# Misinterpreting Social Outcomes and Information Campaigns[*]

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We explore how information campaigns can counteract inefficient choices in a social learning setting with model misspecification. We study the optimal way for a social planner to release costly information about the state. For example, this could entail a public health campaign to encourage parents to vaccinate their children or a savings campaign that encourages workers to invest in the stock market. We characterize how the type and level of misspecification affect the optimal information policy, and show that the duration – temporary or permanent – and target – intervene to correct inefficient action choices or to reinforce efficient action choices – of the optimal information campaign depend crucially on the form of misspecification. We close with an application in which agents misunderstand other agents' risk preferences.

KEYWORDS: Social learning, model misspecification, information campaigns
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# 1 Introduction

Information plays a key role in shaping economic behavior and market outcomes. Faced with uncertainty about the quality of a product, the technology of a competing firm or the likely outcome of a policy, individuals often observe information before making a decision. A rich literature explores how long-run learning outcomes depend on the type of information that individuals observe and the way that individuals process this information. This literature establishes that when individuals use misspecified models to interpret information, long-run inefficiencies may arise and persist, even when sufficient information arrives for a correctly specified agent to identify the state.[1] In such settings, an information planner, such as a public health agency or government, may have scope to *strategically* release information to influence long-run behavior.

To fix ideas, suppose that individuals are learning about whether or not it is dangerous to drive without a seatbelt. Each individual observes how frequently others get injured in car accidents and attempt to incorporate that information into their decision. But agents may have a misspecified model of how others weigh the risk of injury relative to the discomfort of wearing a seatbelt. We know from Bohren and Hauser (2018) that incorrect learning can arise in such settings – in particular, if decision makers overestimate how many of their peers are willing to risk not wearing a seatbelt, they may never be certain that wearing a seatbelt is the optimal action. Now suppose that an information planner, such as a public health agency, seeks to ensure that individuals accurately learn. Each period, the public health agency can release a costly public signal about the seatbelt's safety, such as a public service announcement or online promotion. Alternatively, the agency can provide information about the choices that underlie a given outcome by releasing information about whether an individual who was injured in a car crash was wearing a seatbelt. What is the optimal way to release information? In particular, how does the *timing*, *precision* and *frequency* of the information campaign depend on how severely and in which direction individuals misinterpret the informativeness of prior outcomes?

In this paper, we study the optimal way for an information planner to reveal information in a sequential social learning setting in which individuals learn from the outcomes of prior individuals and have a misspecified model of others' preferences. A sequence of agents observe the outcomes of the decisions of their predecessors, then each make a one-shot decision. The probability of these stochastic outcomes depends not only on

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[1]For example, inefficient learning can raise when individuals have confirmation bias (Rabin and Schrag 1999), overweight information (Epstein, Noor, and Sandroni 2010), misunderstand the correlation between other individuals' actions (Bohren 2016; Eyster and Rabin 2010), use a level-k model of inference (Bohren and Hauser 2018) or systematically slant information (Bohren and Hauser 2018).

the predecessors decisions, but also on the state of the world. Therefore, agents use this past history of outcomes to draw inferences about the state of the world.

Learning from others' outcomes requires an understanding of how these individuals make decisions. Individuals often have substantial heterogeneity in their preferences and past experiences, which complicates this learning process. A rich literature in psychology and economics documents settings in which individuals exhibit *social misperception* – that is, they misperceive the population distribution of preferences or beliefs. In some settings, individuals overestimate the population prevalence of their preferences, opinions or behaviors – that is, they perceive a *false consensus* (Ross, Greene, and House 1977). This often arises in the context of non-normative behaviors, such as estimating peer smoking choices (Sherman, Presson, Chassin, Corty, and Olshavsky 1983), the prevalence of excessive drinking (Suls, Wan, and Sanders 1988) and peer sexual activity Whitley (1998). In other social settings, individuals perceive a discrepancy between their preferences and beliefs, and the preferences and beliefs of others – that is, they exhibit *pluralistic ignorance.* For example, pluralistic ignorance has been documented with respect to perceptions of gender stereotypes (Prentice and Miller 1996), the extent of others' social inhibition (people underestimate it, relative to their own inhibition) and the inclination of others to choose a beneficial action that may have embarrassing consequences (people overestimate it, relative to their own inclination) (Miller and McFarland 1987). In contrast to the false consensus, pluralistic ignorance often arises in contexts where there is widespread behavioral adherence to a social norm, or where individuals believe that a *negative* trait affects their own behavior but not others' behavior.

Motivated by this empirical evidence, we allow agents to have a misspecified model of other agents' preferences, i.e. an inaccurate belief about the population distribution of preferences. This leads to an incorrect models of how others make decisions, and therefore, an incorrect interpretation of the underlying choices that were likely to generate a given outcome. We restrict attention to settings in which sufficient information arrives for asymptotic learning to obtain in the correctly specified model – in other words, correctly specified agents will eventually choose the efficient action almost surely. This allows us to isolate the impact of misspecification. When agents have misspecified models, in the absence of an informational intervention, they may learn the incorrect state, have beliefs that perpetually oscillate, or learn at a slower rate than in the correctly specified model. All three possibilities lead to a higher rate of inefficient action choices, relative to the correctly specified model.

We use this framework to study how an information planner, such as a government or firm, can release information to facilitate learning. The planner has two tools to counteract individuals' misspecification: she can generate costly public signals and she

can reveal the action choices that underly different realized outcomes. Specifically, in each period, the planner can release a signal whose precision she chooses, where the cost of this signal is increasing in the precision. Given a realized outcome, she can also choose to reveal the agent's underlying action choice to future agents, for a cost.

We establish that in such settings, an information planner can effectively restore the long-run rate of learning in the correctly specified model. We show that the type of policy that effectively counteracts misspecification depends crucially on the form of misspecification. For instance, when facing agents who mistakenly believe others have similar preferences to their own – the false consensus effect – an effective policy must counteract incorrect learning. Such a policy needs to include an intervention that corrects inefficient choices, but this intervention can be temporary – after a finite number of periods, agents will be on track to choose efficient actions and an intervention will no longer be necessary. But this intervention would be ineffective for agents with other forms of misspecification. For instance, when facing agents who mistakenly believe that others have different preferences to their own – pluralistic ignorance – an effective policy must counteract fragility i.e. oscillating beliefs. Such a policy needs to include an intervention that reinforces efficient choices, and this intervention needs to be permanent – the planner intervenes infinitely often. We then explore properties of the optimal action revelation policy, including characterizing the set of outcomes after which it is optimal to release information about the underlying actions.

We illustrate the insights from the general framework in an application where agents choose between a sure action and a lottery, and have misspecified beliefs about how others evaluate risk. Both overestimating (false consensus effect) and underestimating (pluralistic ignorance) the similarity of others' risk attitudes has been well documented in the psychology literature (Miller and McFarland (1987), Ross et al. (1977)). For instance, it is well documented that college students overestimate the proportion of the student body who enjoy binge drinking. This bias may lead students to underestimate how risky alcohol consumption is, since they observe their peers succeeding in school and believe that their peers are consuming much higher amounts of alcohol than they actually are. This in turn leads them to underestimate the risks of alcohol and suboptimally increase their own level level of consumption. We show that in the presence of such bias, many well known information campaigns are ineffective and any short-run reduction in overconsumption eventually dissipates if the intervention ceases.

Our results contribute to understanding how to design informational interventions in complex learning environments. They yield insight into how to design policies that improve the accuracy of learning and combat misinformation.

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