Better late than Now-or-Never: The case of interactive repair phenomena

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Abstract: Empirical evidence from dialogue, both corpus and experimental, highlights the importance of interaction in language use – and this raises some questions for Christiansen & Chater's (C&C's) proposals. We endorse C&C's call for an integrated framework but argue that their emphasis on local, individual production and comprehension makes it difficult to accommodate the ubiquitous, interactive, and defeasible processes of clarification and repair in conversation.

Language is first encountered and deployed in interaction. A characteristic feature of natural interaction is that people often need to address problems with mutual understanding in which elements of what has been said need to be reworked or redone in some way. These processes raise some important questions for Christiansen & Chater's (C&C's) proposals. We support C&C's approach and agree that an integrated framework for the language sciences is a desirable goal for language researchers. However, we argue that C&C's emphasis on local, individual production and comprehension misses some of the key challenges posed by the processes of clarification and repair in conversation.

The thrust of C&C's approach is that language processing is a "Now-or-Never" process that involves rapid, local, lossy chunking of linguistic representations and facilitates a form of autonomous prediction of both our own and each other's utterances. This leads to the proposal that "Chunk-and-Pass processing implies that there is practically no possibility for going back once a chunk is created." (sect. 3.3, para. 2)

The phenomena of clarification and repair seem to present an important counterexample to this picture of language use. Dynamic revisions to utterances, or *repairs*, are ubiquitous in dialogue. In natural conversations it is rare for even a single utterance to be produced without some form of online revision, with these occurring approximately once every 25 words in conversational speech (Hough & Purver 2013), with the rate of repairs adjusted to task demands (Colman & Healey 2011) and to individual differences such as clinical conditions (Howes et al. 2012; Lake et al. 2011).

Repair contagion, whereby the probability of another repair occurring increases after an initial one, is also common (Hough & Purver 2013).

Although many of these repairs are syntactically or lexically local in C&C's sense – for example, words or word fragments that are restarted – some involve more-substantial revisions, and some occur after a turn is apparently complete (Schegloff et al. 1977). Conversation analysts claim that the (minimum) space in which direct repairs or revisions to a speaker's utterance can be made is the four subsequent turns in the conversation (Schegloff 1995). This highlights the operation of significant, nonlocal mechanisms that can make use of prior phonetic, lexical, syntactic, and semantic information over relatively long intervals.

Even self-repairs, the most common and most local form of backtracking in conversation, are often nonlocal in a different sense, as they are produced in response to concurrent feedback from an interlocutor, which works against the idea of encapsulated local processing (e.g., Bavelas & Gerwing 2007; Goodwin 1979). The more strongly people are committed to the predictions of their own language processor, the less able they must be to deal with these real-time adjustments or reversals of decisions – potentially of phonetic, lexical, syntactic, or semantic information – in response to feedback from others. However, it seems that in conversation such revisions are the norm, not the exception. People can take advantage of each other's repair behavior, too: In a visual world paradigm, when experimental subjects hear repaired referring expressions compared to fluent ones, participants can use repaired material to speed up reference resolution (Brennan & Schober 2001). Additionally, experiments in interruptive clarification (Healey et al. 2011) show that participants often restart the interrupted turn after responding to a clarification request, again showing that people must, at least in some cases, have access to the previously produced material.

Ambiguities can emerge late in a dialogue, and people routinely deal with them. Although C&C do acknowledge the availability of mechanisms to "repair the communication by requesting clarification from the dialogue partner" (sect. 3.1, para. 8), they do not discuss how and whether these repair phenomena are consistent with the Chunk-and-Pass model. Similarly, C&C argue that early commitment to predictions about what is coming next should lead to frequent reuse of our own and each other's lexical and syntactic representations; however, the evidence for this in natural conversation is controversial. We have found that syntactic reuse is actually less common than would be expected by chance (Healey et al. 2014). The need to respond constructively to a conversational partner seems to overwhelm some of the processes observed in individual language processing.

These observations reinforce C&C's emphasis on the highly time-critical and piecemeal, incremental nature of language processing, but they also suggest that the demands of engaging with a live conversational partner requires more flexible, defeasible, and interactive mechanisms. Their proposal currently captures a type of incrementality that is essential for efficient working memory, what Levelt (1993) calls "Wundt's Principle," whereby a consuming module can begin operating with a minimal

amount of characteristic input. However, repair phenomena entail other kinds of incrementality as desiderata for a psychological model: namely, recoverability and repairability of increments from the interactive context.

One existing formal and computational model capable of capturing the different facets of incrementality needed for repair mechanisms is Dynamic Syntax (DS, Purver et al. 2006; 2011). DS models language as a set of mechanisms for incrementally building up interpretations in context, and is therefore broadly commensurate with the C&C program; these mechanisms can also be induced (acquired) from the data available to a child learner (Eshghi et al. 2013), with the learning process being piecemeal, incremental, and process-driven as required by C&C. However, DS can also account for repair phenomena by using explicit recoverability mechanisms through backtracking over stored graphs of incrementally constructed semantic content (Eshghi et al. 2015; Hough & Purver 2012). We take this approach to be complementary to the C&C model, showing that many of their insights can be practically implemented, while also addressing the significant challenges posed by interactive repair phenomena in dialogue. In sum, we propose a model that is compatible with the "Now" aspect of their approach, but not with the "Never."

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