THE ROLE OF VARIABILITY IN LEARNING GENERALIZATION: A COMPUTATIONAL MODELING APPROACH

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The impact of training variability on generalization has been a long-standing topic in the study of human learning, with conflicting evidence about its potential benefits. This dissertation addresses these ambiguities by examining the effects of varied versus constant training in visuomotor skill learning through a combination of experimental and computational modeling approaches. Across two projects, we systematically compare varied training (multiple items) to constant training (single item) in a projectile-throwing task. Empirical findings reveal both positive and negative impacts of variability, highlighting the complex interplay between training conditions and generalization performance. To provide a theoretical account of these findings, this dissertation employs both instance-based and connectionist computational modeling approaches. The instance-based modeling approach introduced in Project 1 provides a theoretically justifiable method of quantifying and controlling for similarity between training and testing conditions, while also demonstrating that varied training may induce broader generalization in the similarity function relating training and test items. In Project 2, the Extrapolation-Association Model (EXAM) provided the best account of the testing data across all experiments, capturing the constant groups' ability to extrapolate to novel regions despite limited training experience, while also revealing potential detriments of varied training for simple extrapolation tasks. These results challenge simplistic notions about the universality of variability benefits in training and emphasize the need for tailored approaches that consider both the structure of the task environment and the prior knowledge of the learners.

Table of contents

Introduction

Varied Training and Generalization

Varied training has been shown to influence learning in a wide array of different tasks and domains, including categorization (Hahn et al., 2005; Maddox & Filoteo, 2011; Morgenstern et al., 2019; Nosofsky et al., 2019; Plebanek & James, 2021; Posner & Keele, 1968), language learning (Brekelmans et al., 2022; Jones & Brandt, 2020; Perry et al., 2010; Twomey et al., 2018; Wonnacott et al., 2012), anagram completion (Goode et al., 2008), perceptual learning (Lovibond et al., 2020; Manenti et al., 2023; Robson et al., 2022; Zaman et al., 2021), trajectory extrapolation (Fulvio et al., 2014), cognitive control tasks (Moshon-Cohen et al., 2024; Sabah et al., 2019), associative learning (Fan et al., 2022; Lee et al., 2019; Livesey & McLaren, 2019; Prada & Garcia-Marques, 2020; Reichmann et al., 2023), visual search (George & Egner, 2021; Gonzalez & Madhavan, 2011; Kelley & Yantis, 2009), voice identity learning (Lavan et al., 2019), face recognition (Burton et al., 2016; Honig et al., 2022; Menon et al., 2015), the perception of social group heterogeneity (Gershman & Cikara, 2023; Konovalova & Le Mens, 2020; Linville & Fischer, 1993; Park & Hastie, 1987) , simple motor learning (Braun et al., 2009; Kerr & Booth, 1978; Roller et al., 2001; Willey & Liu, 2018), sports training (Breslin et al., 2012; Green et al., 1995; North et al., 2019), and complex skill learning (Hacques et al., 2022; Huet et al., 2011; Seow et al., 2019). See Czyż (2021) or Raviv et al. (2022) for more detailed reviews.

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Journal Articles and Conference Proceedings

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Presentations

- Half Day Tutorial on Measuring Mindfulness Behaviorally: Onsite/Online Data Col-lection with jsPsych - Cognitive Science Conference – 2018
- Does interleaving go the distance? Exploring the effect of dissimilarity on interleaved category learning - Math Psych/ICCM 2018
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Awards

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