



# Bayesian persuasion and information design: perspectives and open issues

## Introduction to the Special Issue on Communication and Persuasion

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Bayesian persuasion, or information design,<sup>1</sup> is one of the most prolific fields of economic theory in the recent years.<sup>2</sup> Celebrating the decade of its success, and projecting another fruitful decade, we would like to outline a few current issues of acute interest and potential directions for the development of the field. We note that this editorial is not meant to be a comprehensive survey of the literature and there are several important contributions not discussed here.

Bayesian persuasion studies the design of information structures with the purpose of influencing behavior of a receiver or receivers (e.g., Kamenica and Gentzkow 2011). The basic theory makes a number of assumptions, which are sufficiently plausible in many contexts and have enabled various novel insights. Yet, we think that a more flexible approach that relaxes these assumptions would significantly enhance the applicability of the theory. Here we focus on two of the assumptions. First, the receivers are the standard rational players who maximize their expected utility and make Bayesian inferences. Second, there are few or no constraints on feasible information structures (signals, experiments).

<sup>1</sup> We use the two terms synonymously, as in Kamenica (2019). Some literature makes a distinction, with the former term referring to the case of a single receiver, and the latter covering the case of multiple receivers (e.g., Bergemann and Morris 2019).

<sup>2</sup> See Bergemann and Morris (2019) and Kamenica (2019) for surveys of this literature.

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To begin with, the assumption of fully rational Bayesian receivers is too demanding and raises significant doubts in several applications. For example, if the receivers are individual voters or consumers, it is implausible that they would form a common prior and process any new information as standard Bayesian players. Consequently, Bayesian persuasion under alternative models of belief formation and processing is a matter of acute interest. The receiver's systematic distortion of beliefs from Bayesian posteriors appears in De Clippel and Zhang (2021); correlation neglect in Levy et al. (2018); the multiplicity of the receiver's priors in Kosterina (2020); the multiplicity of the designer's priors in Hu and Weng (2021), and the model misspecification by the designer in Dworzak and Pavan (2020). Yet, not only the development of such alternative models, but also their empirical testing and validation by the field data or in laboratory experiments are crucially important. For example, when facing repeated messages about an unobserved state of the world, will the receivers follow Bayes rule or any of the distorted rules of De Clippel and Zhang (2021)? Or will the players behave as classical statisticians? Can the players' choices be justified by Bayesian optimization under some belief, or by alternative non-Bayesian models, such as maximin utility, as in Beauchêne et al. (2019) and Liu and Yannelis (2021)?

The assumption that the designer is unconstrained in the design of information structures is questionable in many applications. Optimal information structures can be infeasible or difficult to implement in practice. A commitment to randomized messages is difficult to verify and enforce; an inspector may be unable to tell whether a message is truly randomized or strategically chosen from the permitted support. A prosecutor may have access to a number of available forensic tests but be unable to design a new one. A data analyst may be able to strategically cherry-pick a sample from a dataset, but unable to control how data are generated. These types of constraints emerge in many relevant contexts, such as bank stress tests Faria-e-Castro et al. (2017), Goldstein and Leitner (2018) and Inostroza and Pavan (2021), quality certification Rosar (2017) and Zapechelnyuk (2020), and clinical trials Henry and Ottaviani (2019). This issue is being addressed in two distinct but complementary directions. One direction identifies sufficient conditions for simple information structures to be optimal among all information structures, as in Kolotilin and Wolitzky (2020), Ivanov (2021), and Kolotilin et al. (2021). The other direction explicitly incorporates relevant constraints, as in Degan and Li (2021), Di Tillio et al. (2021) and Onuchic and Ray (2021). Gentzkow and Kamenica (2017) analyze how the constraints on senders' information structures influence the impact of competition on information provision. Overall, this line of research is application-driven and bound to receive a lot of attention as more applications of Bayesian persuasion are brought to light.

Another promising avenue is to think of Bayesian persuasion in a broader context. For example, one can analyze how Bayesian persuasion can be embedded in models of dynamic interaction between the sender and the receiver (Best and Quigley 2020; Bizzotto and Vigier 2021; Che et al. 2021). One may also combine Bayesian persuasion with other forms of strategic communication. If the sender has private information before communication, then the persuasion problem becomes a signalling game (Perez-Richet 2014; Hedlund 2017; Koessler and Skreta 2021). If the sender has limited commitment power, then the problem exhibits features of cheap talk (Guo and Shmaya 2021; Lipnowski and Ravid 2020; Lipnowski et al. 2019; Min 2021). Bayesian

persuasion can naturally incorporate information costs, the literature on which is growing fast (Caplin et al. 2017; Pomatto et al. 2018). It could be costly for the sender to generate information (Gentzkow and Kamenica 2014), or for the receiver to process provided information (Bloedel and Segal 2020; Lipnowski et al. 2020). Or, the receiver may acquire additional information for himself (Matysková 2018). It is also of interest to investigate how Bayesian persuasion is related to other types of problems. For example, Dworzak and Martini (2019) explain how price theory can be used to interpret and analyze Bayesian persuasion. Kolotilin and Zapechelnyuk (2018) establish an equivalence result between Bayesian persuasion and delegation and show how the former can be used to improve upon results on the latter. Kleiner et al. (2020) explain how the same mathematical technique can be applied to several different economic problems, including auction and contest design, Bayesian persuasion, delegation, and decision making under uncertainty.

With the recent rapid progress in its theoretical understanding, we expect Bayesian persuasion to become an integral part in an increasing number of applications. Just like mechanism design reshaped our approach to incentives and became ubiquitous in economic models over the last 40 years, information design is reshaping our understanding of the role of information, and we expect it to become a routine tool of an economist in the near future.

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