

## Measuring Gricean processing: eye movements as a reflection of speakers' drive to be informative

Although Grice's Cooperative Principle (1975/1989) was not originally intended as a cognitive model, one strand of research in experimental pragmatics aims to measure the extent of the psychological reality of its maxims, i.e. the measurable expectation that one's interlocutor will speak informatively, truthfully, clearly and relevantly, lest an implicature be triggered (Bott & Noveck, 2004; Davies & Katsos, 2010; Engelhardt et al., 2006; Eskritt et al, 2008; Papafragou, & Musolino, 2003; Sedivy, 2001; Surian et al, 1996, i.a; see Noveck & Reboul, 2008 for a review). Leaving aside the philosophical analysis of the role of psychological reality as a strength or weakness of Gricean theory (Saul, 2002), the current paper surveys the field to date from a psycholinguistic / methodological perspective. Further, it presents new data from a study looking at the relationship between speakers' visual scanning behaviour and the informativity of their referring expressions (REs).

In line with Halberda (2006), who used eye-tracking to document the mental computations behind disjunctive syllogism as a word learning strategy, this study analyses fixations to contrast objects as a predictor of subsequent informativity. More broadly, it investigates the prerequisites for producing optimally informative REs, i.e. those which adhere to Quantity maxims.

Using a 2 (presence vs. absence of contrast) x 2 (array complexity: 4 or 8 objects) within-subjects design, 20 adult participants played a referential communication game in which they instructed an addressee (the experimenter) to click on a target object. Arrays containing a target, a contrast-mate, and unrelated distracters were displayed on a monitor. After a short preview phase, the target was highlighted for the participant, who then had four seconds to produce their RE. As well as the informativity of these REs, fixation times to the target (e.g. a big hat) and contrast-mate (a smaller hat) were measured over three temporal regions: pre-, during, and post-utterance. Speech onset times were also analysed.

Preliminary analyses over the aggregated temporal regions suggest that speakers were largely informative in their choice of RE (a mean of 78% of all REs were so,  $SD=21$ , contrast condition only), although they tended to fixate the contrast object only briefly (fixation time:  $M=483ms$ ,  $SD=456$  for 4-object arrays;  $M=398ms$ ,  $SD=360$  for 8-objects; total trial time 4000ms: fixation count:  $M=1.5$ ,  $SD=1.4$  for 4-object arrays,  $M=1.4$ ,  $SD=1.2$  for 8-objects). A linear mixed effect model revealed that speech onset was earlier for underinformative utterances ( $M=1095$ ,  $SD=287$  vs.  $M=1106$ ,  $SD=244$  for optimal utterances; estimated effect 84.1ms,  $t=2.97$ ,  $p<.05$ ).

These results suggest that visual scanning preceding or during speech production is not the main factor in informative verbal behaviour. We conclude that speakers are compelled to provide sufficient information even under time constraints and with minimal checking of contrast objects. Instead, speakers may rely on their memory of visual scenes to assess distinctive features, accessed during a pre-utterance phase.

Subsequent finer-grained analyses examine eye movements during the separated temporal regions in order to more precisely monitor differences in visual scanning behaviour preceding informative and underinformative utterances. Implications for eye movements as an index of Gricean processing are discussed.

## References

- Bott, L. and Noveck, I. 2004. Some utterances are underinformative: the onset and time course of scalar inferences. *J.Mem. Lang.* 51, 437–457
- Davies, C. and Katsos, N. 2010. Over-informative children: Production/comprehension asymmetry or tolerance to pragmatic violations? *Lingua*, 120 (8), 1956-1972
- Grice, H. P. 1975. Logic and conversation. In P. Cole and J. Morgan (eds), *Syntax and semantics*, 3: *Speech Acts* (41-58). New York: Academic Press. Reprinted in Grice, H.P. 1989. *Studies in the Way of Words*. Cambridge, MA: Harvard University Press, 22–40
- Engelhardt, P. E., Bailey, K. G. D. and Ferreira, F. 2006. Do speakers and listeners observe the Gricean Maxim of Quantity? *Journal of Memory and Language*, 54(4), 554-573
- Esikkert, M., Whalen, J. and Lee, K. 2008. Preschoolers can recognize violations of the Gricean maxims. *British Journal of Developmental Psychology*, 26, 435-443
- Halberda, J. 2006. Is this a dax which I see before me? Use of the logical argument disjunctive syllogism supports word-learning in children and adults. *Cognitive Psychology*, 53(2006), 310-344
- Noveck, I. and Reboul, A. 2008. Experimental Pragmatics: A Gricean turn in the study of language. *Trends in Cognitive Sciences* 12(11), 425-431
- Papafragou, A. and Musolino, J. 2003. Scalar implicatures: experiments at the semantics-pragmatics interface. *Cognition* 86, 253–282
- Saul, J. 2002. What is said and psychological reality: Grice's project and relevance theorists' criticisms. *Linguistics and Philosophy* 25: 347-372
- Sedivy, J. 2001. Evidence for Gricean mechanisms in on-line language processing. Paper presented at the *14th CUNY Conference on Human Sentence Processing*. Philadelphia, PA.
- Surian, L., Baron-Cohen, S. and van der Lely, H. 1996. Are children with autism deaf to Gricean maxims? *Cognitive Neuropsychiatry*, 1, 55-71