Lombard and temporal effects in concurrent conversations

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Abstract

Conversing in the presence of a background conversations is an everyday act yet little is known about how speakers maintain intelligibility and comprehensibility when confronted with a background of intelligible speech. Speaking in non-informative noise (Lombard speech) has largely been described in terms of induced spectral changes, but it is possible that speakers employ a richer set of strategies, including temporal modifications, to help overcome the disrupting effect of competing speech (e.g. [1]).

In the current study pairs of British English talkers engaged in natural dialogues in the presence or absence of another talker pair. Talkers were instructed to converse only with the other interlocutor in their pair. Pairs sat facing each other around a round table, so that when both pairs were present, talkers had to "talk across" the other pair. In half of the conditions talkers wore visors which prevented them seeing their interlocutors but with no effect on audio transmission.

In both face-to-face and audio-only conditions, speaking simultaneously with another talker resulted in overall increases in energy, F0, F1 and a decrease in speech rate. A distinction between within- and across-pair overlaps however revealed that overlapping with the background pair resulted in an increase in energy but no change in the two prosodic parameters F0 and speech rate, whereas within-pair overlap led to an increase in F0 and a decrease in rate, and no change in speech level (Figure 1). This contrasts with previous studies on simultaneous conversations where the seating configuration did not demand "talking across" the other pair [2], suggesting that background "noise" that consists of intelligible speech does not automatically induce increases in speech output level routinely observed when speaking in the presence of, for example, stationary noise.

Not seeing the interlocutor actually led to a decrease of energy during within-pair overlaps, contrasting with [3] where more effortful speech was oberved, however with non-interactive maskers. This absence of visual cues also led speakers to reduce their overlap with their interlocutor, and to a greater extent when the background pair was present. Although overlap with a background speaker was as high as 80%, we also uncovered evidence of turn-taking behaviour between foreground and background speakers, hinting at a speaker overlap avoidance strategy, albeit necessarily rather weak in such a dense speech background.

Taken together, the finding suggests that adverse conditions cause interlocutors to adopt more careful dialogue strategies, perhaps to reduce both energetic and informational masking at the ears of the listener.

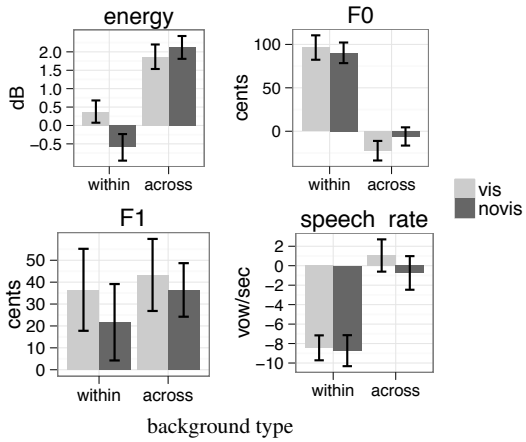

Figure 1: *Lombard effects contrasting within- and across-pair overlaps background types.*

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References

[1] M. Cooke and Y. Lu, "Spectral and temporal changes to speech produced in the presence of energetic and informational maskers," *J. Acoust. Soc. Am.*, vol. 128, no. 4, pp. 2059–2069, 2010.

[2] V. Aubanel, M. Cooke, J. Villegas, and M. L. Garcia Lecumberri, "Conversing in the presence of a competing conversation: effects on speech production," in *Interspeech*, Florence, Italy, 2011, pp. 2833–2836.

[3] M. Fitzpatrick, J. Kim, and C. Davis, "The effect of seeing the interlocutor on speech production in different noise types," in *Interspeech*, Florence, Italy, 2011, pp. 2829–2832.