Personal Statement

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I am an applied theorist who studies the role that information plays in our societies. A central question that underpins many of my papers is how parties with vested interests can use information to influence the behavior of strategic agents. For instance, a digital platform may use consumer data to design a recommendation algorithm that maximizes its revenues. A social media platform may strategically curate content to maximize user engagement. A financial regulator may impose disclosure standards on firms to protect investors and promote competition. My research highlights the importance of understanding the role of information in these contexts, which is crucial for regulating the evolving "data economy." These issues are particularly important as data becomes an increasingly critical component of the modern economy.

More specifically, my research studies strategic interactions under incomplete information, with primary applications in industrial organization and political economy. I contribute to two principal areas of research: *Strategic Information Transmission* and *Information Markets*. In the former, I explore how information can be used to influence the behavior of strategic agents. My research makes methodological contributions—such as providing analytical tools to characterize optimal information policies—and practical ones, such as identifying key features that optimal information policies should have in specific applications. Additionally, I design experiments to empirically test the predictive power of our theories of information transmission. In the latter area, my papers analyze specific markets in which information is exchanged, either as a productive input (e.g., the market for consumer data) or as a final good (e.g., the news media industry). The main goal of this research is to identify externalities and inefficiencies within these markets, and propose remedies that inform regulators and policymakers.

1 Research

My research advances our understanding of how incomplete information shapes strategic behavior. The common thread in my work is the focus on settings in which information is *endogenously* determined. Some of my papers study scenarios in which information is provided by an informed third party aiming to achieve a specific goal. Others explore situations in which information allocation results from market interactions.

Overall, my research falls within the field of information economics. In recent years, various novel questions—both conceptual and applied—have emerged in this field. These questions are motivated by the increasing digitization of our societies and the growing reliance on information and data. My research tackles questions in this space. For instance, what is the value of personal data? How can it be used to influence the outcome of strategic interactions? Why does competition in information provision increase polarization? How effectively do social media platforms aggregate information?

Addressing these questions poses significant challenges because, in strategic settings, seemingly secondary details of the information environment can have major consequences on agents' equilibrium behavior. To make progress, in some of my papers I innovate by introducing methodological tools that ease the analysis. In others, I propose parsimonious models that transparently emphasize the novel and important aspects of a problem. Finally, in others I design experiments and collect data to test the predictive power of theories of information transmission. This wide range of tools is a feature of my approach to research.

The rest of this section provides more details regarding my research. In Section 1.1, I discuss my work in the area of *Strategic Information Transmission*. The papers in this section study how an interested third party can use information to provide incentives to strategic agents, thus affecting their equilibrium behavior. In Section 1.2, I discuss my work on *Markets for Information*. These papers investigate specific market institutions that determine the equilibrium allocation of information.

1.1 Strategic Information Transmission

This section discusses papers that focus on the provision of incentives via information. My work covers several different communication paradigms. The main distinction among them is the extent to which the information provider is able to commit to an information policy. Much of this work studies information provision under commitment, a paradigm known as information design or Bayesian persuasion. The other papers study information provision under partial or no commitment, which encompasses different paradigms, including verifiable disclosure and cheap talk.

► In my paper ***On Information Design in Games*** (2020, *Journal of Political Economy*), Laurent Mathevet, Ina Taneva and I contribute to the foundation of the fast-growing literature on information design. Information design complements the more classical approach of *mechanism* design, in which the allocation of information is exogenous but the designer can affect behavior by changing agents' incentives (e.g., with transfers). Our paper studies how to manipulate the beliefs of a group of agents who interact strategically, i.e., in a game, to achieve certain goals. The earlier literature, which started with Rayo and Segal (2010) and Kamenica and

Gentzkow (2011), focuses primarily on how to manipulate the beliefs of a single agent who acts in isolation. A theory of information design in games is valuable for two reasons. The first one is practical. Many important applications feature multiple interacting agents, rather than a single one. For example, an online marketplace may provide information to competing sellers; a startup may provide information to a group of early investors, etc. The second reason is conceptual. When multiple agents interact, the provision of public information may no longer be optimal. In these cases, the designer may need to provide information privately, which requires harnessing complex hierarchies of higher-order beliefs.

Our paper proposes a "belief approach," which complements the "recommendation approach" proposed by Bergemann and Morris (2016). With our approach, we provide conceptual and methodological tools that help researchers better understand and solve information design problems in games. We show that any information-design problem can be solved with a two-step approach: the first step optimizes among "simple" distributions, and the second step optimally combines these distributions subject to Bayesian plausibility. The latter step generalizes to games the concavification approach of Kamenica and Gentzkow (2011). Our technique is general and applies to a variety of solution concepts and equilibrium selection rules.

To illustrate, we show that our approach can shed light on a problem that was understudied at the time of the paper, now commonly referred to as the information-design problem under adversarial selection. The typical approach in information design presumes that, whenever multiple equilibria exist, agents coordinate on the one preferred by the designer. However, a cautious designer may want to design information under the assumption that agents will coordinate on the worst equilibrium. We study this problem in the context of an investment game, where the coordination motive gives rise to equilibrium multiplicity under incomplete information. Since our paper, the literature has recognized the importance of adversarial selection in information design, which is now the subject of significant contributions, including Halac et al. (2021), Ali et al. (2021), Inostroza and Pavan (2024), Morris et al. (2024), and others.

- Motivated by this earlier work of mine, in ***Games with Information Constraints: Seeds and Spillovers*** (2024, accepted at *Theoretical Economics)*, Simone Galperti and I explore settings in which a key assumption of the information-design paradigm is relaxed. The classic paradigm assumes that the information designer (or nature, for that matter), can choose among all information structures, without constraints. However, when using information to influence agents' behavior, one constraint seems especially important: That information provided to an agent could spill over to another. To accommodate constraints of this kind, we study a model in which only a given subset of agents, called seeds, can initially receive information. This information then spills over from the seeds to other agents, following the links of an exogenous spillover network. Thus, the seeds and the spillover network act as constraints on what infor-

mation agents can have before playing the game, and in particular, on what they know about each other's information. Our model encompasses the standard one as a special case.

What equilibrium outcomes can feasibly arise given these constraints? Unfortunately, existing methods to address this question do not apply in the presence of these constraints, thus making the analysis of these problems particularly challenging. To overcome these challenges, we show how to recast the problem in a way that enables the characterization of all feasible outcomes in terms of recommendation mechanisms, even if in our setting the mediator cannot communicate directly and privately with all agents. We achieve this in two steps. First, we allow the mediator to communicate directly with the agents by fully relaxing the seeding constraint. To compensate, we tighten the spillover constraint by adding new links to the spillover network and show that this can be done in a way that leaves the set of feasible outcomes unchanged. Second, under these modified constraints, we show that we can characterize all these outcomes by focusing on a mediator who directly recommends a (possibly mixed) action to each agent.

Our leading application is a problem of organization design, a classic topic in organizational economics. We consider an effort-provision game among various teams in an organization. Its manager can choose once and for all which teams are tasked with sourcing information from the outside (the seeds) and which teams have to report their information to which other teams (the spillovers). The manager's goal is to design an organization that performs well across all possible outcomes of the teams' interactions as driven by the information they obtain on a daily basis. Our exercise offers insights into when it is optimal to mandate full transparency between teams, to institute a "firewall" that prevents them from sharing information, or to impose a hierarchy in which lower teams must report their information to higher teams.

► In my paper ***Rules and Commitment in Communication: An Experimental Analysis*** (2022, *Econometrica*), Guillaume Frechette, Alessandro Lizzeri, and I conduct the first experimental test of communication under commitment, thus investigating one of the central tenets of the information design literature. We do so by developing a simple model of communication under *partial commitment*. The focus on partial commitment is a key feature of our analysis: It allows us to develop novel comparative statics that vary the sender's commitment power, which then play a central role in our experimental analysis. Additionally, we contrast situations in which information is verifiable with those when it is unverifiable. This further enriches our analysis, as the main comparative statics have opposite signs under these two alternative rules. An observable prediction of the model is that variations in commitment power generate outcomes that are qualitatively different depending on the communication rule. For instance, an increase in the sender's commitment power should increase the amount of information conveyed under unverifiable information, whereas it should decrease it under verifiable information. When the

sender can fully commit, these two scenarios coincide and the information conveyed in equilibrium is independent of the communication rule. We exploit these theoretical predictions to experimentally test the role of commitment in communication. We do so by comparing subjects' behavior in various treatments, which differ in how effectively the sender can commit to an information structure and whether or not the information is verifiable.

Our framework captures the flavors of a wide variety of models of communication, including models of cheap talk (Crawford and Sobel, 1982, Green and Stokey, 2007), disclosure (Milgrom, 1981, Grossman, 1981, Okuno-Fujiwara et al., 1990), and Bayesian persuasion (Kamenica and Gentzkow, 2011). The comparison across models generates contrasting predictions that go to the heart of the strategic tension of communication under commitment.

We find that both senders and receivers react to commitment. For senders, we show that, when information is unverifiable, senders reveal more information in the commitment stage than in the revision stage. When information is verifiable, this ranking is reversed, as predicted by the theory. For receivers, we show that, as commitment increases, they become more responsive to the information they receive, which is consistent with the fact that information is more meaningful when the level of commitment is higher. We then test how increasing commitment power changes the amount of information conveyed by the senders. In line with the theory, we find that this amount increases with commitment in treatments with unverifiable information and decreases with commitment in treatments with verifiable information. Overall, these strong treatment effects validate the qualitative implications of the theory, especially given the contrasting implications of the theory depending on the verifiability of information. Finally, we document important quantitative departures from the theory. Specifically, we find that a form of commitment "blindness," by which some senders behave as if they did not have any commitment power, leads them to persistently over-communicate when information is verifiable and under-communicate when it is not. This generates an unpredicted gap in information transmission across the two rules, suggesting a novel role for verifiable information in practice.

- In a related paper titled ***The Selective Disclosure of Evidence: An Experiment*** (2024, *working paper*), Agata Farina, Guillaume Frechette, Alessandro Lizzeri and I conduct a systematic experimental test of the theory of *selective disclosure*. We focus on settings in which an informed sender seeks to influence the actions of an uninformed receiver by disclosing selected pieces of evidence. For instance, a journalist may only select news stories that favor a political candidate, or a defense lawyer may select evidence for the court that increases the likelihood of an acquittal. These settings, common in practice, share two key features: the disclosed evidence is *verifiable* but can be *selected* from a larger pool of evidence known only to the sender. Although the evidence itself cannot be fabricated, its selection affects how it is interpreted, influencing how effectively the sender can communicate with the receiver.

The existing experimental literature on verifiable disclosure documents widespread failures of the "unraveling principle," which posits that senders will disclose all available information, even if unfavorable, to avoid negative inferences the receiver would draw. In practice, however, senders often conceal unfavorable evidence while receivers are not always sufficiently skeptical about it (e.g., Jin and Leslie (2003) and Jin et al. (2021)). These failures support the implementation of disclosure mandates, which are indeed common practice.

Our paper introduces a new perspective on this classic problem by focusing on the distortions that arise from the *selection* of evidence, rather than its concealment. Our experimental analysis is informed by a model where a sender observes a state of the world and has access to multiple independent signals that can be selectively disclosed. The experiment varies the number of signals available to the sender (N) and the number of signals she can disclose (K). Changing K and N affects the relative importance of concealing versus selecting evidence, generating rich comparative statics that we use to provide a systematic test of the theory.

Our data reveal patterns that are consistent with the key qualitative predictions of the theory. In particular, as N increases relative to K, senders become more selective, and receivers grow more skeptical of the increasingly selected evidence. When selection opportunities are abundant, senders rarely conceal evidence, suggesting that existing disclosure mandates may not effectively address the distortions caused by selection. We also document quantitative departures from the theory. Unlike most prior experimental literature on disclosure, we find that senders' strategies are more informative than predicted, i.e., senders overcommunicate. This is due to a behavior we interpret as "deception aversion." Finally, we show that some receivers underestimate the impact of selection, a phenomenon we attribute to a "selection neglect" bias, which persists despite ample learning opportunities in our experiment.

► In many settings, communication requires the interaction of facts, which are verifiable, and opinions, which are unverifiable. In our ongoing research ***Facts and Opinions*** (2024, *work in progress*), Alessandro Lizzeri, Yichuan Lou, and I investigate theoretically these interactions. We consider the typical environment of communication models: an informed sender can communicate with an uninformed receiver who has the power to make a decision. The sender and the receiver have conflicting preferences. For simplicity, we focus on settings where senders and receivers have quadratic preferences that are identical up to an additive bias: both the sender and the receiver would like to tailor the action to information, but the sender has a preference for higher actions.

We begin by characterizing the equilibria when the sender can communicate with the receiver only through verifiable but noisy information. This case has been previously studied (e.g., Milgrom, 1981, Fishman and Hagerty, 1990, Di Tillio et al., 2021) only in cases in which the bias of the sender is large. Under that assumption, complete information unraveling is an

equilibrium, just as in the typical disclosure models (Okuno-Fujiwara et al., 1990). In contrast, in our setting, when the bias is not too large, we find that the most informative equilibrium does not feature unraveling and that mandating disclosure would hurt the receiver. Indeed, when evidence is noisy, silence is a useful means to communicate the fact that the sender knows that the evidence she has is misleading. This additional communication benefits both the sender and the receiver. This result formalizes how verifiability can act as a constraint on the sender's ability to truthfully communicate the state.

We then enrich our baseline model by allowing the sender to also communicate by using unverifiable information. Our equilibrium characterization illustrates how verifiable and unverifiable information can complement each other: Evidence and cheap talk are jointly used in equilibrium. We show that the complementarity between the two forms of communication is maximal for moderately biased senders. Moreover, the sender relies more on verifiable information when the bias is large and more on unverifiable information when the bias is small.

1.2 Markets for Information

This section discusses papers that investigate market institutions that determine the equilibrium allocation of information. Depending on the paper, information can be traded as a final good (e.g., the news media industry) or as a productive input (e.g., the market for consumer data). Papers in this section tend to be more applied than those discussed in Section 1.1 and have policy implications. However, the connection with the topics and the tools I described earlier is substantial, especially so for the first three papers that I discuss below—those on consumer data. These papers critically leverage the methodological tools and the expertise developed from my work on information design.

I begin by discussing a series of three papers that are tightly connected to each other. In these papers, my coauthors and I study various topics concerning the value of consumer data, how it is affected by privacy-protection policies, and its price in a competitive market. This research agenda was awarded a grant by the National Science Foundation (NSF) during the period 2022-2024 (SES-2149315 and SES-2149289).

- In my paper ***The Value of Data Records*** (2023, *The Review of Economic Studies*), Simone Galperti, Aleksandr Levkun, and I address the following question. It is generally understood that personal data contributes to fueling multi-billion-dollar industries. Search engines and social media platforms use it to sell targeted advertisements; e-commerce platforms use it to intermediate trade between buyers and sellers; job-matching platforms use it to match workers and employers. In many ways, personal data is the "new oil" of modern economies. But how much of this total value is created by the data of each single individual?

This basic question is at the core of some of the recent debates regarding the future of data markets, including how to design them to compensate individuals for their data, how to conduct demand analysis for data brokers, and to what extent data is a source of market power. Yet, the value of personal data is not well understood and can be difficult to assess. For instance, an online advertisement platform can pool together the data of different users in order to maximize revenues from an ad auction. While this is a well-understood practice, the act of pooling data records obscures the contribution each one of them makes to the total value the platform obtains from using them.

To address this question, our paper proposes a unifying and inherently classical approach, whose roots are in the information design literature (see Section 1.1). Our main contribution is to characterize the value of each data record for an intermediary—like the above-mentioned platform—that uses data to influence the behavior of strategic agents to its own advantage. Our analysis reveals the value of a record is the sum of two components. The first is the payoff the intermediary *directly* obtains from this record (e.g., when the corresponding user trades with the advertiser in the example above). The second is a novel *externality* between records that arises when the intermediary pools them to withhold information from the agents (e.g. the advertisers in the example above). This externality arises not from exogenous correlation between records, but endogenously from how the intermediary uses records to withhold information from the agents. As such, this externality is a hallmark of intermediation problems due to their inherent conflicts of interest between the various parties involved, leading to information withholding.

Our analysis yields two main practical implications. First, we show that the values of data records constitute a useful benchmark for compensating individuals for their data. By doing so, we contribute to an active policy debate about data dividends and data unions. Second, we draw an analogy between how an intermediary values data records and a consumer from standard consumer theory. This opens the door to applying well-known analytical tools for studying the demand side of data markets and optimal strategies to invest in data acquisition.

► In a closely related paper titled ***Privacy and the Value of Data*** (2023, *American Economic Association, Papers & Proceedings*), Simone Galperti and I examine how data-privacy laws can affect the value of personal data for firms and, in turn, can impact consumers' welfare. We illustrate these effects by extending the model in *The Value of Data Records* to incorporate consumer privacy protection. We do so by introducing elicitation constraints into an otherwise standard information-design problem. In the model, an e-commerce platform intermediates the interaction between a monopolistic seller and a population of heterogeneous consumers. The platform aims to maximize consumer surplus. To do so, it influences the seller's price by providing information about the consumers. How effective the platform is at influencing the seller ultimately depends on what it knows about the consumers, which is endogenous in this

paper.

Our analysis yields three main insights. First, protecting consumer privacy can affect the value of data in complex ways, as it can increase or decrease the value of some consumers' data while not changing that of others' data. Second, privacy protection can impact how data is used by the platform and, therefore, consumers' payoffs. We show that privacy protection can benefit some consumers but harm others, particularly those who have no reason to withhold their data. Third, protecting consumer privacy increases the average transaction price but also limits trade. Overall, this leaves the seller indifferent but has a negative impact on the platform.

- In my paper ***Competitive Markets for Personal Data*** (2024, *working paper*, with an extended abstract published in the *Proceedings of ACM Economics and Computation*), Simone Galperti, Tianhao Liu, and I investigate whether competitive markets for personal data can promote efficient allocations and maximize consumer welfare. Our question is motivated by an active policy debate that concerns the design of data markets and their properties. Today, consumers have limited control over how their data is used and by whom, and are imperfectly compensated in return (if at all). Such an arrangement could harbor inefficiencies and lead to market failure. Thus the question is, what is an optimal design for a data market?

  We model an economy where consumers own their data and can sell it to a platform at a given price, which they take as given (i.e., the economy is competitive). In addition, the platform provides a service to the consumers who sell their data: It intermediates them with a third-party merchant, from whom they can buy a product. The platform uses the consumers' data to inform the merchant about their willingness to pay for the product, enabling the merchant to extract surplus from them. Therefore, how the platform uses this data affects the merchant's profits, the consumers' surplus, and, ultimately, the price of data.

  Our main result shows that the efficiency of this competitive economy crucially relies on the platform's objective. When the platform's and the merchant's objectives are sufficiently aligned, the equilibrium allocation is efficient and consumers' welfare is maximized. By contrast—and perhaps counterintuitively—when the platform's objective is sufficiently aligned with that of the consumers, the equilibrium can be inefficient.

  We then propose three alternative market designs that correct the aforementioned inefficiency. The first involves the introduction of a "data union," namely, an intermediary that manages consumers' data on their behalf and returns to them all the proceeds in the form of a data dividend. The second one involves the introduction of a "data tax," which is levied on consumers when they trade their data. The third involves letting the price of data depend on its intended use, in the spirit of Lindahl pricing.

- In my paper ***Media Competition and Social Disagreement*** (2022, *Econometrica*), Sevgi Yuk-

sel and I study the competitive provision of political information—the news-media industry. The overarching goal of the paper is to study the unintended effects that increased competition in the news-media industry can create on the efficiency of electoral outcomes. Our interest is motivated by a growing public debate on the consequences of a fast-changing media landscape and information consumption habits in our democracies.

We present a simple model in which a number of nonpartisan information providers (firms) compete to sell information to agents before they cast a vote. We are able to characterize the equilibrium of this market for an arbitrary number of firms. We study the implications of increasing the number of firms, thus, making the market for news more competitive. Our analysis leads to three novel conclusions. First, we show that competition leads to informational specialization. The critical insight we put forward is that competition forces information providers to become relatively less informative on issues that are of common interest and, therefore, are particularly important from a social perspective. Second, we analyze the downstream effects of such specialization and show that, while agents become better informed on an individual level, competition amplifies social disagreement. Third, we highlight the social welfare implications of increased disagreement. Specifically, we establish that in societies that are large enough, competition makes every agent worse off by decreasing the utility that she derives from the policy outcome.

Our results contribute to the literature on political economy by advancing our understanding of how competition affects the strategic incentives of news media and its possible consequences on the political process. Additionally, they contribute to the large industrial-organization literature on spatial competition. From this perspective, we innovate on three fronts. First, we explicitly model equilibrium interactions between vertical and horizontal competition. Thanks to this, we can show that competition leads firms to disinvest from vertical features—which are beneficial to all consumers—in favor of horizontal features—which are beneficial only to a niche segment. Second, we study the consequences of specialization in a context in which private consumption generates social externalities (in our case through voting). This feature is common to many markets, well beyond our political-economy application. Third, our firms sell information and, to account for this, we build Bayesian foundations into a spatial competition model. For these reasons, we hope that this model can become a workhorse for study questions at the intersection of political economy and industrial organization.

► In my paper ***Searching for Information and the Diffusion of Knowledge*** (2018, *working paper*), Sevgi Yuksel and I study an informal market for information that is akin to social media. We study a dynamic model in which agents from consecutive generations can either produce information for themselves or learn from others' past behavior. Both activities are socially valuable: The first adds new information to the economy while the latter helps aggregate

it. Agents are heterogeneous in two dimensions. First, more connected agents can observe past behavior more accurately and exert a stronger influence on the behavior that is observed by future generations. Second, players have idiosyncratic biases. We allow for uncertainty about the average bias of the society. We show that the structure of social connections interacts with this type of uncertainty affecting equilibrium information production and its social diffusion in ways that are complex and subtle. We identify two main channels through which players generate externalities on each other. The first, *the learning effect*, captures the intuitive idea that more connected players, who have access to more information, take more informative actions and hence increase the attractiveness of learning from others for the rest of the society. The second, *the amplification effect*, refers to an equilibrium mechanism by which uncertainty about others' preferences reverberates and amplifies throughout the society as more people choose to learn from others. We show that increasing the connectivity of the society or generally shifting influence towards more connected types, can lead to a strict decrease in the quality of social information. Moreover, we find that the socially optimal allocation into learning activities can differ dramatically from the equilibrium one: under certain conditions, the planner would reverse the equilibrium allocation, forcing highly connected players to work, and moderately connected ones to learn from others.

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