



# The Hazards and Benefits of Condensation in Social Learning

ITAI ARIELI, Technion, Israel

YAKOV BABICHENKO, Technion, Israel

STEPHAN MÜLLER, University of Göttingen, Germany

FARZAD POURBABAEI, Caltech, USA

OMER TAMUZ, Caltech, USA

In a misspecified social learning setting, agents are condensing if they perceive their peers as having private information that is of lower quality than it is in reality. Applying this to a standard sequential model, we show that outcomes improve when agents are mildly condensing. In contrast, too much condensation leads to worse outcomes, as does anti-condensation.

In our misspecified setting agents perfectly understand and interpret their own signal but misperceive the quality of their predecessors' signals. When agents are mildly condensing, efficient learning occurs. Because agents underestimate the quality of others' signals, they put too little weight on their predecessors' actions. In consequence, their actions are suboptimal, but reveal more of their own private information. When this is done in moderation more is gained than lost, and in the long run the result is quick convergence to the correct action. This occurs even with signal distributions that would have induced inefficient learning for well-specified agents. Of course, since agents are misspecified, each agent attains lower expected utility than they would if they were not, *ceteris paribus*. Nevertheless, their behavior has positive externalities on later agents, with improved asymptotic outcomes.

When agents are too condensing they put so little weight on their predecessors' actions that no herd forms and both actions are taken infinitely often, i.e., asymptotic learning is not obtained. When agents are anti-condensing they put too much weight on their predecessors' actions. In consequence wrong herds form with positive probability, and again asymptotic learning is not obtained. Interestingly, it follows that asymptotic learning is equivalent to efficient learning across all misspecified regimes.

A full version of this paper can be found at <https://arxiv.org/abs/2301.11237>.

CCS Concepts: • **Theory of computation** → *Social networks; Convergence and learning in games.*

Additional Key Words and Phrases: Social Learning, Misspecified Learning, Speed of Learning

## ACM Reference Format:

Itai Arieli, Yakov Babichenko, Stephan Müller, Farzad Pourbabaee, and Omer Tamuz. 2023. The Hazards and Benefits of Condensation in Social Learning. In *Proceedings of the 24th ACM Conference on Economics and Computation (EC '23)*, July 9–12, 2023, London, United Kingdom. ACM, New York, NY, USA, 1 page. <https://doi.org/10.1145/3580507.3597752>

---

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

EC '23, July 9–12, 2023, London, United Kingdom

© 2023 Copyright held by the owner/author(s).

ACM ISBN 979-8-4007-0104-7/23/07.

<https://doi.org/10.1145/3580507.3597752>