# INCREMENTAL TURN PROCESSING IN DIALOGUE

A. Eshghi (Queen Mary University of London), P. G. T. Healey (Queen Mary University of London), M. Purver (Queen Mary University of London), C. Howes (Queen Mary University of London), E. Gregoromichelaki (King's College London) and R. Kempson (King's College London)
arash@dcs.qmul.ac.uk

In ordinary conversation, a Clarification Request (CR) can be posed before a turn is complete:

A: They X-rayed me, and took a urine sample, took a blood sample. Er, the doctor …

B: Chorlton?

A: Chorlton, mhm, he examined me [. . .]

(From the British National Corpus)

Such examples demonstrate (a) that sentence processing is incremental (the CR can be understood and responded to even though the original antecedent sentence is incomplete), and (b) that this incremental processing must somehow make prior material available for later reference. This raises the question of what the increments are (e.g. words vs. structured constituents) and how they're processed. To address it, we test whether the syntactic point of interruption affects ease of processing of an interruptive CR.

A purely word- or string-based processing model would predict an effect of string distance between antecedent and interruption point. A purely semantic model, wherein phrases introduce discourse referents to some unstructured record (e.g. Kamp & Reyle (1993)), would predict no effect of interruption point. On the other hand, a model based on syntactic or semantic sentence structure (e.g. Kempson et. al. (2001)) predicts dependence on structural factors at the point of interruption, e.g. whether the constituent under construction is complete.

We test these predictions experimentally by introducing artificial probe CRs into ongoing dyadic dialogues. Using a novel character-by-character version of the DiET chat-tool methodology (Healey et. al. 2003), we track the syntactic structure of turns in a real, ongoing dialogue as they are typed. This enables us to select Noun Phrases (NPs) as potential targets for a CR. We then insert 'spoof' CRs - verbatim repeats of the target NP plus a question mark (i.e. reprise fragment CRs) - apparently originating from the other participant.

The experimental manipulation is to control the point at which the spoof CR is inserted. The target is always a prior, completed NP. The spoof CR is then inserted either within a subsequent incomplete sub-tree (e.g. after a determiner) or at the end of a subsequent complete sub-tree (e.g. after a complete NP). The string distance of the CRs from their targets in the latter condition will thus be higher on average.

24 pairs of participants carried out 'balloon task' dialogues. Insertion point was manipulated within-subjects with each participant exposed to an average of 3.7 instances of each manipulation.

The results indicate that the position of CR insertion does not cause a reliable difference in the overall likelihood of a response, nor in the likelihood that the target NP is reformulated ($Chi2(1)=0.57$, $p>0.05$). However, the within-sub-tree CRs are more likely to cause a restart from the beginning of the interrupted clause ($Chi2(1)=6.6$, $p<0.05$) and less likely to be interpreted as a CR ($Chi2(5)=12.1$, $p<0.05$). They are therefore more disruptive and 'harder' to integrate. This is despite the fact that within-sub-tree CRs were, on average, closer to their targets (average 21.4 vs. 25.2 characters ($Z=-3.07$, $p<0.05$)). Hence, this is not an effect of string distance or memory decay.

We conclude that increments in dialogue processing are organised in terms of structured syntactic/semantic constituents, rather than simple strings/words or unstructured semantic referents. Moreover, the results demonstrate the need for a sub-sentential, highly structured and incremental concept of context (e.g. Cann et. al. (2007)).

Cann, R., Kempson, R. and Purver, M. 2007. Context and Well-formedness: the Dynamics of Ellipsis. Research on Language and Computation

Healey, P. G. T., Purver, M., King, J., Ginzburg, J., and Mills, G. 2003. Experimenting with clarification in dialogue. In R. Alterman & D. Kirsh (Eds.), Proceedings of the 25th annual Conference of the cognitive science society.

Kamp, H. and Reyle, U. 1993. From Discourse to Logic. Dordrecht: Kluwer

Kempson, R., Meyer-Viol, W. and Gabbay D. 2001. Dynamic Syntax: the flow of language understanding. Blackwell Publishers.