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Journal of Economic Theory 163 (2016) 222–247

JOURNAL OF Economic Theory

www.elsevier.com/locate/jet

Informational herding with model misspecification ☆

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Received 9 December 2014; final version received 25 January 2016; accepted 26 January 2016

Available online 2 February 2016

Abstract

This paper demonstrates that a misspecified model of information processing interferes with long-run learning and allows inefficient choices to persist, despite sufficient information for asymptotic learning. I consider an observational learning environment in which agents observe a private signal about an unknown state and some agents observe the actions of their predecessors. Individuals face an inferential challenge when extracting information from the actions of others, as prior actions aggregate multiple sources of correlated information. A misspecified model allows for the fact that an agent may not be able to distinguish between new and redundant information, and may have an incorrect model of how others process this information. When individuals significantly overestimate the amount of new information, beliefs about the state become entrenched and incorrect learning occurs with positive probability. When individuals sufficiently overestimate the amount of redundant information, beliefs fail to converge and learning is incomplete. Learning is complete when agents have an approximately correct model of inference, establishing that the correctly specified model is robust to perturbation.

JEL classification: D82; D83

Keywords: Model misspecification; Observational learning; Informational herding

☆ I thank Nageeb Ali, Vince Crawford, Ernesto Dal Bo, Alex Imas, Frederic Koessler, George Mailath, Craig McKenzie, Matthew Rabin, Joel Sobel and an anonymous referee for useful comments. I also thank participants of the NSF Information Transmission in Networks Conference and the UCSD theory lunch for helpful feedback.

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http://dx.doi.org/10.1016/j.jet.2016.01.011

1. Introduction

Observational learning plays an important role in the transmission of information, opinions and behavior. People use bestseller lists to guide their purchases of books, cars and computers. Co-workers' decisions to join a retirement plan influence a person's decision to participate herself. Social learning also influences behavioral choices, such as whether to smoke or exercise regularly, or ideological decisions, such as which side of a moral or political issue to support. Given the gamut of situations influenced by observational learning, it is important to understand how people learn from the actions of their peers. This paper explores how a misspecified model of information processing may interfere with asymptotic learning, and demonstrates that biased learning offers an explanation for how inefficient choices can persist, incorrect beliefs can become entrenched, or beliefs can fail to converge, despite sufficient evidence for complete learning.

Individuals face an inferential challenge when extracting information from the actions of others. An action often aggregates multiple sources of correlated information. Full rationality requires an agent to have a correct model of how others process this information, in order to parse out the new information and discard redundant information. This is a critical feature of standard observational learning models in the tradition of Smith and Sorensen (2000). In these models, agents understand exactly how preceding agents incorporate the action history into their decision-making rule, and are aware of the precise informational content of each action. However, what happens if agents are unsure about how to draw inference from the actions of their predecessors? What if they believe the actions of previous agents are more informative than is actually the case, or what if they attribute too many prior actions to redundant information and are not sensitive enough to new information? Motivated by this possibility, I allow agents to have a misspecified model of the information possessed by other agents. This draws a distinction between the perceived and actual informational content of actions.

Consider an observational learning model where individuals have common-value preferences that depend on an unknown state of the world. They act sequentially, observing a private signal before choosing an action. A fraction p of individuals also observe the actions of previous agents. These socially informed agents understand that prior actions reveal information about private signals, but fail to accurately disentangle this new information from the redundant information also contained in prior actions. Formally, informed agents believe that any other individual is informed with probability $\hat{p}$, where $\hat{p}$ need not coincide with p. When $\hat{p} < p$, an informed decision maker attributes too many actions to the private signals of uninformed individuals. This leads her to overweigh information from the public history, and allows public beliefs about the state to become entrenched, possibly unjustifiably so. On the other hand, when $\hat{p} > p$, an informed decision maker underweights the new information contained in prior actions, rendering beliefs more fragile to contrary information. Thus, the difference between $\hat{p}$ and p determines the level of model misspecification.

To understand how model misspecification affects long-run learning requires careful analysis of the rate of information accumulation, and how this rate depends on the way informed agents interpret prior actions through their belief $\hat{p}$. The main result of the paper (Theorem 1) specifies thresholds $\hat{p}_1$ and $\hat{p}_2$, such that when $\hat{p} < \hat{p}_1$ both correct and fully incorrect learning occur with positive probability, when $\hat{p} > \hat{p}_2$, beliefs about the state perpetually fluctuate, rendering learning incomplete, while when $\hat{p} \in (\hat{p}_1, \hat{p}_2)$, correct learning occurs with probability one. The first two cases admit the possibility of inefficient learning: with positive probability, informed agents choose the inefficient action infinitely often, despite observing sufficient information to