anonymously.

5.17. OTHER

Messages falling into the admittedly vague category of "other" did not match any other category. Examples are "Olli har alltid feeeeeeeel!!!!!" ("Olli is always wroooooooong!!!"), and "Hobbes Hub dominerar" ("Hobbe's Hub dominates"), which seems to be a comment of some kind. This type of message is obviously very hard to interpret without relevant contextual knowledge. The majority of the messages were sent within lab rooms with identified senders. Some as yet uncategorizable messages were sent anonymously within the same lab room, and fewer yet were sent between lab rooms (Distributed).

6. Discussion

The aim of this study was to attempt to find out if and how awareness of the recipient's presence affects written messages. We hypothesized that the sender's knowledge of the recipient's actual and immediate presence, which is being visualized through the WebWho web page, would affect the topic of messages sent using the instant messaging system. Other factors, such as the electronic medium, user location, level of synchronicity, etc., were also taken to influence messages. The WebWho message log was compared to linguistic analyses of other CMC studies (on email and chat). We also compared it to corpora of traditionally written language and of spoken language in order to find out if there was any correspondence with findings from previous studies

stating that the more synchronous and fast the text communication gets, the more the interactions carry features associated with spoken interaction. It has to be kept in mind, though, that the different forms of communication are used for different activities.

While there are many factors that influence message composition, awareness of presence seems to be one of them, as well as the purpose of the interaction and the nature of the computer medium. Our contribution to the discussion on awareness and the WWW is the conclusion that the instant messages sent via WebWho—with respect to topic—can be argued to be affected by the senders' awareness of both the receivers' physical presence and of virtual presence, as visualized on the web page.

Much of our results follow what could be anticipated intuitively, and confirm our hypotheses about what WebWho is used for. We found it to be used extensively for collaborating on mutual assignments and for coordinating social activities. 15.8% of the messages of our sample were task related, and 13.8% were related to social coordination. As we have seen, instant messaging using WebWho is also used for playful behaviour, 18.2% of the messages in our sample were nonsense and mischief, another 6.5% were mischief with sexual content, the latter two categories together forming 24.7%—which is the largest category in the sample. Sending mischievous messages anonymously seems like a good way to avoid "being caught", for example. It is possible that text-only communication in combination with the virtual awareness of presence increases the temptation to toy with the possibilities of the messaging system. Awareness of physical presence might also make people send messages anonymously, perhaps to be able to view the effect of the text in person. Messages of the meta comment-type often explored the possibilities of the system and reflect the users' unfamiliarity with what it can do and curiosity to find out what they can actually use it for. A total of 11 messages were sent but never received, because of the fact that the system does not allow users located in the computer lab to send messages to people outside the building. The users were able to receive messages from outside the building, though, and the message composition was characterized by comments on the communication *per se*. Here is an example of a message of this type, where people tried to send messages to other people outside the building (by manually altering CGI parameters in the URL string):

> "Får du detta skall du inte vara glad, för då kan jag terra dig järnet i fortsättningen :)"
> ("You shouldn't be glad if you get this because then I can harass you a lot in the future :)").

So far, most results confirmed our hypotheses and intuitions. Some results, though, seem to be contrary to expectation. Most of what intuitively feels like contradictory results are found among the messages that were sent anonymously. At first, it seems pointless and strange to be anonymous in discussing mutual assignments, or to send anonymous greetings, comment on the system and ask for feedback without telling who you are, receive encouragement from someone who is unwilling to give away their identity, or to try to coordinate your social interaction without giving deictic reference. Shared background knowledge, previous experience and contextual information which is outside the messages themselves surely account for relevant explanation in most cases. Human interaction may not always be rational or has different goals than one expects it to have, though, and everything cannot be rationally accounted for.

A special case of deploying the anonymity-feature are the several examples of anonymous messages that were signed with the sender's name, which seems to eliminate the whole idea of going anonymous. Why do people explicitly make the message anonymous to the receiver, by consciously checking a box to make it anonymous to the receiver, and then sign the actual message with their names in the end? Out of a total number of 1067 anonymous messages, 19 messages were signed with the sender's name (1.8%), the majority of these were sent in the Distant Anonymous category (14 messages). In some cases one could perhaps guess that the sender wished to make the receiver believe that someone else sent it, like in this example:

"tyvärr lunch stängt, åter 990402 Mvh NN"
("sorry closed for lunch, back April 2, 1999 Best regards NN").

This message is an ironic imitation of a possible message sent by the department secretary, which the sender seems to think is having too long lunch breaks (the message was sent on February 2, 1999).

In most cases the messages seem just ordinary, and probably reflect the same idea as noted in Nardi *et al*. (2000)—it is a nice way of saying hi without being too intrusive. Here is an example:

"Gomorron!/NN"
("Good morning!/NN").

Another way of using the instant messaging system, which seems intuitively strange, is when people communicate anonymously about their mutual assignments. It seems difficult to be able to collaborate on a mutual task, when the person who keeps sending you messages is anonymous.

"nää nu får du lösa det här"
("noo you've got to solve this one now").

The messages of the rather large category that we choose to remain called "Other", which include messages that did not fall into any other category, may in many cases be explained and filed away in the various categories respectively if we had had access to the senders' knowledge and context. Much of what we communicate, be it in speech or writing, would be pretty unintelligible if it were cut out from the situation and the context in which it occurred. Shared background knowledge of facts and situations, our experience of how the world works and how communication works give us clues as to how to interpret messages. We gather that many messages that we find incomprehensible without access to those particular situations and minds, for that matter, would certainly clear things up in the slightly messy "Other" category.

Having no knowledge of the background to the communicative situation, and other clues that give away information about how messages should be interpreted, such as facial expression, tone of voice, etc., also leaves us without proper backup for example, for the claim that all of the messages of sexual content were playful and friendly. We cannot know that for sure. But this also holds true for any communication in any other situation. It is difficult to tell exactly what other people mean us to believe. This pragmatic issue is indeed intriguing, but for the sake of the limitations of the scope for this article, we will have to leave this for the time being.

The study presented in this paper has indicated that the instant messages sent via WebWho—with respect to topic—can be argued to be affected by the senders' awareness of both the receivers' physical presence and of virtual presence, when visualized on the WebWho web page. However, further research is clearly needed to gain a more thorough understanding of how awareness of presence affects written messages.

To conclude, WebWho was mainly used for supporting collaborative work and for coordinating social activities. It was also used for playful behaviour and for simply keeping in touch, which are just as important means for working together, or for just having fun, for that matter.

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