OMB No. 0925-0001 and 0925-0002 (Rev. 03/2020 Approved Through 02-28-2023)

BIOGRAPHICAL SKETCH

**Provide the following information for the Senior/key personnel and other significant contributors.**

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NAME: Kleinschmidt, David Francis

eRA COMMONS USER NAME (credential, e.g., agency login): dkleinschmidt

POSITION TITLE: Assistant Professor of Psychology

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

| INSTITUTION AND LOCATION | DEGREE  (if applicable) | Completion Date  MM/YYYY | FIELD OF STUDY |
| --- | --- | --- | --- |
| Williams College | BA | 06/2009 | Mathematics |
| University of Rochester | Ph.D. | 08/2016 | Brain and Cognitive Sciences |
| Princeton University | Postdoctoral | 08/2018 | Neuroscience |
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# A. Personal Statement

I am a cognitive scientist specializing in the computational modeling of perception and speech/language processing. My background combines formal training in mathematics, statistics, and machine learning with cognitive psychology, psycholinguistics, and cognitive neuroscience. I have a track record of successfully using computational modeling to not only fit data but to provide theoretical insight, and developed the influential Ideal Adapter theory of how listeners cope with talker variability (Kleinschmidt & Jaeger 2015).

# B. Positions and Honors

## Positions and Employment

2009-2010 Baggett Fellow, University of Maryland Linguistics, College Park, MD

2018- Assistant Professor of Psychology & Cognitive Science, Rutgers University, New Brunswick, NJ

## Other Experience and Professional Memberships

2012- Member, Cognitive Science Society

2016- Member, Association of Laboratory Phonology

2016- Ad-hoc reviewer, NSF SBE (PAC/Linguistics)

## Honors

2010 NSF Graduate Research Fellowship

2015-2016 NIH F31 NIH F31 Ruth L. Kirschstein National Research Service Award

2017 Glushko Dissertation Prize (5 awarded annually by the Cognitive Science Society)

2017 Outstanding Dissertation Award (Natural Sciences), University of Rochester

# C. Contribution to Science

1. Computational modeling of how listeners cope with talker variability: Beginning with my dissertation work, I developed a Bayesian framework for modeling how listeners can cope with talker variability. The problem posed by talker variability is well-known and long established as a primary concern, and my framework (the Ideal Adapter, Kleinschmidt & Jaeger, 2015) provides an elegant solution which unifies the various strategies that have been identified empirically (adapting to unfamiliar talkers, recognizing familiar talkers, and generalizing to similar talkers). This framework can also be extended to account for syntactic adaptation/priming (Kleinschmidt, Fine, and Jaeger, 2012) and to second-language acquisition and processing (Pajak et al., 2016). The ideal adapter has been widely influential outside my own work, and has been cited more than 400 times according to Google Scholar.
   1. Kleinschmidt, D. F., Fine, A. B., & Jaeger, T. F. (2012). A belief-updating model of adaptation and cue combination in syntactic comprehension. In N. Miyake, D. Peebles, & R. P. Cooper (Eds.), *Proceedings of the 34th Annual Conference of the Cognitive Science Society* (pp. 599–604). Cognitive Science Society.
   2. Kleinschmidt, D. F., & Jaeger, T. F. (2015). Robust speech perception: Recognize the familiar, generalize to the similar, and adapt to the novel. *Psychological Review*, *122*(2), 148–203. <https://doi.org/10.1037/a0038695>
   3. Pajak, B., Fine, A. B., Kleinschmidt, D. F., & Jaeger, T. F. (2016). Learning Additional Languages as Hierarchical Probabilistic Inference: Insights From First Language Processing. *Language Learning*, *66*(4), 900–944. https://doi.org/10.1111/lang.12168
2. Quantification of the structure of talker variability: Another, related contribution of my work has been to quantify the amount and structure of talker variability in various phonetic categories and cues, and link that to the speed and degree of adaptation to different phonetic contrasts. In Kleinschmidt (2019), I develop information-theoretic measures of talker variability for two different contrasts (word-initial stop voicing and vowels) and related ideal observer measures of impact on speech recognition performance. These measures allow for the first time an apples-to-apples comparison of the extent of talker variability in very different phonetic categories, and provides firm footing for the common intuition that vowels are more variable across talkers than stop voicing (at least in American English). Kleinschmidt (under revision) builds on these results to show that adults’ distributional learning is strongly constrained by the extent of talker variation in stop voicing.
   1. Kleinschmidt, D. F. (2019). Structure in talker variability: How much is there and how much can it help? *Language, Cognition and Neuroscience*, *34*(1), 43–68. <https://doi.org/10.1080/23273798.2018.1500698>
   2. Kleinschmidt, D. F. (under revision). What constrains distributional learning in adults? *Manuscript Submitted for Publication*. [Preprint] <https://doi.org/10.31234/osf.io/6yhbe>
3. Computational models of non-linguistic perceptual category learning: My work also addresses parallel questions in non-lingustic perceptual category learning. In work begun as an undergraduate, I applied computational models of visual category learning and developed novel Bayesian data analyses to advance the debate on whether there are functionally separate procedural and declarative systems for visual category learning (Zaki and Kleinschmidt, 2014). More recently, I’ve worked to develop online approximations of Bayesian non-parametric clustering models, applying these to provide insight in how people pick up on implicit contexts in a visual short-term recall task (Kleinschmidt and Hemmer, 2019)
   1. Zaki, S. R., & Kleinschmidt, D. F. (2014). Procedural memory effects in categorization: Evidence for multiple systems or task complexity? *Memory & Cognition*, *42*(3), 508–524. <https://doi.org/10.3758/s13421-013-0375-9>
   2. Kleinschmidt, D. F., & Hemmer, P. (2019). A Bayesian model of memory in a multi-context environment. In A. Goel, C. Seifert, & C. Freksa (Eds.), *Proceedings of the 41st Annual Conference of the Cognitive Science Society*.
4. Cognitive neuroscience of phonetic adaptation and perceptual learning: Another strain of my work addresses the neural mechanisms responsible for category learning and adaptation. In Wu, Kleinschmidt, et al. (2020), we use representational similarity analysis (RSA) of fMRI data to show that learning to categorize complex objects into non-linearly-separable categories results in wide-spread re-structuring of representations across the middle visual system (LO) as well as fronto-parietal attention networks. In Kleinschmidt, Raizada, and Jaeger (2016), we use RSA to show that implicit distributional learning of a voicing (e.g., “beach-peach”) contrast yields changes in neural representations in left inferior parietal areas, which Luthra et al. (2020) validated with a reanalysis of fMRI data from an earlier lexically-driven perceptual recalibration study using similar multi-voxel pattern analysis techniques.
   1. Wu, M.-H., Kleinschmidt, D., Emberson, L., Doko, D., Edelman, S., Jacobs, R., & Raizada, R. (2020). Cortical Transformation of Stimulus Space in Order to Linearize a Linearly Inseparable Task. *Journal of Cognitive Neuroscience*, *32*(12), 2342–2355. <https://doi.org/10.1162/jocn_a_01533>
   2. Kleinschmidt, D. F., Raizada, R., & Jaeger, T. F. (2016) Neural mechanisms for coping with talker

variability by rapid distributional learning [Talk presented at the Society for the Neurobiology of

Language meeting].

* 1. Luthra, S., Correia, J. M., Kleinschmidt, D. F., Mesite, L., & Myers, E. B. (2020). Lexical Information Guides Retuning of Neural Patterns in Perceptual Learning for Speech. *Journal of Cognitive Neuroscience*, *Early Access*, 1--12. <https://doi.org/10.1162/jocn_a_01612>

# D. Additional Information: Research Support and/or Scholastic Performance