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Advances in Methods and Practices in Psychological Sciences

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Dear Editors of *Advances in Methods and Practices in Psychological Science*,

This letter is to accompany our submission *Multidimensional signals and analytic flexibility: Estimating degrees of freedom in human speech analyses* as a Registered Report. In order to effectively accumulate knowledge, researchers need to arrive at robust conclusions substantiated by the data. The robustness of data interpretation is challenged by the inherent flexibility in the measurement, analysis, and interpretation of theoretical constructs (e.g. Silberzahn et al. 2017, *AMPPS*). It is thus paramount to assess the extent of this flexibility and to explore factors that explain it.

While several crowd-sourced studies have demonstrated flexibility in either analysis or measurement, the present study investigates how flexibility of measurement and analysis might interact during the analysis of speech production data. The speech signal is a particularly complex signal, informing psychological models of language, categorization, and memory, guiding methods for diagnosis and therapy of speech disorders, and facilitating advancement in automatic speech recognition and speech synthesis. One major challenge in the speech sciences is the mapping between communicative intentions and their physical manifestation. This is not trivial, given the temporal extension of the acoustic signal and its complex structural composition.

In this Registered Report, we propose to investigate the variability in analytic choices when many analysis teams analyze the same speech production data set, a process that involves both decisions regarding the measurement of a complex signal and decisions regarding its statistical analysis. We will use Bayesian meta-analytic techniques to summarize the variability in reported effect sizes across teams and will explore how this much variability can be accounted for by researcher-related factors (researchers expertise

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in both acoustic and statistical analysis), perceived quality of analyses (as assessed by peer reviewers), and analysts' analytical choices.

There are several reasons why we consider a Registered Report the appropriate article type for this endeavor. Given the large amount of degrees of freedom in assessing and modelling researchers' behavior and their research reports, we presume that a Registered Report will provide the ideal workflow for receiving valuable expert feedback before data collection begins. Moreover, it would effectively shield us against our own biases during data analysis. Because the possible implications of our results might have far-reaching consequences for psychologists working with speech, a Registered Report allows the research to be evaluated based solely on its theoretical rationale and its proposed methods, rather than on its outcome and interpretation.

Support and public storage of materials

We hereby confirm that necessary support in the form of funding and facilities are in place for the proposed research and we will be able to commence the necessary work immediately upon receiving a provisional acceptance. Upon in-principle acceptance, the approved protocol will be stored on the Open Science framework, alongside all our materials. All materials, questionnaires, and corresponding analysis scripts will become publicly available once the study is completed, but reviewers will have preview access to the materials here: https://osf.io/3bmcp/?view_only=4f00dff704d742d493870f9f3d68e432. The final analyses will be made available there as well. Upon acceptance, we hereby agree to store all relevant data and metadata for all published results.

Timeline

Upon acceptance, we will immediately commence data collection. We anticipate the following timeline: Recruitment of analysts and reviewers will take 8 weeks; completing questionnaires, analysis and report of the analysts will take 12 weeks; peer-reviewer assessments of those reports will take another 4 weeks; the final meta-analysis by the initiating authors will take 4 weeks and the write-up of the final manuscript in collaboration with all parties will take 6 weeks. Thus overall, we anticipate to finish the project within 34 weeks.

Suggested reviewers
We suggest the following reviewers for this Registered Report:

- Eleanor Chodroff's (eleanor.chodroff@york.ac.uk) research focuses on phonetics and prosody, two central topics of this study.
- Jessica Flake (kayflake@gmail.com) is a quantitative psychologist and the first author of Flake et al. (2020) which deals with operationalisation and related degrees of freedom.
- Christina Bergmann (Christina.Bergmann@mpi.nl) is a psycholinguist with an interest in meta-analytical methods.
- Krista Byers-Heinlein (K.Byers@concordia.ca) works on language acquisition and large-scale Open Science collaborations.
- R. Silberzahn (R.Silberzahn@sussex.ac.uk) is the first author of Silberzahn et al. (2017), whose similarity in methods would be valuable for assessing our proposal.
- Florian Jaeger (fjaeger@ur.rochester.edu) is a computational psycholinguist with a strong focus on human speech and an established expertise in statistical modelling.

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The contents of this manuscript have not been copyrighted or published previously, and they are not currently under consideration for publication elsewhere. This manuscript will not be copyrighted, submitted, or published elsewhere, while acceptance is under consideration. We have no conflicts of interest to disclose. All authors have approved this submission. We further agree that if we withdraw the paper after provisional acceptance, the journal is allowed to publish a short summary of the pre-registered study under a section Withdrawn Registrations.

Thank you for your time and efforts.

Sincerely yours,

Dr. Stefano Coretta
Dr. Joseph Casillas
Dr. Timo B. Roettger (corresponding author)