

Individualization versus cooperation: The effect of group size on voice individuality

Elisa Pellegrino¹, Volker Dellwo¹

¹Dept. of Computational Linguistics, University of Zurich

{elisa.pellegrino, volker.dellwo}@uzh.ch

Abstract

Compared to other species, humans have an unparalleled ability to cooperate with unrelated individuals (see a. o. McClung *et al.*, 2017). Cooperation, acoustically signalled by convergent accommodation (see a. o. Dragojevic *et al.*, 2016), is facilitated when group members are more similar. Nevertheless, convergence constraints may arise when interlocutors need to mark their vocal individuality. Inspired by findings in animal communication showing higher vocal individuality in larger groups (Pollard & Blumstein, 2011), the focus of this presentation will be on the effect of group size on vocal individualization in human interactions. We will illustrate the novel data collection method designed to investigate the trade-off between acoustic convergence and voice individualization in cooperative situations wherein voice recognition is at stake. We will describe the computational approaches used to quantify between- and within-speaker acoustic similarity across group sizes (i-Vector PLDA; Principal Component Analysis) with the results based on automatic features (MFCC) and more traditional acoustic features relevant for identity processing (e.g., F0, harmonicicity, formant dispersion, duration) (see a.o. Latinus *et al.* 2013; Nolan *et al.*, 2011). We will also show the effect of individualization vs. cooperative accommodation on automatic voice discriminability in terms of Equal Error Rate. Results pointing to vocal convergence in larger groups will be discussed compared to the opposite trend observed in animal species. Alternative interpretations will be offered that are based on the role of feedback, the effect of first exposure, and familiarization between speakers' voices.

References

- Dragojevic, M., Gasiorek, J. & Giles, H. (2016). Accommodative Strategies as Core of the Theory. In H. Giles (ed.), *Communication Accommodation Theory: Negotiating Personal Relationships and Social Identities across Contexts* (pp. 36-59). Cambridge United Kingdom: Cambridge University Press <https://doi.org/10.1017/CBO9781316226537.003>
- Latinus, M., McAleer, P., Bestelmeyer, P. E., & Belin, P. (2013). Norm-based coding of voice identity in human auditory cortex. *Current biology: CB*, 23(12), 1075–1080. <https://doi.org/10.1016/j.cub.2013.04.055>
- McClung, J. S., Placì, S., Bangerter, A., Clément, F. & Bshary, R. (2017). The language of cooperation: shared intentionality drives variation in helping as a function of group membership. *Proceedings. Biological sciences*, 284 (1863), 20171682. <https://doi.org/10.1098/rspb.2017.1682>
- Nolan, F. McDougall, K. & Hudson, T (2011). Some acoustic correlates of perceived (Dis)similarity between same-accent voices. *Proceedings of the 17th International Congress of Phonetic Sciences*, Hong Kong, 1506-1509.
- Pollard K.A. & Blumstein, D.T. (2011). Social Group Size Predicts the Evolution of Individuality. *Current Biology* 21, 413-417. <https://doi.org/10.1016/j.cub.2011.01.051>