

Grounding is not Shared Understanding: distinguishing grounding at utterance and knowledge levels

Jakko van der Pol ^[i], Mauro Cherubini ^[ii] and Pierre Dillenbourg ^[iii]
^[i] *IVLOS, University of Utrecht, NL*
^[ii] *CRAFT, Swiss Federal Institute of Technology, Lausanne (EPFL), CH*
^[i] *j.vanderpol@ivlos.uu.nl*
^[ii] *{mauro.cherubini, pierre.dillenbourg}@epfl.ch*

Abstract

This paper argues that for the study and facilitation of collaborative learning, existing theories of grounding such as that of Clark & Brennan [5] cannot be applied without adjustments. When comparing collaborative learning and conversation, four dimensions can be identified where grounding at a knowledge level differs from the grounding at an utterance level. Firstly, the indirect access and the existence of a range of manifest meaning, poses the need for a notion of 'groundedness'. Secondly, we propose providing evidence in 'co-referenced actions' to be an important process as well as an additional marker to assess grounding. Thirdly, instead of simply repairing misunderstandings after they arise, 'perspective taking' becomes a more prominent mechanism. Fourthly, effort into grounding is turned from needing to be minimized, into needing to be 'optimized'. Since grounding for learning cannot rely on the self-regulative nature as grounding for conversation, implications for the design of collaborative learning tools are proposed, resulting in a collaborative annotation tool for the studying of texts.

1. Introduction

Many studies of collaborative learning identify *grounding* as an important process [17, *inter alia*], and analyse it using the theory of (or models based on) Clark & Brennan [5]. However, because communication for learning is not the same as everyday conversation, the application of Clark and Brennan's theory within the field of CSCL holds some problems. Clarks linguistic theory analyses conversation on a *micro* or 'utterance' level and is not developed to describe the *macro* or 'knowledge' level, which is the aim of most CSCL research. While the

micro level focuses on the dialogue interchange occurring between two or more interlocutors, the macro level refers to the shared understanding that is constructed as a consequence of that exchange (see Dillenbourg & Traum, under review). We argue that the observable presentation and acceptance of utterances, as can be described with Clarks' contribution theory, cannot automatically be translated into the sharing of knowledge. Rather, because language is not a direct translation of a speaker or writer's knowledge, there is a complex interaction between knowledge and language when communicating about knowledge [1].

Koschmann's [10] example of a learning conversation between surgeon and student in an operation room, shows that even repeated presentation and acceptance phases of a referent in a shared but dynamic environment, do not necessarily lead to a shared representation at a knowledge level. We believe the differences between the utterance and the knowledge level are –amongst others– related to the existence of different goals. While everyday human interaction has developed to be foremost directed at the recognition of mutual *intentions* (and, ultimately, at maintaining social relationships), conveying *knowledge* (or 'semantic grounding', see [2]) cannot automatically rely on the unproblematic and self-regulating character of 'grounding-for-conversation'. Because intentions are sometimes easier recognised than precise content, "a *communicative intention can be fulfilled without the corresponding informative intention being fulfilled*" ([19], p. 30). Our reason for stressing this, is while we believe in the great potential of communication to produce learning, we want to caution that not all communication will automatically do so. When analysing or designing for collaborative learning, we need to take into account the idea that successful conversation is not necessarily the same as successful knowledge sharing.

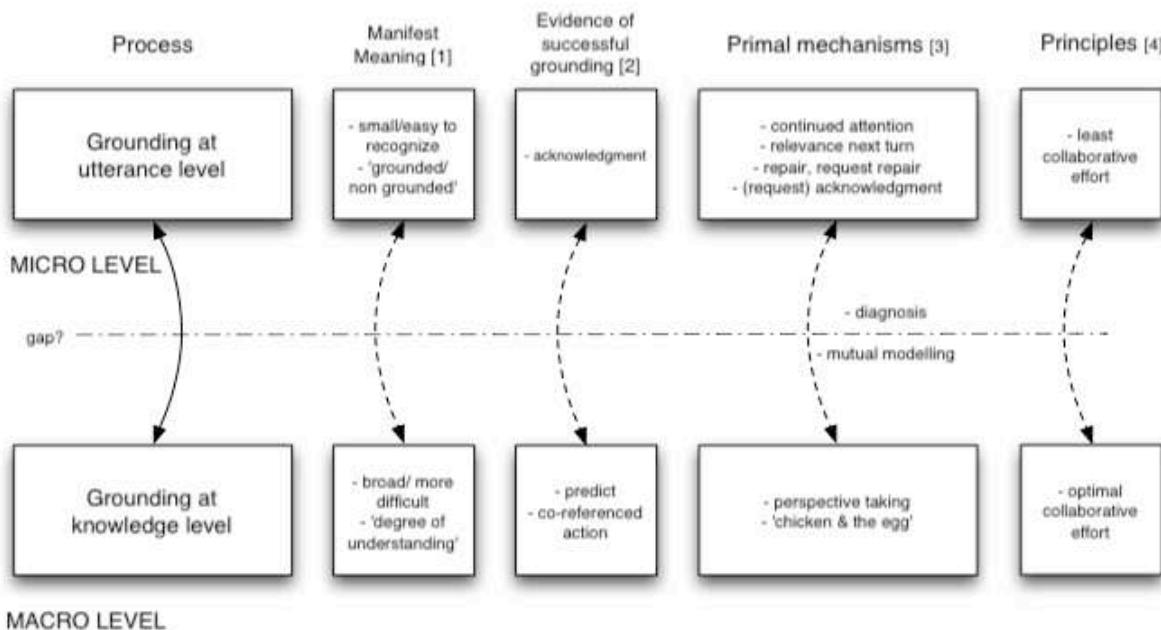


Figure 1: A four-component model of grounding at utterance and knowledge levels.

2. Four dimensions of grounding at a micro and macro levels

We will now elaborate on the difference between the micro and macro level, in four interrelated dimensions (see Figure 1). Firstly, our examples show that the broad range of possible meanings on a knowledge level makes grounding more difficult, and is more likely to result in partial understanding than at a conversation level. Secondly, when it comes to measuring successful grounding, we propose to look at levels of commitment and co-referenced action, which might demonstrate (degrees of) shared knowledge better than acknowledgements. Thirdly, we will look at the underlying principles and see that because grounding is essentially efficiency-driven, the notion of 'effort' plays a central, but different, role at both levels. Finally, we will investigate where this effort is or should be directed and identify of perspective taking as a primal grounding mechanisms on the knowledge level.

2.1. Manifest meaning

Knowledge can never be accessed directly. As Laurillard [12] states, we have to *infer* conceptual information from our physical or communicative interactions, thus making abstract learning, or communicating about knowledge, an essentially *mediated* phenomenon. Since this mediation is never perfect and 'common ground' can never be reached

completely, we will use the notion of 'mutual cognitive environment' instead [19]. Sperber and Wilson define a cognitive environment as the set of facts that are 'manifest' at a certain moment to a person: the facts that he or she is capable of representing and accepting as true or probably true. In other words, what is manifest for a certain person is the range of possible meaning that is evoked or triggered by the presented evidence, in a certain context. This collection of associated meanings can even be so broad that it includes contradictory points of view [4]. The difference with Clark's description of common ground, is that to say two people share a cognitive environment does not imply they make the same assumptions; merely that they are *capable* of doing so.

While Clark's though experiments started from the idea that a piece information *x* is either known or unknown to person *a* or *b*, the notion of manifestness shows that there are also many stages in between, and many different ways of 'knowing piece of information *x*'. We can say that the bigger the overlap is between the manifest meanings of different conversation partners, the more successful their grounding. When looking at the two levels we distinguished, we can state that the need for a notion of 'groundedness' that can account for subtle differences in interpretation is even greater at a knowledge level than it is at an utterance level. Or, as Andriessen and Alargamot [1, p. 8] put it: "*semantic understanding is something gradual*".

2.2 Evidence of successful grounding

The more evidence we have, the more we know about the levels of shared understanding (though it may never be conclusive). As we have stated in the introduction, we do not think acknowledgements are always a valid measure of shared understanding. Ross, Green and House [15] have shown that a (partial) ‘illusion of shared knowledge’ is not only possible, but even likely to occur (called the *false consensus effect*). Therefore we propose to look at verbal and physical *actions* as well. Bereiter’s term ‘knowledgeability’ [3], or ‘being able to take intelligent action’, indicates that (verbal or physical) actions intrinsically contain knowledge. If a person commits to a previous statement, and subsequently does something directly related to it in the forthcoming action or statement (we use this notion of commitment in accord with [7]), we can infer that the pair successfully grounded to a high degree. Since this relatedness between communicative actions requires a large overlap in the cognitive context and shared referents, we will label them as *co-referenced actions*.

On a knowledge level, for an action to be ‘co-referenced’, it is required that it refers to a shared piece of knowledge and needs to be relevant from someone else’s view. According to Sperber & Wilson: “*something is relevant to an individual when it connects with background information he has available to yield conclusions that matter to him: say, by answering a question he had in mind, improving his knowledge on a certain topic, settling a doubt, confirming a suspicion, or correcting a mistaken impression.*” [21, p. 608]. While at an utterance level, both recognizing a certain speech act, (such as identify a question by its question mark) and providing a relevant response (giving an answer) is pretty straightforward, on a knowledge level the requirements for action to be relevant or co-referenced are much higher.

2.3. Grounding mechanisms

At an utterance level, human communication is very efficient by investing minimal effort in elaborate message design or conscientious interpretation, but rather by jumping to (subjective) conclusions and repairing possible misunderstanding *after* it arises. At a knowledge level however, we have seen that because of the mediated nature of grounding and the more complex collections of associated (manifest) meanings, this presents more problems. Miscommunication can be both harder to detect (thus cannot be relied upon to reveal itself) and to repair. Therefore, grounding at a

knowledge level might present us with a shift of which grounding mechanisms are most important. To understand what nuanced meaning other people attribute to certain statements, one must ‘put oneself in the other’s shoes’ and try to identify which meaning will be relevant for that person [19]. In order to infer someone else’s cognitive environment or ‘frame of reference’, both for reading and writing messages (audience design), we rely on strategies like *perspective taking* [9] and *mutual modeling* (for a definition see [13]).

While at an utterance level repair mechanisms are known to be self-regulating (the less shared understanding, the more grounding will take place [8]), this is less evident for knowledge level perspective taking. It seems that at this level, the ‘chicken & the egg’ relation between grounding and common ground (“*It is hard to find some if you don’t have some already and you don’t have any unless you find it*” [13, p. 4]) is even more prevalent than it is at the utterance level. This shows that at a macro level, knowledge of other’s perspectives and the subject matter plays a role as a prerequisite as well as an outcome. Identifying another’s frame of reference is easier if one has knowledge of the different possible existing frames of reference. This underlines the reciprocal relationship between individual and collective processes in collaborative learning, as depicted in the Stahl’s [17] model of the collaborative learning cycle: it is not only so that individual learning results from collaborative processes, but individual knowledge also influences the success of collaboration.

2.4. Grounding principles

First of all, grounding is functional and driven by mechanisms of efficiency, as Clark & Wilkes-Gibbs [6] demonstrate with their ‘principle of least collaborative effort’ and Sperber & Wilson [19] in their ‘relevance-theoretic comprehension procedure’. The fact that in grounding, not more effort will be invested that what is ‘sufficient’, can explain the lack of co-referenced action in our examples. For students the costs (relative to the goals) may simply be too high, or they might not attach the same weight to as us researchers to co-referenced actions, especially because high level learning goals are usually translated into practical tasks, with which students deal in a pragmatic way. Taking the perspective of someone else may take more effort than staying within one’s own perspective, and what is ‘sufficient to continue the conversation’ might not be ‘sufficient for learning’ [2]. That is why, for learning, instead of trying to

‘minimize the collaborative effort’, we strive for an ‘optimal collaborative effort’ [8].

The effect of effort into perspective taking and co-referenced actions is twofold: not only does relevant feedback enhance collaborative knowledge building, but the effort after shared meaning itself is also strongly associated with learning [16], especially if the effort is directed at the knowledge level (or ‘semantic grounding’ [2]). Spending effort into trying to understand another perspective is learning: it is leaving one’s personal preconceptions and trying to integrate new information and insights in a more objective way. This is also true for reading, since trying to comprehend (scientific) texts is also trying to take the perspective of the author(s).

3. Practice

For collaborative learning, we argued that effort into perspective taking, both as direct individual effect and indirect as a way to achieve co-reference between communicative content, is crucial to developing shared understanding. However, since the relationship between these processes is reciprocal, they will be especially difficult for novices (students) who start collaboration with low levels of understanding. The more evidence is presented, the easier it becomes to take another’s perspective, make co-referenced actions and enhance the degree of shared understanding. Thus, a certain level of shared understanding (‘overlap in cognitive environment’) is necessary for providing evidence and acting in a co-referenced way.

Because effort is also a limited resource which best is directed at knowledge level processes like perspective taking (as opposed to being ‘spent’ on coordination processes), we suggest to try to facilitate this. For collaborative learning it would be beneficial to provide students with some starting point of shared cognitive context, which would enable them to start perspective taking and give each other relevant feedback.

4. Tools

In order to facilitate perspective taking and providing co-referenced feedback, communication tools could be developed that provide more ‘evidence’ for perspective taking. A better-defined semantic (micro) context, which provides information to electronic messages, could limit the range of manifest meanings and facilitate interpretation and co-referenced actions. Earlier research has revealed that a fixed and limited discussion domain can increase the relevancy of peer feedback [18]. This means that

further developing collaborative annotation tools (see figure 2) could be a means to increase co-reference in academic collaboration tasks.

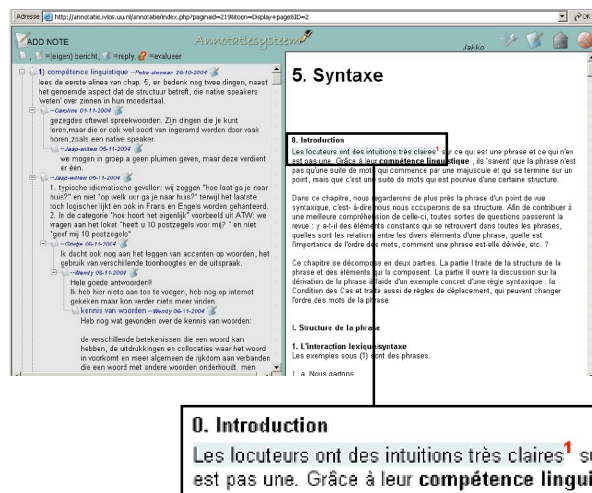


Figure 2: Annotation system to support co-reference

This Annotation System simultaneously displays both a normal ‘threaded’ discussion and a document that is being discussed. Discussion and text are cross-linked with each other by the possibility of anchoring messages to a selection from the text (right hand frame). When reading and responding to messages in the left frame, one automatically sees the particular frame of reference for each message in the right frame, clarifying ‘what exactly the author of the message is talking about’.

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