

Making things worse to make them better: The role of negative evidence in the coordination of referring expressions

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Abstract

Perhaps one of the oldest and most robust findings in dialogue research is that when describing referents to a conversational partner, interlocutors rapidly converge on a shared set of contracted referring expressions (Krauss and Weinheimer, 1966; Clark, 1996) which become progressively systematized and abstract. This development of systematicity occurs for a wide range of referents, e.g. when referring to shapes and spatial locations (Garrod and Doherty, 1994), pieces of music (Healey et al, 2002), conceptual structures (Schwartz, 1995; see also Voiklis, 2012), levels of confidence (Fusaroli et al., 2012), temporal sequences (Mills, 2011) and also when describing how to manipulate physical objects (Shirozou, 2002). Systematization of referring expressions also occurs across modalities – in spoken interaction (Pickering and Garrod, 2004), text-based interaction (Healey and Mills, 2006) and in graphical, mediated interaction (Healey, 2001).

The development of systematicity is not simply due to the coordination problem of securing reference: once referring expressions have been used successfully, they continue to develop (Garrod 1999, Healey, 2004). This pattern is observed both when interlocutors are faced with the task of describing unfamiliar referents using novel referring expressions (Galantucci, 2005), as well as in situations where interlocutors already possess referring expressions and concepts that are sufficient for uniquely individuating the referents (Pickering and Garrod, 2004). Even when the names of the referring expressions are given experimentally, as in the map task (Anderson et al., 1991), interlocutors coordinate on the semantics of their referring schemas (Larsson, 2007). Further, the quality of the interaction

directly affects the development of coordination. If interlocutors are prevented from providing each other with feedback, e.g. by being prevented from drawing on each other's drawings, this impedes the development of systematicity (Healey, 2007). Similarly, in multiparty interaction, the development of systematicity occurs at a different rate between fully ratified participants than between ratified participants and overhearers who have limited opportunities for engaging in the interaction (Healey and Mills, 2006 – see also Brown-Schmidt and Tanenhaus, 2008; Kühlen and Brennan 2012).

Cumulatively, these findings suggest that interaction in dialogue places important constraints on the semantics of referring expressions (see also Freyd, 1983). However, there is currently no consensus about how best to account for the development of semantic coordination, e.g. whether it occurs as a natural consequence of exposure to another's linguistic output (Kirby, Cornish, Smith, 2008), as a consequence of mutual priming (Pickering and Garrod, 2004), or via interlocutors providing each other with positive evidence of understanding (Brennan, 1998; Clark, 1996). One central problem with these accounts is that the basic mechanisms they propose are inherently conservative (Healey, 2004). Once a particular form is the most successfully and widely used by members of a group, there is no mechanism to explain how it might be supplanted by another. Yet interlocutors continue to develop more systematized descriptions throughout the interaction. Further, experiments conducted by Garrod (1999), Healey (1997), Healey and Mills (2006), Mills (2013), Schwartz (1995) suggest that the development of systematicity can be driven by participants encountering and resolving problematic understanding.

To investigate in closer detail the development of referential coordination, this talk will describe three chat tool experiments that involve relatively fine-grained manipulations of people's referring expressions during live conversations. Participants carry out Garrod and Anderson's (1987) Maze task in pairs using a chat tool. To succeed at this task people must repeatedly describe locations in a maze to each other. In the normal case with this task people tend to produce more 'abstract' and systematized Cartesian location descriptions as they become more experienced. We investigate the influence of three factors on people's ability to co-ordinate on the matrix-like descriptions. The first 'downgrade' experiment involves selective weakening of grounding cues (e.g. "Okay" -> "Uhhh") used during the maze dialogues. The results show that this interferes with people's ability to co-ordinate their referring expressions and supports Clark's account of grounding in dialogue. The second 'degrade' experiment involves inserting 'spoo' clarification questions e.g., "What?", "Sorry" "huh?" that appear to originate from the other person into the maze dialogues.

The results show that these additional spoo questions interfere even more strongly with people's ability to co-ordinate on the Cartesian descriptions. The third experiment involves 'upgrading' or amplifying the problems raised by participants actual questions. For example, when one participant asks a relatively specific clarification question such as "On the left?" the other participant sees this transformed into a "What?"/"Sorry"/"huh?". In contrast to experiments 1 and 2 this manipulation of the dialogue through 'upgrading' of participant's problems leads to significantly stronger convergence on the Cartesian descriptions i.e. higher levels of semantic coordination. We argue that these results show that semantic coordination is primarily driven by negative evidence; problem detection and resolution drives convergence.

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References

Anderson, A. H., Bader, M., Bard, E. G., Boyle, E., Doherty, G., Garrod, S., and Weinert, R. (1991). The HCRC map task corpus. *Language and Speech*, 34(4), 351–366.

Brown-Schmidt, S. and Tanenhaus, M. K. (2008). Real-time investigation of referential domains in unscripted conversation: A targeted language game approach. *Cognitive Science*, 32(4), 643–684.

Clark, H. H. (1996). *Using Language*. Cambridge University Press.

Freyd, J. (1983). Shareability: The social psychology of epistemology. *Cognitive Science*. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0364021383800111>

Galantucci, B. (2005). An experimental study of the emergence of human communication systems. *Cognitive Science: A Multidisciplinary Journal*, 29(5), 737.

Garrod, S. (1999). The Challenge of Dialogue for Theories of Language Processing. In S. Garrod & M. Pickering (Eds.), *Language Processing*. Hove: Psychology Press.

Garrod, S. C., & Anderson, A. (1987). Saying what you mean in dialogue: A study in conceptual and semantic coordination. *Cognition*, 27, 181–218.

Garrod, S and Doherty, D. (1994). Conversation, co-ordination and convention.. *Cognition*, 53, 181–215.

Healey, P. G. T. (1997). Expertise or expert-ese: The emergence of task-oriented sub-languages. In Proceedings of the 19th Annual Conference of the Cognitive Science Society (pp. 301–306).

Healey, P. G. T. (2004). Dialogue in the degenerate case? {Peer commentary on Pickering & Garrod (2004)}. *Behavioural and Brain Sciences*, 27(2), 201.

Healey, P. G. T., & Mills, G. J. (2006). Participation, Precedence and Co-ordination. Proceedings of the 28th Conference of the Cognitive Science Society. Vancouver. Canada.

Healey, P. G. T., Swoboda, N., Umata, I., & Katagiri, Y. (2001). Representational form and communicative use. Proceedings of the 23rd Conference of the Cognitive Science Society (pp. 411–416). Mahwah, N.J.: LEA.

Healey, P. G. T., Swoboda, N., Umata, I., & King, J. (2007). Graphical Language Games: Interactional Constraints on Representational Form. *Cognitive Science*, 31, 285–309.

Kirby, S., Cornish, H., & Smith, K. (2008). Cumulative cultural evolution in the laboratory:. Proceedings of the National Academy of Sciences, 105(31), 10681–10686.

Krauss, R. M., & Weinheimer, S. (1966). Concurrent feedback, confirmation and the encoding of referents in verbal communication. *JPSP*, 4, 343–346.

Kuhlen, A. K., & Brennan, S. E. (2012). Language in dialogue: when confederates might be hazardous to your data. *Psychonomic bulletin & review*, 20(1), 54–72. 341-8

Larsson, S. (2007). Coordinating on ad hoc semantic systems in dialogue. In Proceedings of DECALOG.

Mills, Gregory J. (2011). The emergence of procedural conventions in dialogue. In Proceedings of the 33rd Annual Conference of the Cognitive Science Society. Boston.

Mills, Gregory J. (2013). Dialogue in joint activity: complementarity, convergence and conventionalization. *New Ideas in Psychology*, <http://dx.doi.org/10.1016/j.newideapsych.2013.03.006>

Pickering, M. J., & Garrod, S. (2004). Towards a mechanistic psychology of dialogue. *Behavioural and Brain Sciences*, 27(2), 169–190.

Schwartz, D. L. (1995). The emergence of Abstract Representations in Dyad Problem Solving. *Journal of the Learning Sciences*, 4(4), 321–354.

Shirouzu, H., Miyake, N., & Masukawa, H. (2002). Cognitively active externalization for situated reflection. *Cognitive science*, 26(January 2001), 469–501