

“The hand is not a banana” On Developing a Robot’s Grounding Facilities

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We investigate human-robot interaction and human-robot communication (HRI, HRC) with a robot named Flobi trained to acquire category terms like “banana” or “pine-apple”. More precisely, we present a system in which a robot and a human WOZ observer interact on this purpose. For ease of reference we call the whole system robot. Intuitively, we consider a sort of tutorial dialogue between a human user and the robot. We do a deep evaluation of such a dialogue relying on standard paradigms, CA, dialogue theory, pragmatics, and formal theories of public information. Consequently, the HRC is seen as a datum in the ethno-methodological sense. As standards of comparison we use several notions set up or extended by H. Clark (Clark 1996, Clark and Marshall 1981) such as “action ladder”, common ground (CG), grounding (G), and mutual information. These notions all derive from human-human interaction (HHI), hence we call them STandard CG and STandard G. We contrast STandard CG and STandard G with Foundational CG and Foundational G needed in our tutorial dialogues. There is a difference between these two concepts, standard and foundational: Foundational CG and Foundational G deal with rooting a concept. They are hence at the basis of establishing a convention of use. To grasp that in David Lewisian terms one can say that Foundational CG and Foundational G mark the very beginning of a convention for the use of a category term, where a dyad, a robot and a human, starts to form a group initiating a convention of use. In other words, we deal with the building up of a precedent, a case not treated in Lewis’ “Convention” (1969).

We show in our talk how Foundational CG and Foundational G can fail or be achieved in the human-robot interaction. For this purpose we present two case studies, “The hand is not a banana” (fail) and “The pine-apple” (success). Both studies relying on standard paradigms and Clark’s “action ladder” as reference points show general problems arising in HRC. We point out which of these are due to the set up of the system, for example to the ASR and the grammar used or to the behaviour of the human user interacting with the robot. On the user’s side problems might arise due to his style of pointing (deixis) or to his use of politeness conventions not accounted for in the set-up of the current system (see however Peltason et al., 2012). From the case studies we can derive a preference list of mechanisms to be generally observed in the construction of robots, a FCG and FG scale. Most communication problems



arising in human-robot dialogues are well known from semantics, pragmatics and dialogue theory. Others do simply not arise in natural data since they are due to the workings of the system, for example, to its parsing component or its interaction patterns.

In contrast, from investigation of HRC we also get information we cannot normally access in HH communication. A case in point is the possibility to inspect the robot's mind, since we have access to the results of the ASR decodings and the content of deictic acts and can trace which internal state led to which verbal behaviour. This constellation has an interesting methodological side-effect: Especially the success case in the "pine-apple" study shows that in order to derive a working proposition one need not always rely on a standard "action-ladder" and that a proposition can be derived using multi-modal information.

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