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J. van der Pol · W. Admiraal · P. R. J. Simons

Context enhancement for co-intentionality and co-reference in asynchronous CMC

Abstract The regulative and semantic 'distance' of electronic conferencing may impede the topical alignment and the unambiguous interpretation of messages, hindering collaborative learning processes. Compared to a face-to-face environment, in electronic conferencing this distance may be caused by a reduced strength of online 'context'. Explicitly defining the context of messages in an electronic environment may increase the writers' co-intentionality and co-reference. An annotation tool is presented, strengthening the context by providing a document under discussion and enabling users to anchor their messages in specific passages of the document. Preliminary results indicate that the tool does indeed reinforce the context, focusing the online discussion around a certain topic (increasing co-intentionality) and providing a frame of reference for single messages (increasing co-reference).

Keywords Asynchronous discussion · Collaborative learning · Common ground · Co-intentionality · Co-reference · Perspective taking · Annotation System

1 Introduction

Computer-mediated communication (CMC) is often compared with face-to-face (F2F) conversation and regular mail. Some forms of CMC bear more resemblance to the first (e.g. chat) and some more to the latter (e.g. asynchronous discussion or email). However, all types of CMC share a fundamental characteristic that results in a new and unique way of communication. One basic characteristic, which will be studied in this article, is the 'distance' that is inherently implicated: What are the communicative effects of this lack of shared physical context? With respect to synchronous communication (chat), Reid (1996) suggests that its lack of social cues provides a high degree of personal

J. van der Pol (✉) · W. Admiraal · P. R. J. Simons
IVLOS, Utrecht University, Postbus 80127, 3508, Utrecht, The Netherlands
E-mail: j.vanderpol@ivlos.uu.nl
Tel.: +31-30-2531613

freedom. Asynchronous CMC seems to provide this communicative freedom as well. While in F2F conversations—even in groups—it would be awkward for one of the communication partners to suddenly remain silent, an email or discussion board message that goes without response will not surprise anyone. Both in synchronous and asynchronous CMC, receiving a response to a particular message seems not to be as self-evident as in F2F communication, resulting in a lower degree of 'answerability' (Hunt 1996).

The distance of CMC not only influences social aspects, such as personal freedom, but also—in more subtle manners—*regulative* and *semantic* aspects of collaboration. Even if participants in an online conference respond to each other (motivated by task instruction, tools, social bonding or other factors), content analysis reveal problems with the alignment and unambiguous interpretation of messages (Van der Pol 2002). Only a few online discussion tools have been specifically designed to deal with the regulative and semantic effects, and opportunities, of distance in CMC. In this study, which is concerned with the use of CMC for educational purposes, we will investigate how and why the distance of online communication influences regulative and semantic processes, aiming to arrive at a specialized tool for asynchronous collaborative learning. We will present a preliminary analysis of the affordances of this tool for collaborative learning in academic education, as compared with a regular discussion board.

2 Regulative and semantic characteristics of asynchronous CMC

Closely related to the largely socially based decreased level of 'answerability', as described in the introduction, a second effect of CMC is the fact that participants seem less inclined than in F2F conversation to continue subjects raised by others. Users seem to experience more freedom to engage in new topics, which causes most electronic discussions to be divergent of character (Andriessen and Sandberg 1999; Mäkitalo et al. 2001). Educational researchers have found that, due to this divergence, it is more difficult to keep an asynchronous discussion focused on topic than is the case F2F (Romiszowski 1995). Herring (1999) reports a high degree of 'disrupted adjacency' and 'topic decay' in CMC. Hence, many instructional techniques have been developed for 'keeping the thread', such as restating the original question when responses are going in the wrong direction (Beaudin 1999). We define such problems of topic decay as a lack of *co-intentionality*. Co-intentionality concerns the degree of explicit or implicit common goal directedness ("What are we going to discuss here?" or "Do we want to talk about the same subject?") and relates largely to regulative processes.

A third and again closely related effect of distance in asynchronous CMC is that participants appear to experience difficulties in interpreting messages, caused by a lack of 'perspective taking' (Järvelä and Häkkinen 1999). When studying the implementation of a bulletin board in an advanced university course, Pena-Shaff and Nicholls (2004, p. 258) found that "students did not always reach interpretations based on the analysis of all the ideas stated in the discussions, but rather stated their own interpretations and beliefs", which the authors identify as producing primarily a process of self-reflection rather than a

dialogical process of knowledge construction. Wan and Johnson (1994) conclude that a lack of integration of other participants' ideas left the group knowledge base with a substantial amount of redundancy and inconsistency. Winiecki (1999) describes how students and instructors often found discussions difficult to follow and also observed frequent misunderstandings, at times seriously affecting the learning process. This link between the problem of interpretation and the integration of ideas seems obvious. If a student is not quite sure what someone else means (a meaning that might even be obscure for the writer himself[1]), it will be very hard to process and elaborate on those ideas. Interpretation difficulties by remaining in one's own frame of reference and not successfully grasping the meaning that someone else attributes to a certain concept or statement can be defined as a lack of *co-reference*. Co-referencing, or 'referring to the same entity' (Hirschman et al. 1997), is a more micro-level process than co-intentionality and situated rather in a semantic dimension.

3 Common ground and context

Both levels of co-intentionality and of co-reference can be seen as aspects of the 'common ground' of communication partners and thus theories on common ground can help us understand how co-intentionality and co-reference might be related to the distance of CMC. Common ground refers to the goals, information, meaning and ideas people believe they share with others, which can be used to communicate and collaborate efficiently (Clark and Wilkes-Gibbs 1986). The notion of common ground enables people to refer to objects, people or ideas without having to describe them explicitly or comprehensively. However, critics of Clark's theory have demonstrated that common ground is not a fail-proof resource that simply accumulates (Koschmann 2003). While in Clark's idea using common ground seems to be a logical and almost mathematical process of deduction, the practice of the human mind does not behave this logically or computer-like. With the aim of minimizing the effort invested in communication the human mind rather takes shortcuts and works by association, thereby being highly context sensitive. Bereiter (2002) even states that meaning cannot be separated from context and exists only in the relation between a person and a situation. Put more generally, common ground can never be reached completely because any situation triggers a broad range of meanings that is unique for each individual. However, the individual ranges of meanings can overlap to a certain extent, resulting in a certain degree of a 'shared cognitive environment' (Sperber and Wilson 1995). As it still holds a wide array of meanings, a shared cognitive environment (or common ground) does not imply that people *will* make the same assumptions, merely that they are *capable* of doing so. Hence we do not define 'common ground' as equalling 'shared understanding'. We see it rather as a prerequisite.

Besides being largely determined by situational characteristics and contextual variables such as common background, culture or personal history, the degree to which participants' cognitive environments overlap in a certain situation can

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[1] This is especially in the case of learning situations, where students start the discussion with low levels of understanding of the subject matter (Cherubini et al. 2005).

also be increased by activities such as checking, clarifying or perspective taking (Fussel 2002). These activities are also called 'grounding'. Baker et al. (1999) distinguish *semantic* and *pragmatic* grounding. Semantic grounding is concerned with establishing shared meanings (resulting in co-reference), whereas pragmatic grounding is concerned with understanding each other's communicative intentions (resulting in co-intentionality). Together with a much used socio-emotional account of grounding (Mäkitalo et al. 2004), we would like to picture three interrelated sub-areas of grounding and common ground (Fig. 1). We use this distinction to be able to show that social, pragmatic and semantic processes are parallel type of activities, which sometimes have mutually beneficial influences, but also, in the case of limited resources, might interfere.

Figure 1 also shows the cyclical character of grounding and common ground, since a higher degree of common ground to begin with greatly facilitates grounding, which in its turn is directed at enhancing common ground (see Cherubini et al. 2005). Note that 'context' is mentioned as well because, apart from grounding, it also influences the degree of common ground in a certain situation. Because contexts differ in the strength of their 'meaning triggering effect', they influence the degree of overlap between participantś activated cognitive environments, thus focusing co-reference and co-intentionality to a higher or less high extent.

4 Online context: 'bridging the distance'

Especially in situations where grounding becomes problematic, as provided by asynchronous CMC's lack of non-verbal communication and low rate of 'turn-taking', the influence of context on common ground becomes more important. Therefore, it does seem fruitful to examine the possibilities to focus co-intentionality and co-reference (as specific elements of common ground) through the influence of context. It seems clear that, because of the absence of a shared physical context, "CMC may be considered to be 'context-reduced' in nature" (Smith 2003, p. 30). While this decreases the medium's focusing effect, it might also provide some opportunities. One could say that F2F conversation has its participants engaged in social processes to such a high degree that there is less
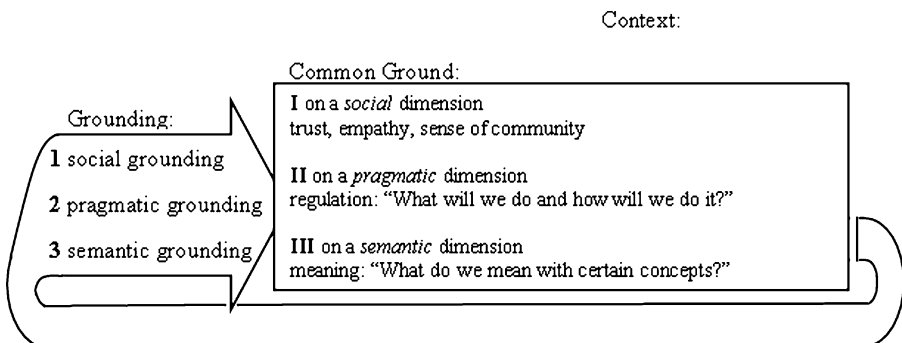

Fig. 1 Distinguishing interrelated sub-areas of grounding and common ground

room left for the semantic content. Therefore the absence of certain social contextual features in CMC also creates room for new elements. Instead of seeing social processes as a prerequisite for collaborative learning and developing online environments that increase social reciprocal responsibility (e.g. by introducing different communicative 'roles'; Strijbos et al. 2004), improving 'sociability' (Kreijns et al. 2002) or applying 'uncertainty reducing cooperation scripts' (Mäkitalo et al. 2004), our approach will be different. Creating a stronger context for co-intentionality and co-reference could directly increase the focus on task-directed and task-effective communication in CMC, without the need to increase social, coordinative or regulative communication. As Andreasen concludes: "The richer the context is represented, the bigger the chance for students to develop shared understandings" (2005, p. 11).

4.1 Increasing context for co-intentionality

As described, CMC can lack sufficient levels of co-intentionality because its communicative distance produces a variety in participants' intentions. Especially when the goal is to have a focused and detailed theoretical discussion, this variety can become problematic. Even when an original remark or question is aimed at processing some literature, the affordance of online discussion groups seems to make reactions often drift in the direction of expressing opinions and personal experiences (Preece 2000), which decreases the coherence of the messages in a particular thread. This way, personal and opinion-oriented discussion can interfere with theoretical knowledge building (Järvelä and Häkkinen 1999). Earlier research in asynchronous CMC (Van der Pol 2002), on the coherence of messages within threads, has identified the domain of discussion as an important variable: more coherent discussion was found within discussions with fixed and limited topics. Thus, when the intention ('what is it that we are going to talk about') is more clear to all participants, they are less likely to drift off. This means that if a tool can naturally direct and focus the domain of discussion around a certain topic (e.g. in our case one of the actual course readings), it should be able to increase the topical alignment of the messages. The first threaded discussion system to group discussions explicitly into specific items for discussion was the BSCW system or 'Basic Support for Cooperative Work' (Bently et al. 1997). As can be seen in Fig. 2, BSCW contains a number of documents, such as a URL ('BSCW project page'), an object representing an item for discussion ('Features of 2.0') and a document ('Publications'). This way of focusing the discussion around particular documents sets up a context for co-intentionality, directing and focusing the overall aim of the conversation.

4.2 Increasing context for co-reference

In our search for ways to enhance co-reference within learning in CMC, we follow Reyes and Tchounikine (2003), who define learning in CMC to require more than just information exchange and being directed at the integration of messages and the taking of new perspectives. One particular concern is the fact that traditional forum type systems only allow users to respond to entire messages as a whole. As messages often consist of multiple lines of thoughts, online discussion threads hide the true relation between replies and the thoughts they

Fig. 2 Screenshot of an overview of the different discussion spaces in a BSCW environment

address. In agreement with Bellamy and Woolsey (1988), Reyes and Tchouni-kine state that this 'interactional incoherence' impedes the emergence of learning conversations in two ways: both in the topical alignment and in the establishment of common ground. The forum type system developed by Reyes and Tchounikine is an attempt to increase the interactional coherence of learning conversations by introducing the 'what you answer is what you link' criterion. This means they change the actual minimal unit that can be referred to from a message to a topic within a message (see Fig. 3), giving the reply a more detailed frame of reference or context for co-reference. This context could draw students from their personal frame of reference, stimulate perspective taking and facilitate the interpretation and integration of ideas.

4.3 Integrated design: an Annotation System

In our setting of university education, we are particularly interested in increasing co-intentionality by drawing collaborative learning conversations deeper into the subject matter and providing co-reference by identifying which specific frame of reference messages relate to (as miscommunication is often caused by the fact that the meaning of scientific concepts often differs from their common-sense one). Both functionalities of the two described systems, setting up a domain for
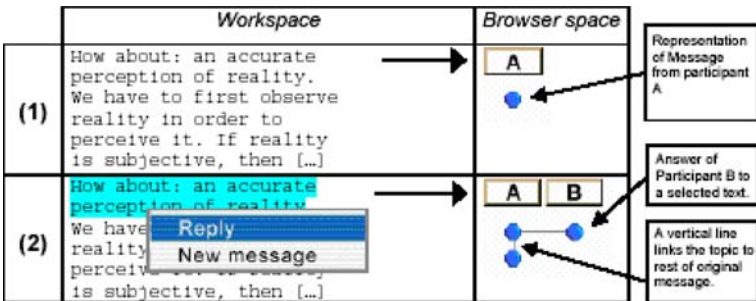

Fig. 3 Illustration of the system developed by Reyes and Tchounikine (2003)

discussion (context for co-intentionality) and creating a localized frame of reference (context for co-reference), are incorporated in the design of an 'Annotation System'. The context for co-intentionality means that it concentrates the discussion around a specific document; the context for co-reference allows the user to anchor messages to specifically marked statements or ideas. Different with the two tools described earlier, the Annotation System reinforces co-intentionality by integrating both document and discussion in the same screen (instead of presenting it as a downloadable file) and increases co-reference by referring to passages from the discussed document (instead of referring to topics from other messages). This makes the Annotation System particularly useful for the collaborative processing of literature.

The Annotation System simultaneously displays both the regular 'threaded' discussion and the document under discussion (see Fig. 4). Moreover, both items are cross-linked. Every new posting (in the left-hand frame) can be anchored to a selection from the text (right-hand frame), which gives it the term 'anchored discussion' (Bernheim Brush et al. 2002). The left-hand frame of the Annotation System functions as a regular forum type tool, with options for creating new messages (Notes) or replying to existing ones. The left and right-hand frames are automatically kept synchronized as well: when clicking at a particular selection in the text to the right (such as the blue 'N1' icon), its connected messages appear left and when clicking at a particular message on the left (the blue 'text' link), the appropriate text selection is automatically displayed to the right. In the example below, the left-hand frame shows a part of the second thread and the right-hand frame shows the first page of the

Fig. 4 Openlaw Annotation Master (by Wendy Selzer)

article, with the anchors for threads one and two. This Annotation System has been used in our study into the enhancement of context to increase co-intentionality and co-reference in asynchronous learning conversations about course literature.
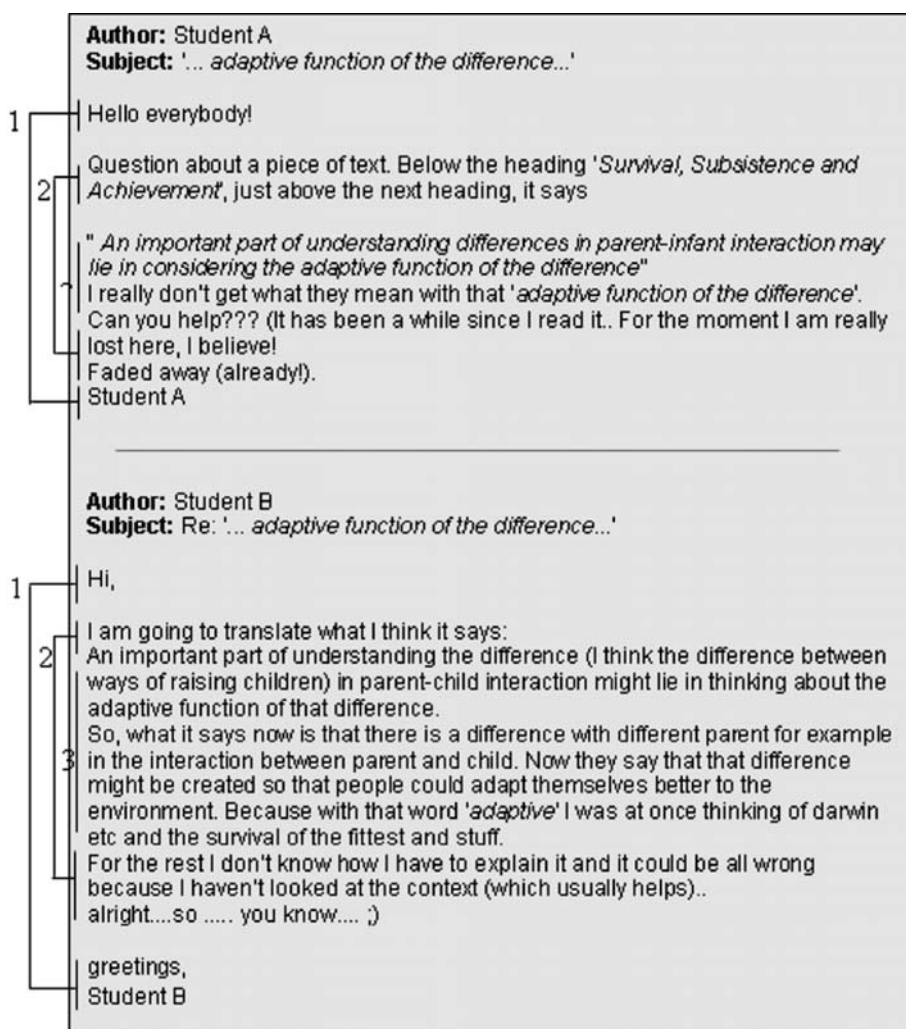
5 Comparing an Annotation System with a standard discussion forum

In a Dutch first-year university course on General Pedagogics, we used two conferencing systems for the collaborative processing of the course literature. About 50% of the students used Blackboard as a standard discussion forum and the other half used an adapted version of the 'Openlaw Annotation Master' (Selzer 1997) as an example of an Annotation System. Apart from the described differences, both systems provided the functionality of creating new messages and replying to other ones. Identical instruction in both systems has been used including that the students had to ask each other questions about text passages they did not understand. We present a typical thread of each system and describe some of the differences that became apparent after a first qualitative comparison of the interactions in both systems.

Starting with Blackboard, the regular discussion forum, messages resemble email correspondence in more than one respect, most of them carrying more information than just the student's actual question or answer about the subject matter (see 3 in Fig. 5). First of all, most open and close with a *social* introduction and a departure phrase (1). They also contain *regulative* statements about what it is the author is going to do in this mail and what subject he or she wants to talk about, thus creating a context for co-intentionality before introducing the core message (2). After this core message, we again find regulative (and partially social) statements in which the authors seem to want to justify their questions or give some additional information about the value of their response (2). This structure very much resembles the standard structure of outgoing messages on telephone answering machines, described by Hammer and Veronesi (1999) as having an opening, a core section with a directive speech act (requesting the caller to leave a message) and a closing. Hammer and Veronesi explain that this format is useful to construct a social relationship between caller and 'callee', with the purpose of keeping in contact and requesting a response from the caller, who is situated at such a distance that he cannot be relied upon to do so automatically.
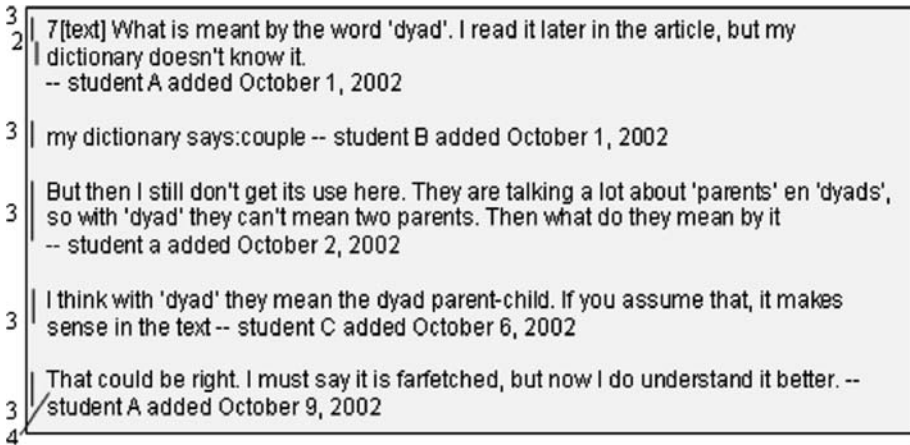
When looking at a typical sequence from the Annotation System, the short and 'to the point' nature of the messages immediately stands out (see Fig. 6). We do not find any social introductions or closings and only one regulative comment about the reason for posting a message (2). The messages consist, for the most part, solely of the actual question or remark about the content (3), and the students do not seem to feel a need to explain why they are asking a question or to mention that they would really like an answer. The fact that the discussion document is dominantly present on screen seems to strengthen student's intention to discuss the documents' meaning, thus making it clear what is going to happen and increasing co-intentionality.

Fig. 5 Thread from a traditional threaded discussion (Blackboard). The messages were translated into English, where words that already were written in English are given in *italics*

The Annotation System would seem to enhance co-reference as well. This is not only caused by the anchoring of the messages, but may also be influenced by the fact that its layout presents related messages more closely positioned near each other, whereas Blackboard usually displays only one message at a time. The impression of enhanced co-reference appears to be supported by the use of demonstrative pronouns to the content of other messages such as 'that' (element 4 in Fig. 6). Finally, the decreased length of the messages also translated itself into a larger number of messages. If we assume that shorter messages require less effort to write than longer messages, this indicates that the total amount of effort that is put into the creation of messages remains more or less stabile for both conditions. This increased rate of turn-taking could also very well facilitate

Fig. 6 Thread from the Annotation Engine. The messages were translated into English, where words that already were written in English are given in *italics*

grounding. As we see in Fig. 6, the author of the original question (student A) is not satisfied after the first response (student B). When the thread would have ended at this point, as was the case in the Blackboard example, an important chance for further elaboration, or clarification, might have been missed.

6 Conclusion

Comparing the communication we found in both systems, the Annotation system appears to create a different kind of communication in three ways:

1. The Annotation System produces less social and regulative activities which demonstrate higher levels of answerability and co-intentionality.
2. It produces short, demonstrative referring statements which indicate the presence of a shared frame of reference for individual messages.
3. It produces shorter messages, increasing the number of message within threads, thus increasing the amount of turn-taking and the possibilities for repairing misunderstandings. This effect was unexpected and possibly partly caused by the first two effects.

While these results indicate a stronger sense of context in the Annotation System, they also seem to support our suspicion that social communication and coordination is not always necessary for a successful collaboration. As we have seen users in the Annotation System put all their energy straight into the core content of their messages, we do not want to overvalue the importance of social communication for collaborative learning in CMC.[2] These findings about the lack of a relation between social communication and successful collaboration is

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[2] Note that we are concerned with regular university education, where students do know each other. When participants do not know each other (as is the case in distance education), social processes are likely to be of higher importance.

supported by other studies. Dewianti (2005) concluded that stimulating the regulation of group processes does not enhance the process of knowledge co-construction. This result was also found by Lockhorst (2004, p. 220), who studied asynchronous CMC used in teacher training, and writes that: "In our research we did not find a relation between the students' online social off-task communication and their content related communication. Moreover, after teambuilding activities to improve the collaborative processes of the students, the social communication increased while communication about task content decreased". In a study aimed at establishing the beneficial effects of socio-emotional processes in CMC, Mäkitalo et al. (2004, p. 312) also had to conclude a negative effect of coordinative and social communication: "The results indicate that the uncertainty reducing script in fact increased the amount of discourse and decreased information seeking". Especially within academic education, where the main goal of online discussion often includes a thorough processing of literature and collaboratively building a deeper understanding of it, we want to emphasize the importance of students integration of online communication with information seeking and content-related reflection.

Finally, a more general conclusion from these preliminary findings could be that, although people in a new medium will at first tend to copy known ways of communication, they are by no means set in their old ways and can—stimulated by a tool—easily adopt new ways of interaction. The observation that the contextualized design of the Annotation System seems to give the tool a stronger sense of purpose, means that the functionality of a tool can influence patterns and forms of collaborative learning conversations. As predicted by the grounding model of Baker et al. (1999), tools can (without having to train 'new literacy' or to direct communication in more forceful ways), influence communicative behaviour by means of their 'affordance', or *'the aspects of an artefact's design that suggests how it is to be used'* (Johnson, 1995, 219).

6.1 Future research

We will use these first empirical impressions of the Annotation System to develop a coding scheme to categorize the collected data and perform statistical analyses. We will then investigate whether our preliminary conclusions about the levels of increased co-intentionality and co-reference will indeed turn out to be valid and whether the statistical analyses allow us to make more definite statements about the affordances of annotation systems for the online collaborative processing of literature. Should this turn out to be the case, we will continue with the development of a more sophisticated annotation system in order to further increase the quality of online asynchronous learning conversations.

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