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## Talk isn't always cheap: A theory of social influence and deliberation in group decision-making

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| Abstract:        | <p>Organizations rely on groups to process information and make decisions, yet deliberation's effectiveness remains contested. We develop an agent-based model to examine under what conditions deliberation helps or hinders organizational decisions. In the model, group members influence one another through two distinct processes: informational influence, which promotes updating beliefs based on perceived expertise, and normative influence, which drives conformity to gain social approval. While each can improve group outcomes under the right conditions, they can also undermine deliberation; informational influence may spread inaccurate beliefs, while normative influence can suppress dissent and obscure critical information. The model examines how social influence relationships, particularly network density, shape the interplay between these dual processes. Our results identify two key mechanisms: certification, where groups benefit from recognizing expertise without isolating members, and censoring, where conformity cascades suppress diverse viewpoints. We propose a theoretical framework linking network structure to deliberation outcomes, offering propositions on when organizations can reduce censoring, enable certification, or balance both.</p> |
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## Introduction

Organizations often rely on groups to process and aggregate information (Puranam, 2018; Mowday and Sutton, 1993). The effectiveness of this organizational information processing depends critically on how groups deliberate (Brodbeck et al., 2007; Krause et al., 2025; Cronin, 2015) – how group members share information and express opinions, potentially changing the opinions of others. In this paper, we develop a theory that explains when and why deliberation leads to better-informed groups and, in turn, to better organizational decisions.

Prior research highlights diverging accounts on deliberation's value. Optimistic accounts emphasize how deliberation enables groups to share specialized and unique information held by individual members (Argote et al., 2018). Deliberation can also help group members correct misunderstandings (van Dijk et al., 2014). By developing a shared understanding, deliberation can potentially lead to better outcomes than even the most informed individual member could achieve alone (Larson, 2013). Yet decades of research have documented deliberation's downside. Conformity pressures and groupthink can lead deliberative processes toward suboptimal decisions (Bikhchandani et al., 1998; Cialdini and Goldstein, 2004). For instance, groups systematically fail at "hidden profile" tasks, where the optimal solution only emerges if members share their unique information, yet groups consistently focus on the majority opinion while neglecting these unique, potentially dissenting insights (Stasser and Davis, 1981; Stasser and Abele, 2020; Stasser and Titus, 1985).

Our theory incorporates this dual nature of social influence, which is inevitable during deliberation. We argue that two distinct influence processes primarily shape group members' behaviors: informational and normative influence (Kelman, 1958; Deutsch and Gerard, 1955).<sup>1</sup>

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<sup>1</sup> For other types of influence, such as coercion, compliance, or guilt, see Cialdini (2021).

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Consider a board of directors evaluating CEO candidates. When a director revises her assessment after a colleague explains why a candidate’s strategy succeeded in similar contexts, it represents informational influence: updating beliefs based on the perceived expertise of the colleague. When the same director states a preference to align with the majority of board members, while privately disagreeing, it exemplifies normative influence: conforming for social approval.

These dual influence processes create deliberation’s central tension. Informational influence can improve deliberation effectiveness when members correctly identify and learn from those with relevant expertise. Yet normative influence can suppress the information sharing that makes deliberation valuable, as members withhold dissenting views to be liked and accepted by the group (Cialdini and Goldstein, 2004; Castelli et al., 2001; Cialdini, 2021). Both forms of influence coexist in groups and can lead to the convergence of opinions (Kaplan and Miller, 1987; Price et al., 2006).

The interaction between these influences is complex and shaped by the structure of social relationships among members. Informational influence typically arises from dyadic factors such as shared experience and expertise (Liang et al., 1995), whereas normative influence intensifies as more connected members share the same opinion (Bond, 2005). As deliberation unfolds over time, belief changes through informational influence can trigger conformity pressures in others, and vice versa. Consequently, understanding when deliberation is effective requires examining how network structure, particularly the density of social ties, shapes these dual processes (Bavelas, 1950). Network density varies across organizations, from sparse links in ad hoc committees to dense relational webs in established teams (Reagans and McEvily, 2003), and this variation determines both the flow of information and the emergence of social pressures. Table 1 illustrates contexts from boards selecting executives to committees evaluating investments, each

characterized by different network densities and influence structures.

*Insert Table 1 here.*

To examine how the structure of influence relationships shapes the interplay between informational and normative influence processes, we develop a formal agent-based model by building on the tradition of prior theories of group processes (Penrod and Hastie, 1980; Stasser, 1988; Stasser and Davis, 1981). Our model captures the deliberation process preceding a decision in which the group selects among alternatives, such as a board choosing between CEO candidates, and in which members possess different information and preferences. Through repeated discussion rounds, members share information and potentially update views based on both expertise recognition (informational influence) and conformity pressure (normative influence), with network density serving as our primary structural parameter that determines how these dual processes unfold.<sup>2</sup>

Our analysis yields two main results. First, we identify network structures that enable strong synergy (i.e., outcomes better than what could be accomplished by the best member alone). A structure that does not isolate any members allows groups to benefit most from dyadic expertise recognition, which we call group-level “certification.” At the same time, the structure should reduce local clusters to avoid conformity cascades that create group-level “censoring.” Second, we develop a theoretical framework that explains which organizational factors can reduce censoring (Proposition 1), enable certification (Proposition 2), or trade off lower censoring against lower certification (Proposition 3).

We contribute to research on social dynamics during deliberation and emerging consensus

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<sup>2</sup> Following calls for theoretical parsimony, we exclude factors like cognition, strategic misrepresentation, decision rules, formal hierarchies, and emotional dynamics.

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(Yousif et al., 2019; Krause et al., 2025; Brodbeck et al., 2007). Broadly, our model shows that group consensus can emerge through different pathways, either through information integration or through conformity pressures. The quality of consensus depends critically on the balance between informational and normative influence. We also contribute to research on organizational models of information exchange and decision-making (Fang et al., 2010; Csaszar and Eggers, 2013; Christensen and Knudsen, 2010) by explicitly adding the social dynamics of deliberation. Our results highlight expertise recognition as an alternative to success-based imitation as an important mechanism for effective group decisions.

**Theoretical Foundation: The Dual Nature of Social Influence in Deliberation**

Research on organizational groups has explored how groups can achieve outcomes that surpass what an average individual member could accomplish alone, referred to as weak synergy, and, ideally, how they can attain outcomes exceeding even those of the group’s most capable member, strong synergy (Larson, 2013). Prior studies have investigated how group outcomes are influenced by factors such as cognition (McCoy et al., 1999; Cronin and Weingart, 2007; Healey et al., 2015), biases (Krause et al., 2025), decision structures (Csaszar and Eggers, 2013), diversity (Barkema and Shvyrkov, 2007; Boone and Hendriks, 2009), and conflict (Park et al., 2020). In this paper, we focus on the role of social interaction during deliberation.

Research on deliberation has consistently emphasized the central role of social interaction, particularly the exchange of information, in shaping individual preferences, opinions, and judgments (Bales, 1950; Bavelas, 1950; Steiner, 1966; Laughlin, 2011). To understand when social interaction during deliberation leads to better informed groups, we examine the underlying mechanisms through which group members influence one another.

**Understanding Informational and Normative Influence**

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3 Influence structures within groups in organizations may reflect formal hierarchies (Blau,  
4 1968), informal hierarchies built on status (Bunderson and Reagans, 2011; Magee and Galinsky,  
5 2008), or can be based on friendships or advice-seeking (Gibbons, 2004; Lincoln and Miller,  
6 1979), or a combination of all of these.

7  
8 While the sources of social influence can be diverse, there are ultimately two reasons why  
9 people adopt the information or decisions of someone else: they believe they can gain a (more)  
10 accurate view of reality, informational influence, or they value being in agreement with other  
11 persons, normative influence (Deutsch and Gerard, 1955). Prior research on groups has shown  
12 that both forms of influence can shift individual actions as well as group decisions (Kaplan and  
13 Miller, 1987), but their effects depend critically on the specific contexts in which they operate.

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15 Normative influence evokes a desire to conform to the norms that are implicit or explicit in  
16 the behavior of others, possibly because of their perceived power to reward or punish (Cialdini  
17 and Goldstein, 2004), or simply because of an innate tendency to uphold norms (Chudek and  
18 Henrich, 2011). For instance, Asch (1956) as well as Deutsch and Gerard (1955) demonstrated  
19 that individuals have a strong tendency to conform to those they know or are close to, in order to  
20 gain social approval, which may lead to the censorship of one's own opinion (e.g., Castelli et al.,  
21 2001). Individuals may suppress their privately held views to avoid contradicting others who  
22 exert normative influence on them. Thus, normative influence can affect a person's behavior  
23 without necessarily changing their beliefs. Many participants in Asch's conformity experiments  
24 followed the majority even though they knew the answer was wrong (Asch, 1956).

25  
26 One prominent example of the negative impact that normative social influence can have is  
27 the phenomenon of groupthink (Janis, 1972). Groups can fall into the trap of agreeing on an  
28 alternative early in the discussion, with group members not sharing information that could  
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overturn the potentially bad decision (Esser, 1998). The Bay of Pigs invasion serves as a classic example of this, where President Kennedy and his advisors ended the deliberation prematurely and made a flawed decision even though many advisors had private doubts about the decision (Gibson, 2012).

Informational influence, on the other hand, leads to accepting information from others as accurate. However, this does not guarantee a more accurate view of reality because confidence or past accuracy may be imperfect cues as to which actor is truly more accurate (Kruger, 1999). Group members can vary in their capacity to recognize expertise in each other. A failure to recognize expertise can occur, for example, if members use the confidence of someone’s opinion as an indicator for expertise, even though confidence and expertise may only be spuriously correlated (Ehrlinger et al., 2008). In contrast, individuals can develop a reputation by repeatedly demonstrating their expertise (Reyt et al., 2016). More generally, effective expertise recognition in groups emerges when they develop a transactive memory, a knowledge of “who knows what”, through repeated interaction (Lee et al., 2014; Argote et al., 2018; Lewis et al., 2005; Moreland, 1999; Miller et al., 2014). Furthermore, unlike normative influence, informational influence affects not only the recipient individual’s behavior but also their beliefs.

**Implications for Effective Deliberation**

This theoretical foundation reveals deliberation’s fundamental challenge: normative influence during the deliberation process can lead recipients to withhold potentially accurate information, as group members may seek to conform and thus avoid contradicting others. This may still lead to better informed groups if those who censor themselves are less informed. On the other hand, informational influence leads to a change in the recipient individual’s beliefs. However, these beliefs become more accurate only if influence is correlated with relative

accuracy, that is, individuals are more likely to adopt someone's opinion if that person is more likely to be accurate than themselves.

The interplay between these informational and normative influence types embedded in a network structure of influence ties creates the conditions under which deliberation is effective or not, i.e., leading to better informed groups.

### Model Description

To examine how informational and normative influence interact to shape deliberation outcomes, we develop an agent-based model that captures the essential features of organizational deliberation.<sup>3</sup>

### Illustrative Example

An example of deliberation in organizations is the case of a board of directors selecting a new CEO. The choice of a new CEO has important implications for the future of the organization. Board members vary in their preferences regarding which candidate attribute matters most (Shin and You, 2022) and differ on what information they possess (Chow et al., 2022).

The board selects a CEO successor from a pool of candidates who differ in relevant attributes, such as experience, leadership, and domain expertise. Board members enter the process with preferences regarding which candidate attributes are most important, reflecting their individual roles, professional backgrounds, and strategic orientations. In addition to differing evaluative criteria, board members also possess asymmetric information. Some have direct experience or external knowledge about certain candidates, while others rely solely on formal application materials or secondhand accounts.

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<sup>3</sup> The code and further details can be found at: <https://github.com/helgeklapper/deliberation>

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Board members take turns “speaking:” they announce which candidate they prefer and share information about them. Other board members “listen”: they update their own beliefs based on the given information. Social influence shapes the deliberation process of speaking and listening. Board members are more likely to update their beliefs if they share social ties with the speaker and, thus, can assess the speaker’s expertise. Additionally, if a majority of board members have converged on a candidate, the other board members are less likely to speak up against that candidate due to conformity pressure. In many organizational settings, particularly in board meetings, pressure to conform can be high (Veltrop et al., 2017; Krause et al., 2025).

Over time, multiple rounds of deliberation lead to opinion convergence and the board members will end the discussion (for a schematic representation of the deliberation process see Figure 1). Next, we explain how we simulate this process in an agent-based model.

*Insert Figure 1 here.*

**Task Environment**

The group consists of N members, e.g., members of the board, and is tasked with selecting one of M alternatives, e.g., candidates for the CEO position. Each alternative has L attributes on which it has objective attribute scores (Lancaster, 1966). In the example of CEO selection, attributes could refer to communication skills, domain expertise, leadership skills, or experience. Each *true* score  $a_{ml}$  (of alternative m on attribute l) can take values 0 to 1 with  $a_{ml} \sim U(0,1)$ .

**Group Member’s Beliefs**

Every group member has beliefs about the attribute scores of alternatives, denoted  $b_{ml}^n$ . We initialize the information distribution such that, for each member n, each attribute score has a 50% chance of being accurate,  $b_{ml}^n = a_{ml}$ . Otherwise, it is randomly drawn,  $b_{ml}^n \sim U(0,1)$ . This creates a pattern where group members share some common information while also possessing

unique information, capturing the distributed expertise typical in organizational settings. For example, board members may know some candidates and have unique information about their communication skills or leadership skills.

### Group Members' Preferences

The utility of each alternative for a group member is the sum of the products of the attribute scores and an individual weighting vector  $w \in [0,1]$  with  $\sum_{l=1}^L w_l^n = 1$ . Due to incomplete beliefs, group members might (erroneously) prefer different alternatives at any point in time even though their weights are identical:

$$u_{b(m)}^{n,t} = \sum_l^L w_l^n \times b_{ml}^n \quad (1)$$

Thus, group members can disagree for two reasons: they have the same preference but different information, or they have different preferences. However, as in real deliberations, group members do not necessarily know the reason for the disagreement.

The elements of the weighting vector  $w$  are drawn from an  $L$ -dimensional Dirichlet distribution with a tunable concentration parameter  $\beta$ . This parameter allows us to specify whether weights are mostly assigned to a single attribute or many attributes with all possibilities in between. In the case of board members selecting a CEO successor, a high  $\beta$  would indicate that board members equally emphasize communication skills, domain expertise, leadership skills, and experience. A low  $\beta$  suggests that board members only emphasize one of these attributes, e.g., they are only interested in candidates with lots of experience. In the baseline analysis we assume weights are distributed over a moderate number of attributes (with a concentration parameter set to 0.1), and in robustness analyses we show how our results vary with this parameter.

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The weighting vector can also vary across individuals. For example, one board member may focus on experience and another on communication skills. This allows us to model preference diversity. We use  $\gamma$  to indicate how many different weighing vectors exist in the group. This can range from all group members having the same weights, i.e.,  $\gamma=1$ , to all having different weights and therefore different preferences ( $\gamma=N$ ).

**Deliberation Process: How Group Members Influence Each Other**

The deliberation unfolds through sequential rounds where group members take turns to “speak”; they publicly state their preferred alternative and potentially reveal their beliefs about it. Other group members then “listen”; they may update their beliefs based on what they hear. Deliberation rounds represent discrete exchanges of information rather than formal meeting sessions. For instance, in board deliberations about CEO candidates, a single meeting might contain multiple exchanges of information as directors respond to each other’s points, ask questions, and build on previous comments. Multiple rounds of deliberation might also correspond to several board meetings spread over weeks or months for a significant decision like CEO succession. Overall, this process captures the iterative nature of real organizational discussions where members speak in turn, building on previous contributions.

A core assumption is that group members are only influenced by those they share ties with in the influence network. These ties represent both informational influence (the capacity to update beliefs) and normative influence (the pressure to conform), consistent with our theoretical framework (Deutsch and Gerard, 1955). Put differently, a tie indicates that the listener may alter their beliefs and behavior as a consequence of the speaker’s revealed beliefs and behavior. If there is a symmetric network tie between  $n$  and  $j$ , group member  $n$  has social influence, both

normative and informational, over group member  $j$  and vice versa.<sup>4</sup>

The network structure shapes both the flow of information among members and the social pressures they encounter. To study this, we construct Erdős–Rényi (random) graphs of varying densities, using the parameter  $\rho$ . A  $\rho = 0$  suggests a crowd of atomistic agents who ignore each other. A group with few ties (low  $\rho$ ) might be a cross-functional team which is meeting for the first time (see Table 1). A  $\rho = 1$  describes a fully connected graph (akin to a team, see definition by Kozlowski and Bell, 2013). A fully connected group may represent a collocated team of individuals who have worked together for a long time and all members influence each other. For example, this could be a product development team which has completed several products together in the past.

#### ***Speaking (Normative Influence): How Members State or Suppress Their Preferences***

When it is a group member's turn to speak, the member may state their preferred alternative or conform to the majority and superficially support that alternative. If group members are confronted with a large enough (relative) majority in favor of a specific alternative, the members are not motivated (for themselves) to share additional information. Either, they agree with the majority and see additional information sharing as a waste of effort (similar in spirit to lazy consensus), or they disagree and do not want to go against the majority. Both motives reduce the information-sharing effort (De Dreu et al., 2008) and deprive the group of potentially valuable information.<sup>5</sup> On the other hand, if the current majority is small, they state publicly their most preferred alternative based on their current information and share their beliefs on all attributes of that alternative.

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<sup>4</sup> In organizational settings, ties may vary in intensity or be asymmetric. For the sake of parsimony, we limit our analysis to symmetric ties of equal strength.

<sup>5</sup> We maintain the “no brainwashing” assumption—that agents do not adjust their own preferences towards other agents’ preferences because of social influence, only their beliefs (Moscovici, 1980)

We assume that influence ties can prevent listeners from speaking their minds by inducing conformity. Board members might self-censor their true opinion and superficially support the candidate who is the favorite of the majority. The focal group member  $n$  takes account of the public views of the group members that have influence on  $n$ ; if enough connected group members (the “majority”) speak for a particular alternative, this will alter  $n$ ’s behavior when it is  $n$ ’s own turn to speak. Let  $m_n^{max}$  denote the current plurality or relative majority among the group members that have influence over  $n$ ;  $m_n^{max}$  is the number of group members that have publicly supported the alternative with the maximum support. Using the formulation by Stasser et al. (1981),  $m_n^{max}$  exerts conformity pressure on the focal group member, such that the probability of a group member conforming to social influence is given by:

$$p(conform) = \left( \frac{m_n^{max}}{1 + m_n^{max}} \right)^\theta \quad (2)$$

where  $\theta$  is the susceptibility to conformity in  $[0, \infty)$ , which tunes the strength of susceptibility to conformity pressure. The smaller the conformity value,  $\theta$ , and the larger the majority,  $m_n^{max}$ , the greater is the probability that the group member will conform to the relative majority at that point; this means that the focal group member will simply vote publicly in line with the majority (regardless of beliefs) and will not share any information (Moscovici, 1980).

If the current majority is small, members publicly state their preferred alternative using the “softmax” action rule and share information on all attributes of that alternative (Luce, 1959; Posen and Levinthal, 2012; Puranam et al., 2015; Sutton and Barto, 1998). The tendency for group members to mostly, but not exclusively, focus on their preferred alternative captures the tendency towards (but not blatant) “advocacy” (Stasser, 1988), which is prevalent in information exchange settings (Frey and Schulz-Hardt, 2001; Toma and Butera, 2009). All else being equal, a

board member will support and share information about their preferred CEO candidate to persuade others to select that alternative. The probability of a group member selecting a particular alternative  $m$  at turn  $t$  is therefore:

$$p(m)_t = \frac{e^{\frac{u_{b(m)}^{n,t}}{\tau}}}{\sum_{m=1}^M e^{\frac{u_{b(m)}^{n,t}}{\tau}}} \quad (3)$$

The parameter  $\tau$  tunes the probability of the individual choosing an alternative independent of its strength. It can be interpreted as a weakening of the advocacy tendency, or as non-strategic lying (strategic lying is implausible in this setting given the number of group members and their private information and preferences).

### ***Listening (Informational Influence): How Members Learn New Information***

Group members who share a tie with the speaker can learn from the given information on the shared alternative (all dimensions) and update their beliefs. A challenge for those group members is to determine whether other group members have more accurate information. Group members do not know the global accuracy  $c_{ml}^n$  of their beliefs, where  $c_{ml}^n = 1 - |a_{ml}^n - b_{ml}^n|$ , but we assume they are able to compare their *relative* accuracy to group members with whom they share informational influence ties. Board members who share social influence ties are more likely to assess whether the shared information is more accurate than their current knowledge, for example, the listener knows when the topic falls within the speaker's domain of expertise.

However, information transfer through informational influence is not necessarily perfect. We capture expertise recognition with the parameter  $\phi$ , which can represent noise in the communication process or imperfect expertise recognition. It ranges from  $\phi = 0.5$ , which suggests no expertise recognition to  $\phi = 1$ , which indicates perfect recognition.

Formally, if  $n$  states beliefs about an attribute ( $b_{ml}^n$ ) that differ from  $j$ 's ( $b_{ml}^j$ ) and  $n$  has

informational influence over  $j$ , then  $j$  updates her own beliefs with probability  $\phi$  such that:

$$\begin{aligned} P(b_{ml}^j = b_{ml}^n) | c_{ml}^n > c_{ml}^j &= \phi \\ P(b_{ml}^j = b_{ml}^n) | c_{ml}^n < c_{ml}^j &= 1 - \phi \end{aligned} \quad (4)$$

We assume that when group members update their beliefs, they also update their accuracy, i.e.,  $c_{ml}^n = c_{ml}^j$ .

In sum, in our model the deliberation process unfolds as follows: after each speaker's turn, members connected to the speaker in the influence network update their beliefs with probability  $\phi$  if the speaker is more accurate and state their preferred candidate (and possibly information about this candidate), depending on the susceptibility to conformity  $\theta$ . The discussion ends if information exchange has stalled for two consecutive rounds; every group member had the opportunity to share new information but did not due to not having additional information or unwillingness to share it due to conformity pressures.

### Outcome: Information Error

As the outcome of interest, we measure the average information error  $E$ . This is the inaccuracy of information held on average by group members at a point in time, calculated as city-block distance between reality and group members' beliefs.

$$E = \sum_{n=1}^N \sum_{m=1}^M \sum_{l=1}^L \frac{|a_{ml} - b_{ml}^n|}{N} \quad (5)$$

Information error<sup>6</sup> is a good indicator of the quality of the deliberation process of the group, regardless of which decision rules would be used to make the final choice: for example, with either majority vote or autocratic vote (i.e., one group member is allowed to choose), decision

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<sup>6</sup> In order to simplify interpretation, we adjust the information error and set the expected starting information error (if agents know half the attribute scores correctly) to 1, which also equates to weak synergy:

$$Adjusted\ E = \frac{E}{(120/33 * 0.1 * 0.5)}$$

quality will increase with lower information error. We also use two benchmarks as reference points: weak and strong synergy (Stasser and Abele, 2020; Larson, 2013). Weak synergy refers to the information error that is equal or better than the information error of an average group member without deliberation, and strong synergy refers to the information error of the best informed individual.<sup>7</sup>

### Comparison with Related Models

Having detailed our model structure, we now position it relative to existing approaches in the literature. Our model uniquely emphasizes the combination of varied influence structures with the dual nature of social influence – capturing both information exchange and conformity pressure within a single framework (for an overview, see Table 2).

*Insert Table 2 here.*

Similar to classical computational models of group decision-making, our model also incorporates a sequence of changes to members' beliefs (e.g., Penrod and Hastie, 1980; Stasser, 1988; Stasser and Davis, 1981). Relative to the computational model of Stasser (1988), which is closest in structure to ours, we allow for variation in the influence structure, and explicitly model conformity pressure. Also relevant are the models of Bikhchandani and colleagues, who conceptualized the danger of using revealed actions of other agents to inform their own choices (Bikhchandani et al., 1992). Their model assumes that agents can only observe the choices of other agents but do not share information, potentially leading to information cascades. These models do not feature specialization of information, dyadic expertise recognition or conformity pressures, nor do they vary the influence structure. Similarly, Abrahamson and Rosenkopf

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<sup>7</sup> We calculate strong synergy by taking the average of the starting information error of the best-informed group member across all simulations.

(1993) emphasize how imitation and bandwagon pressures can drive the diffusion of practices within organizations, even when those choices are decoupled from informational substance. However, that model does not comprise dyadic expertise recognition or network structures.

Another approach that is close to ours is that of Friedkin and colleagues (Friedkin, 2012; Friedkin et al., 2016; Friedkin and Johnsen, 2011), who have developed a powerful and general graph theoretic formalism to study opinion dynamics in groups. Their approach incorporates diverse preferences, conformity pressure and information exchange, though the information pertains to opinions rather than some underlying reality, and therefore there is no specialization in information. Also, the primary interest of these authors is in studying the dynamics of endogenously changing influence structures. Through a mechanism called “reflected influence”, an individual whose opinion was closer to the group consensus in one issue becomes more influential in the next issue. Relatedly, Wellman et al. (2020) capture normative influence with a collective decision model. Agents take into account their own preference and the preferences of agents that have authority over them. However, the model does not explicitly capture information exchange dynamics, or informational influence.

Models that explicitly focus on the network structure of social influence include Lazer and Friedman (2007) and Fang et al. (2010). The main spirit of the findings from these papers is the “optimal clustering” result: clustering preserves diversity of information but also impedes the spread of useful information. Those models have focused on online search—where members of a group, connected in a network of mutual influence, gather new information from a shared task environment. They also blend informational and normative influence. Agents are perfectly capable of detecting agents who have superior information (informational influence) but use a majority rule (normative) on which information to adapt.

Finally, “wisdom of the crowd” (WOC) models with social influence depict members of a crowd that use the estimates of a sub-group to adapt their own beliefs. There is no specialization of knowledge or conformity pressure in such models, though some have studied variations in informational influence structure (Becker et al., 2017; Moussaid et al., 2018).

### **Baseline Results: Certification and Censoring**

Our analysis reveals how dyadic-level social influence processes aggregate to create group-level effects that determine deliberation effectiveness, i.e., whether the group is better informed than an average member (weak synergy) or even the best-informed member (strong synergy). We first establish the baseline dynamics showing how informational and normative influence operate simultaneously during deliberation. We then demonstrate how these dual processes aggregate to group-level certification and censoring effects, which form the foundation for our theoretical propositions about deliberation effectiveness.

We initialize a model with groups of  $N=10$  group members,  $M=10$  alternatives,  $L=10$  attributes,  $\beta=0.1$  (attribute weights),  $\gamma=1$  (aligned preferences),  $\tau=0.1$  (advocacy),  $\theta=1$  (conformity value), and  $\phi=0.75$  (expertise recognition) (see Table 3). A conformity value of  $\theta=1$  implies that with a relative majority of 2, the probability of conforming and suppressing information sharing is  $2/3$ , and  $3/4$  for a majority of 3 etc. The selection parameter choice of  $\tau=0.1$  is in line with other papers using a similar choice function over similar belief structures (Posen and Levinthal, 2012; Puranam and Swamy, 2016) and indicates that there is a tendency towards advocacy but not exclusively so – group members occasionally share information about their non-preferred options as well when they share information. Deliberations end if no new information has been shared for two rounds and we report results after 20 rounds. The speaking order is drawn randomly. Results are averaged across 10,000 runs to smooth out stochastic

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fluctuations.

*Insert Table 3 here.*

We begin by detailing the baseline dynamics of the model and explaining how informational and normative influences at the dyadic level aggregate to the group level. From these group-level constructs, we develop a theoretical framework of social influence and deliberation, which enables us to examine how key group variables support or hinder effective deliberation. Based on this theory, we propose potential interventions to enhance deliberation effectiveness.

**From Dyadic Influence to Group-Level Effects: Certification and Censoring**

This section provides an overview of how social influence can both support and undermine effective group deliberation, as measured by lower average information error. We examine this dynamic through two key mechanisms: dyadic informational influence, which leads to group-level certification of information, and normative influence, which leads to censoring (for definitions, see Table 4).

*Insert Table 4 here.*

***From Informational Influence to Certification***

Informational influence induces members to update their own information based on that of others to whom they are connected. However, updating beliefs due to social influence does not necessarily make group members better informed. This improvement requires that members can recognize the expertise of others, i.e., whether they possess (more) accurate information.

As a necessary condition, expertise recognition has to be better than chance ( $\phi > 0.5$ ) to create weak synergy, i.e., lower information error than without deliberation. Group members need to be able to determine that the other member is likely better informed on a specific attribute (e.g., “more expertise on evaluating leadership skills”).

While groups can achieve weak synergy if all group members have expertise recognition better than chance, group members can also vary in their expertise recognition. Figure 2 illustrates how many group members with high expertise recognition are required to compensate for group members with low expertise recognition (to surpass weak synergy).

*Insert Figure 2 here.*

The figure illustrates two related aspects. A small number of group members with very low expertise recognition (e.g.,  $\phi = 0.1$ ) require a disproportionately large number of accurate members (e.g., nine members with  $\phi = 0.6$ ) to maintain effective deliberation. Conversely, even a small number of group members with very high expertise recognition ( $\phi = 1.0$ ) can be sufficient to ensure effective deliberation. This underscores the asymmetrical impact of expertise recognition on deliberation effectiveness. Group members with high expertise recognition play a critical role in preserving relevant information, ensuring that once accurate information reaches them, it is not lost. In contrast, group members with low expertise recognition can degrade the quality of deliberation by introducing or reinforcing misleading information, which cascades over multiple rounds of deliberation.

Whereas the properties of the dyadic ties illustrate the necessary condition for effective deliberation, the structure, in particular the density of the influence network shows how these properties aggregate to the group level. In general, more influence ties and thus greater connectivity in the influence structure allow for the distinct information known by others to be leveraged by a focal actor. Even if no individual is very accurate in the information they begin with, as long as they are able to judge the accuracy of shared information of just those they interact with, i.e., expertise recognition at the dyadic level, the entire network will be able to collectively *certify* the accurate information over time. Through the transitive flow of accurate

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information across the network, the group can become better informed than any individual member at the outset, potentially even surpassing the initially best-informed member, thereby achieving strong synergy.

This information flow will be most effective if all information can reach all members. Figure 3 illustrates a scenario with no normative influence and shows how the information error decreases with density of ties. Information error reduces rapidly with the number of isolated group members and exceeds strong synergy. For example, in a cross-functional team, where group members do not know each other, they will find it difficult to assess whether the speaker’s information is (more) accurate than theirs. On the other hand, in family councils everyone will know each other well enough to assess their expertise. In that case, given sufficient time, deliberation will ensure that the superior knowledge of every individual can be accessed (indirectly) by every other, as long as there is effective dyadic-level expertise recognition.

*Insert Figure 3 here.*

Once there are no isolates, i.e., there is a social influence path from every person to every other person, information error decreases only marginally with higher density. Any additional influence tie between members will have diminishing returns for effective deliberation, as more influence would only increase the velocity of information transfer (Lee et al., 2014). This pattern is evident in Figure 3 as information error after 20 rounds and 10 rounds are nearly identical for high-density groups, whereas moderate density groups show meaningful differences.

***Corollary 1a:*** *Deliberation is more likely to be effective when the influence structure contains fewer isolates.*

***From Normative Influence to Censoring***

While certification demonstrates deliberation’s potential to aggregate distributed expertise,

our model simultaneously reveals a countervailing force that can undermine this process. Normative influence creates group-level *censoring* that suppresses the very information sharing that makes certification possible.

Group members take into account the views of others they are connected to, and if confronted with a large majority, they self-censor. This conformity pressure can produce “cascades of conformity” in which members who conform do not share potentially relevant information causing other members to conform as well, resulting in a growing overall pressure to conform. Any additional member conforming to the majority increases the pressure for any subsequent member to conform as well.

To illustrate how conformity pressure leads to group-level censoring, we compare scenarios with varying densities of influence ties (Figure 4). Higher density leads to stronger cascades of conformity, where each member conforming creates more pressure to conform. This also causes the deliberation to end sooner. If group members publicly agree on an alternative and no new information is revealed, the group will stop their deliberation. Thus, small changes in dyad-level conformity pressure can lead to strong effects of group-level censoring.

*Insert Figure 4 here.*

Censoring emerges when majorities form within locally connected sub-groups, known in network theory as local clusters (Watts and Strogatz, 1998). To mitigate censoring, the structure of social influence should avoid individuals being linked to too many others. With such a weakly clustered network, members will not be exposed to large local majorities that can lead to the suppression of information. This corresponds to minimal clustering in network theory. We therefore propose:

***Corollary 1b:*** *Deliberation is more likely to be effective when the influence structure is*

*less clustered.*

Bringing the two corollaries together, we can determine which group influence structures would have both characteristics, no isolates and little clustering. A challenge is that the number of isolates and clustering are not independent, and an increased *density of ties* reduces the likelihood of isolates but increases clustering (Figure 5). However, while clustering increases linearly with density, the number of isolates decreases disproportionately, even dramatically, with small increases in density. At low to moderate levels of density, there are no isolates while clustering remains relatively low, enabling the group to deliberate for sufficient time that most of the relevant information is shared. Here, the deliberation is effective enough to lead to strong synergy, average information error is lower than that of the best informed group member prior to deliberation.

*Insert Figure 5 here.*

Thus, density of ties has an asymmetric U-shaped effect on information error. While increasing density from atomistic groups has a strong positive effect, leading to an optimal density, adding any further ties marginally increases information error.

Consider the board of directors evaluating CEO candidates. When board members can recognize each other's expertise, the network structure becomes crucial. A tightly knit board with dense influence ties among the members may inadvertently foster conformity, discouraging dissenting views. On the other hand, a board with isolated subcommittees may fail to integrate diverse perspectives. The optimal structure involves low to moderate connectivity – enough ties to ensure all directors can access relevant information, but not so many that conformity pressures dominate.

To illustrate the independent effect of clustering and isolated agents, we compare the random

graph with two different structures: a chain and a star (Figure 6). Those structures have the same density ( $\rho = 0.2$ ) as the shown random graph but vary in their share of isolates and clustering. A chain, in which all members are connected to two neighbors, has no isolates and minimal clustering. Thus, it will achieve higher certification than the random graph. Alternatively, a star, in which all members are connected to a central member, also has no isolates but its central member is affected by high clustering. While it has higher certification than the random graph, the central actor is most affected by censoring, which can cause the information flow to break down, resulting in higher information error than a random graph.

*Insert Figure 6 here.*

### **Design interventions on Social Influence in Deliberation**

Effective deliberation can be achieved by increasing certification and lowering censoring. We develop a theoretical framework of social influence and deliberation by analyzing important group factors through the lenses of certification and censoring and (Figure 7). This allows us to predict when deliberation is (more) effective and how the optimal network density of the group will shift.

*Insert Figure 7 here.*

### **Reducing Censoring**

Censoring arises when majorities form in local clusters. As previously discussed, one way to mitigate this effect is by reducing network clustering (Corollary 1b). However, this option is limited as it might increase the number of isolates and thus reduce certification. Another way is by weakening conformity pressure ( $\theta$ ), which can lessen individuals' tendency to suppress dissenting views. However, the tendency to conform cannot be easily adjusted by an organization. In this section, we explore two additional group factors for reducing censoring:

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increasing preference diversity and decreasing time pressure. Each offers a distinct pathway for promoting effective deliberation.

***Preference Diversity***

A potential mechanism to reduce censoring without affecting certification is increasing preference diversity. Figure 8 shows the effect of diversity of preferences on information error. We vary preference diversity by increasing the number of sub-groups ( $\gamma$ ) with different attribute weights. The figure shows that higher diversity of preferences produces lower information error.

*Insert Figure 8 here.*

Groups with uniform preferences tend to quickly converge on a single alternative and censor further information sharing. Such groups might disagree initially, e.g., due to information error, and, thus, continue to share information. However, they will converge on the same alternative with more information. In this case, deliberation accelerates censoring.

In contrast, groups with diverse preferences are less likely to form majorities that trigger such censoring. More diversity of preferences makes it less likely that members prefer the same alternative. As they emphasize different attributes, even with the same information they will prefer different alternatives. In this case, deliberation will not necessarily lead to convergence, and, thus, censoring. Instead, members continue to share information without reaching consensus on a preferred alternative, making them more likely to continue the deliberation process.

However, this assumes that preferences and influence ties are not related, i.e., group members listen to the beliefs of group members with differing preferences. A consistent finding from network research shows that people with the same preferences are more likely to form ties with each other (McPherson et al., 2001). Echo chambers might emerge if influence ties exist only within sub-groups that share preferences. To capture this, we create networks in which the

ratio of ties within a sub-group, compared to outside ties, is gradually increased. We find that a very high correlation between preferences and influence ties leads to higher information error (see Figure 9). This is because information gains within a faction do not travel across factions, leading to echo chambers.

*Insert Figure 9 here.*

However, information sharing within factions still continues, so that even with perfect correlation between influence ties and factions, effective deliberation can still emerge as long as some certification can occur within the echo chambers. Moreover, even just a small number of ties that cut across factions is sufficient to reduce the information error levels to that of groups where ties are uncorrelated within factions (Watts and Strogatz, 1998).

In sum, preference diversity can reduce censoring but only if preferences and influence ties are not strongly correlated. In that instance, preference diversity would also lower certification.

***Proposition 1:*** *Deliberation is more likely to be effective when preference diversity is high, but only weakly correlated with the influence structure (i.e., when individuals listen to others with diverse preferences).*

### **Enabling Certification**

How can groups benefit more from the dyadic ability to recognize expertise? We illustrate the potential of better certification if time pressure and the tendency to advocate are lowered. Both time pressure and advocacy are realistic restrictions that can hinder group discussions. Most discussions have exogenous or endogenous time pressure, e.g., meeting time slots or members becoming bored and detaching themselves from participating. Likewise, research has shown that group members tend to often focus too much on their preferred alternatives (Gigone and Hastie, 1997; Mesmer-Magnus and DeChurch, 2009).

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3 ***(Lower) Time Pressure***  
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5       Certification takes longer to affect deliberations than censoring does. Censoring can curtail  
6 information sharing within one round, whereas certification unfolds over several rounds; group  
7 members only discuss one alternative when they speak and, if not all group members have  
8 mutual influence ties, it can take several rounds for the same piece of information to reach all  
9 group members. Thus, higher time pressure will reduce certification but only marginally weaken  
10 censoring (see Figure 10).  
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22       Higher time pressure also shifts the optimal density. While dense networks lead to high  
23 censoring, the information that is exchanged will be received by most members. In higher  
24 density networks information reaches their targets sooner. Thus, groups with high density ties are  
25 not as strongly impacted by higher time pressure. As Figure 10 shows, if the discussion is  
26 severely restricted (e.g., only one round), there is little harm created by censoring – higher  
27 clustering leads to a lower information error.  
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37                   ***Proposition 2a:*** *Deliberation is more likely to be effective under lower time pressure,*  
38                   *particularly in low-density groups.*  
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41  
42 ***Advocacy***  
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44       If group members only share information about their preferred alternative, i.e., they are  
45 *advocating* for their preferred option (Stasser, 1988). This weakens certification, since the  
46 deliberation will narrow down to only those pieces of information concerning people’s preferred  
47 alternatives (Figure 11a): groups with stronger advocacy focus on fewer alternatives, which is  
48 reinforced by censoring due to density. This, in turn, leads to a premature end of the deliberation,  
49 as no new information is revealed.  
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*Insert Figure 11 here.*

Advocacy also changes the optimal density (Figure 11b). If group members have a strong tendency to advocate, they will share only information about their preferred alternative. Even if they have sufficient time, i.e., multiple rounds, they are not likely to share additional information. A strong-minded board member might focus only on the CEO candidate they think is the best, even if it might be due to wrong information. However, the member might possess relevant information on other candidates that would help other board members change their opinions. With less advocacy, group members will use new rounds to share information on other alternatives. They might highlight one alternative in one round and a (potentially) worse alternative in the next.

Thus, lower advocacy is most beneficial for groups that are not at risk of ending the deliberation due to censoring. If groups end deliberations due to censoring, lower advocacy cannot produce its positive effect. Low to moderate density groups can make the most of the additional information, as they are more affected by lack of certification and not excessive censoring.

***Proposition 2b:*** *Deliberation is more likely to be effective when advocacy is weaker, especially in low-density groups.*

### **Trading off Censoring for Certification**

A third option to improve deliberation effectiveness is to trade off gains in censoring for a reduction in certification, as long as the overall deliberation improves. We discuss two alternative group factors that can reduce censoring more than reduce certification: group size and artificial agents.

#### ***Group Size***

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One of the most relevant characteristics of a group is its *size*. Increasing the number of group members enhances certification, as individuals have access to a broader pool of group members with unique information (Figure 12). Additionally, the deliberation is less likely to end. Large groups make it more likely that at least one or few members continue the deliberation through sharing information.

However, larger groups also face a greater risk of censoring. First, clustering can emerge at lower levels of density (Figure 13b). This occurs because, for the same overall density, a larger network provides more potential opportunities where clusters and, thus, potential local majorities can form. As a result, clustering increases more quickly with group size when density is low. Second, at higher levels of density group members have more absolute neighbors, which increases conformity pressure and leads to more censoring.

*Insert Figure 12 and Figure 13 here.*

As increasing the number of group members increases both certification and censoring, this does not only affect overall levels of information error, but the optimal network structure also shifts. By increasing the number of group members, clustering can already appear at lower levels of density, but *relatively* fewer ties are necessary to ensure that no group member is isolated (see Figure 13). As group size increases, each member gains many more potential partners so that the probability of having zero realized ties declines with size, given the same density. Because density fixes only the proportion of possible ties, larger groups imply a higher expected number of ties per individual even when networks are relatively sparse. As a result, even relatively sparse networks in larger groups are less likely to have isolated members, ensuring that most participants remain embedded in the deliberative process. In essence, low isolates and minimal clustering still leads to the lowest information error, and these conditions are more likely to be

attained at lower density in larger groups.

**Proposition 3a:** *Deliberation is more likely to be effective in larger groups, particularly when network density is low.*

### **Artificial Agents**

Another possibility to consider is whether deliberation can be improved if some group members are replaced by artificial agents, e.g., chatbots, who are immune to conformity pressures but may also have no expertise recognition. We test this by sequentially replacing group members with artificial agents. Figure 14 shows that introducing a small number of artificial agents improves deliberation outcomes. These agents do not contribute to certification, as they cannot recognize expertise, but they counteract censoring by continuously transmitting information. This prevents premature termination of deliberation through censoring. Artificial agents enable non-artificial group members to share information, lowering information error. This, in turn, makes it more likely that other group members continue the deliberation. Although losing a group member reduces the pool of information, the decrease in censoring can compensate for the loss.

*Insert Figure 14 here.*

The effectiveness of adding artificial agents also depends on the level of expertise recognition. When expertise recognition ( $\phi$ ) is high among non-artificial agents, adding more artificial agents (who are no better than chance at recognizing expertise and bring no expertise of their own) yields diminishing returns in reducing information error. While the first artificial agent significantly reduces censoring, each additional artificial agent's impact on censoring decreases; it requires only a few members to share information for the deliberation to continue. At the same time, the loss of unique information and its subsequent reduction of certification

increases with each added artificial agent. With more added artificial agents, the gains from reduced censoring are limited and then reversed by the reduced certification.

However, when  $\phi$  is moderate, the damage to certification by adding artificial agents can be substantial, since these agents are no better than chance at recognizing expertise. Moreover, as artificial agents replace group members and the remaining group members have imperfect expertise recognition, the likelihood of filtering out inaccurate information decreases. Thus, at moderate  $\phi$ , the loss of certification from adding each artificial agent can be significant, shifting the optimal balance toward a greater share of non-artificial members.

Importantly, "artificial agents" do not have to be algorithms. Whether implemented through human moderators trained in resistance to conformity pressures, AI systems designed to maintain productive dissent, or hybrid approaches combining both, the key insight is that effective facilitation may depend less on expertise (recognition) and more on the ability to counteract premature consensus formation. The danger for both human and AI facilitators is if they do more than just continue the discussion. For example, a moderator might (unintentionally) bias the deliberation process (Spada and Vreeland, 2013).

***Proposition 3b:** Deliberation is more likely to be effective when a limited number of conformity-resistant artificial agents are introduced, even if they lack expertise recognition.*

**Robustness**

In the Appendix, we show that the basic pattern emerging from the trade-off between certification and censoring is robust across number of alternatives (M), number of attributes (L), and the number of attributes that agents consider important ( $\beta$ ). We also show that 20 rounds are sufficient for the models reported to reach a steady state.

## Discussion

We set out to reconcile opposing views on the effectiveness of social influence processes in group deliberations. Building on the insight that social influence can have both normative and informational effects at the dyadic level, we studied the conditions under which these dyadic properties produce more or less effective deliberation, using a computational agent-based model. Our theory integrates findings across different streams of literature on deliberation and social influence, offering a framework for understanding when and why social influence enhances deliberation.

We offer several insights from our theoretical framework: First, for deliberation to exceed weak synergy, it is necessary (but not sufficient) for members to recognize each other's *relative* expertise at levels better than chance. Second, to exceed strong synergy, the group should have an influence structure that fosters certification without allowing for too much censoring, a structure that neither isolates any members nor allows for clustering and cliques. Third, preference diversity improves the effectiveness of deliberation through lower censoring if preferences and influence structures are not (strongly) correlated. Fourth, advocacy and time pressure hurt low density groups the most. Fifth, introducing group members who remain relatively immune to conformity pressures—such as professional facilitators, designated contrarians, or rotating devil's advocates—can improve deliberation effectiveness by countering premature consensus formation, even if these agents are no better than chance at expertise recognition.

In terms of the underlying mechanisms, our analysis reveals a fundamental tension: while increased connectivity enables better information access through dyadic expertise recognition (certification), it simultaneously creates conformity pressures that suppress information sharing

(censoring). The interplay between certification and censoring defines whether deliberation is effective.

**Implications And Synthesis of Prior Work on Social Influence**

Our findings contribute to understanding deliberation as a distinct social process that precedes formal decision-making. Unlike simple aggregation mechanisms that treat individual inputs as fixed, deliberation fundamentally alters the information distribution within groups through social influence dynamics. We unpack the unique effects of social influence, offering insights into why different research streams may have differing conclusions. Our theory is broad enough to explain known group phenomena and identify the conditions under which they occur, yet it is precise enough to make specific predictions. This provides a theoretical framework for how social influence shapes deliberation and, as a result, the information accuracy of a group as a precursor to decision-making.

***Deliberation in Organizations***

Research on group deliberation in organizations has long examined when and how groups can achieve outcomes superior to those of their average or even their best-informed member (Larson, 2013; Stasser and Abele, 2020). This literature highlights that understanding deliberation requires accounting for its dynamic nature, as information sharing and influence evolve over time (Sohrab et al., 2015; Sohrab et al., 2022; Cronin et al., 2011).

More recently, Krause et al. (2025) proposed a theoretical framework identifying information distribution, deliberation, and decision-making as the three core processes underlying effective board decisions. Our model platform allows systematic variation and analysis of all three dimensions. Complementing their work, our framework specifies factors beyond cognitive diversity and empowerment that enable effective, or non-biased, deliberation. In particular, we

show that accurate relative expertise recognition is a necessary condition for effective information integration. Finally, our results demonstrate that consensus can be an indicator of a failed or successful deliberation process.

### ***Understanding Failures of Deliberation***

Social influence may create conformity cascades that block information sharing – leading possibly to similarity in behavior but heterogeneity in beliefs. Diffusion models, which assume conformity in beliefs, produce conformity in behavior (e.g., Shore et al., 2015) and do not capture this distinction, which separates important group-level phenomena. For instance, groupthink (Janis, 1972) implies that the group prematurely agrees on one alternative while not all relevant information has been exchanged. In this case, (most) group members agree privately and publicly with the alternative. The illusion of consensus, which is related to pluralistic ignorance (Yousif et al., 2019), appears similar on the surface: the group agrees publicly on an alternative. However, privately many members disagree with the public choice, indicating tacit dissent. While a diffusion process can generate groupthink, it cannot generate the illusion of consensus. The distinction is important because groupthink cannot be detected until the group's decision is implemented and reality eventually provides feedback, whereas an illusion of consensus is diagnostic of the fact that the group members very likely have not revealed all relevant information (i.e., there has been little discussion), so that some corrective action might be taken before the decision is implemented.

### ***Benefits of Deliberation***

It is also instructive to compare our theory of deliberation, which involves social influence, to those obtained by simply pooling individual estimates (the wisdom of the crowds approach popularized by Surowiecki, 2004). The two processes are not mutually exclusive: one could pool

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individual estimates after a process of social influence, or even the reverse (Becker et al., 2022). This could further magnify the effectiveness of information aggregation after deliberation.

Furthermore, our theory suggests a crucial difference between deliberation and pooling: there is no guarantee that the wisdom of the crowd obtained by pooling individual estimates will outperform the best individual in the crowd; it might, depending on the initial distribution of errors, or it might not (Larrick and Soll, 2006; Palley and Soll, 2019). In contrast, if deliberation involving dyadic expertise recognition allows the group to become as good as the best individual for each attribute, and if different individuals were initially more accurate on different attributes, then a group that relies on deliberation, as we have theorized, is guaranteed to be better than the best – it will reliably enable strong synergy.

These insights have particular relevance for strategic decision-making contexts where boards, top management teams, and strategy committees must integrate diverse expertise while avoiding the pitfalls of groupthink. Our framework suggests that the structure of influence relationships—not just the presence of diverse knowledge—critically determines whether deliberation enhances or undermines collective intelligence.

**Limitations and Future Research**

Our model necessarily simplifies complex deliberation processes to focus on the fundamental tension between informational and normative influence. These simplifications create important boundary conditions that future research should address.

We assume symmetric influence ties of equal strength, which may not capture hierarchical dynamics common in organizational settings where power asymmetries significantly shape deliberation processes. In corporate boards, for example, CEO influence may differ qualitatively from that of independent directors. Coercive influence, unlike normative influence,

which operates through self-censorship and desire for social approval, functions through explicit or implicit pressure from other group members. This distinction is particularly relevant in hierarchical organizational settings where power dynamics significantly shape deliberation processes. Future research could investigate how asymmetric ties and formal hierarchies interact with the certification-censoring dynamics we identify. Such extensions would likely need to incorporate explicit decision-making authority structures, examining when hierarchical deliberation outperforms more egalitarian processes.

Our model excludes strategic misrepresentation, assuming participants cannot easily manipulate others through deliberate deception. While this assumption may hold in contexts with sufficient complexity and repeated interaction, it may limit applicability to highly politicized settings where strategic communication dominates. We model expertise recognition capacity as a fixed parameter that remains constant across all interactions, topics, and group members. Whereas in practice, individuals may vary in their ability to assess expertise across different domains or may improve their recognition skills through experience. The model also assumes that expertise recognition depends solely on accuracy comparisons rather than other cues like confidence, status, or communication style that often influence credibility assessments in organizational settings. Additionally, we do not model cognitive limitations, learning costs, or the emotional dynamics that often influence real deliberation processes.

Our framework applies best to deliberation contexts where information sharing is the primary goal and participants have incentives to reach accurate conclusions. It may be less applicable when the goal is preference aggregation rather than information integration, or in settings where symbolic legitimacy matters more than decision accuracy (e.g., political decision-making).

Several promising research directions emerge from these limitations. First, examining how our findings interact with different aggregation methods (voting, consensus, delegation) could bridge deliberation processes with final decision mechanisms. Second, exploring how network structures evolve endogenously during deliberation—where influence ties strengthen or weaken based on perceived expertise—could capture the dynamic nature of real organizational relationships. Third, incorporating dynamic expertise recognition that evolves based on past interaction history could capture learning effects in ongoing teams. Finally, empirical validation of our key predictions—particularly the optimal balance between certification and censoring—represents a crucial next step for establishing the framework’s external validity.

**Conclusion**

Understanding when deliberation enhances versus undermines group decision-making represents a fundamental challenge for organizations. Our analysis reveals that the benefits of deliberation depend not merely on having diverse expertise, but on structuring social influence processes to promote productive information exchange while minimizing conformity pressures. The framework we develop offers both theoretical insights into the social dynamics of deliberation and practical guidance for designing more effective group decision-making processes in organizational contexts.

### Biographical notes

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Tables

Table 1: Examples of group decision scenarios

| Influence structure                                     | Scenario                     | Alternatives                                                  | Attributes                                                                                                  |
|---------------------------------------------------------|------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Low density network<br>(few ties among group members)   | Supplier Selection Committee | Supplier materials or components                              | Quality, cost, reliability, delivery time                                                                   |
|                                                         | Cross-functional teams       | Project priorities, feature designs, resource allocations     | Strategic alignment, feasibility, cost, timeline, innovation potential                                      |
|                                                         | Municipal task force         | Solution to new problem                                       | Costs of implementing, time to implement, chance of success                                                 |
| Moderate density network                                | Board of directors           | Potential merger target, investment decisions, CEO candidates | Risk, expected payoff, relation to current resources/investments                                            |
| High density network<br>(many ties among group members) | Family council               | Investment in family business, philanthropic initiatives      | Fairness, family values alignment, financial return, generational continuity                                |
|                                                         | Product development team     | Product features or versions                                  | Market demand, development cost, time to market, return on investment, compatibility with existing products |

**Table 2: Comparison with related models**

| <b>Model Type</b>                      | <b>Key References</b>                                              | <b>Specialized Information</b> | <b>Dyadic Expertise Recognition</b> | <b>Conformity Pressure</b>           | <b>Explicit Information Exchange</b> | <b>Variable Influence Structure</b> |
|----------------------------------------|--------------------------------------------------------------------|--------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|-------------------------------------|
| <b>Information-Sharing Models</b>      | Penrod and Hastie (1980); Stasser and Davis (1981); Stasser (1988) | ✓                              | —                                   | —                                    | ✓                                    | —                                   |
| <b>Information Cascades</b>            | Bikhchandani et al. (1992);                                        | —                              | ✓                                   | —                                    | —                                    | —                                   |
| <b>Bandwagon Models</b>                | Abrahamson and Rosenkopf (1993)                                    | —                              | —                                   | ✓                                    | —                                    | —                                   |
| <b>Opinion Dynamics</b>                | Friedkin and Johnsen (2011); Friedkin et al. (2016)                | —                              | —                                   | ✓                                    | ✓ (opinions only)                    | ✓                                   |
| <b>Search and Learning Models</b>      | Lazer and Friedman (2007); Fang et al. (2010)                      | ✓                              | —                                   | Conflated with expertise recognition | —                                    | ✓                                   |
| <b>Wisdom-of-Crowds Models</b>         | Becker et al. (2017); Moussaid et al. (2018)                       | —                              | ✓                                   | —                                    | —                                    | ✓                                   |
| <b>Deliberation Model (This paper)</b> |                                                                    | ✓                              | ✓                                   | ✓                                    | ✓                                    | ✓                                   |

Note: “This paper” refers to the model developed in the present study.

Table 3: Overview of main terms and parameters

| Name                                            | Symbol, Default Values | Definition                                                                                                     |
|-------------------------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------|
| Group size                                      | N [10]                 | Number of group members                                                                                        |
| Alternatives                                    | M [10]                 | Number of possible choices (e.g., CEO candidates)                                                              |
| Attributes                                      | L [10]                 | Number of attributes describing alternatives                                                                   |
| Rounds of Deliberation                          | T [20]                 | Sequential turns where members speak and update beliefs                                                        |
| Attribute scores of alternatives                | $a_{ml}$ [0,1]         | True score of attribute of alternative                                                                         |
| Beliefs                                         | $b_{ml}^i$ [0,1]       | Group members' perceptions of attribute scores of alternatives                                                 |
| Preferences (Weighting vector)                  | $w_l^i$ [0,1]          | Individual attribute weights from Dirichlet distribution                                                       |
| Attribute weight heterogeneity                  | $\beta$ [0.1]          | Attribute weight heterogeneity parameter                                                                       |
| Preference diversity                            | $\gamma$ [10]          | Number of unique weighting vectors                                                                             |
| Density of influence ties                       | $\rho$ [0,1]           | Density of influence ties in network                                                                           |
| Advocacy tendency                               | $\tau$ [0.1]           | Selection temperature parameter (How strong members only advocate for preferred option)                        |
| Conformity pressure (Normative Influence)       | $\theta$ [1]           | Conformity value parameter                                                                                     |
| Expertise recognition (Informational Influence) | $\phi$ [0.75]          | Expertise recognition parameter (Probability of recognizing when another member has more accurate information) |

Table 4: Group-level constructs

| Name              | Definition                                                                                       |
|-------------------|--------------------------------------------------------------------------------------------------|
| Information Error | Average inaccuracy of beliefs vs. reality (city-block distance) (Outcome variable)               |
| Certification     | Group-level effect of informational influence (dyadic expertise recognition)                     |
| Censoring         | Group-level effect of normative influence (conformity pressure)                                  |
| Weak Synergy      | Average information error $\leq$ average individual information error without deliberation       |
| Strong Synergy    | Average information error $\leq$ best-informed member information error without deliberation     |
| Clustering        | Extent to which members' neighbors are also connected (measured by local clustering coefficient) |
| Isolates          | Members without influence ties                                                                   |

## Figures

**Figure 1: Process overview of model**

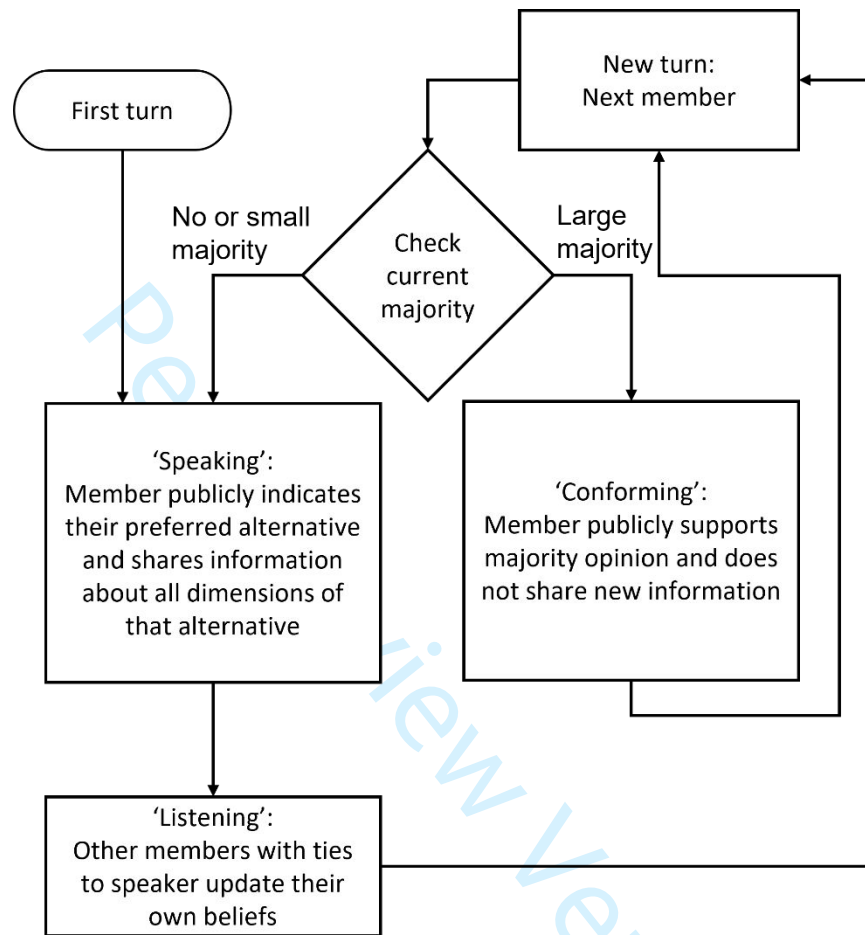
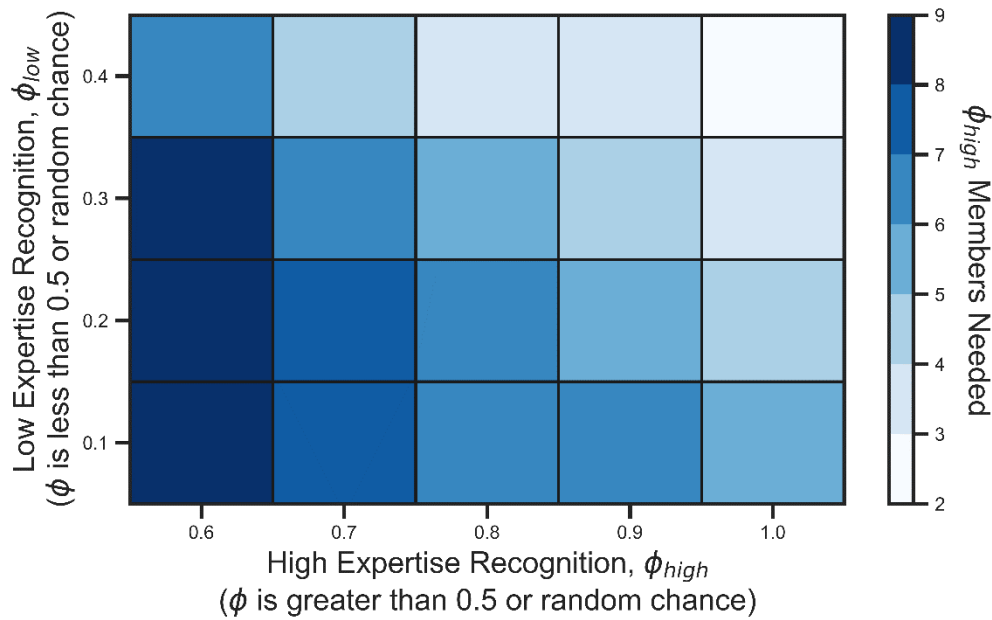


Figure 2: Share of group members with high and low expertise recognition required to achieve weak synergy



Note: The color indicates how many members with high expertise recognition (x-axis) are required to compensate the lack of recognition by other members (y-axis) to achieve weak synergy.

Figure 3: Average individual information error and share of isolated group members dependent on social influence density (no conformity pressure).

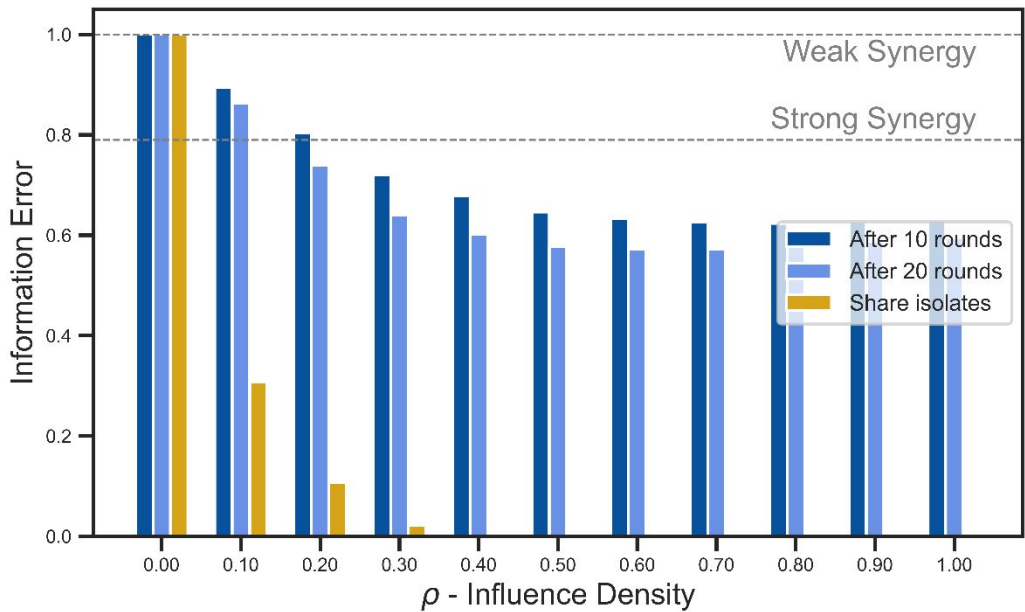
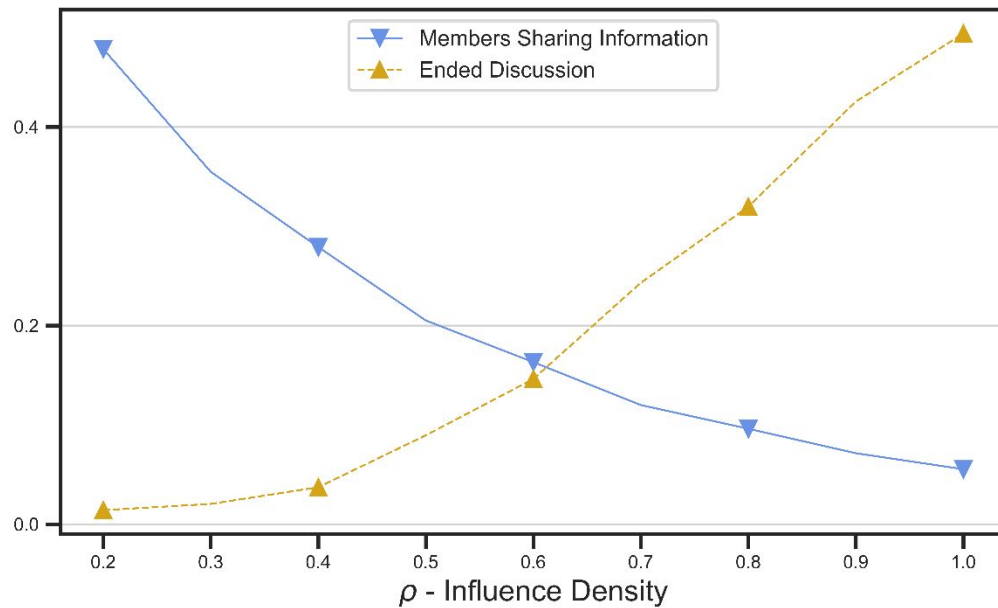
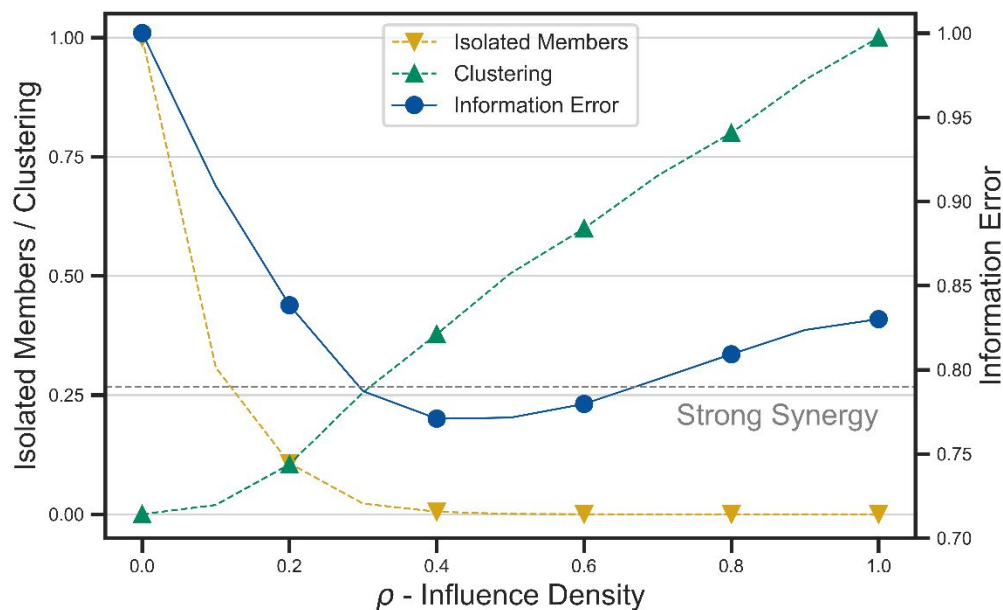


**Figure 4: Percentage of group members sharing information dependent on social influence density and conformity pressure (after 10 rounds).**



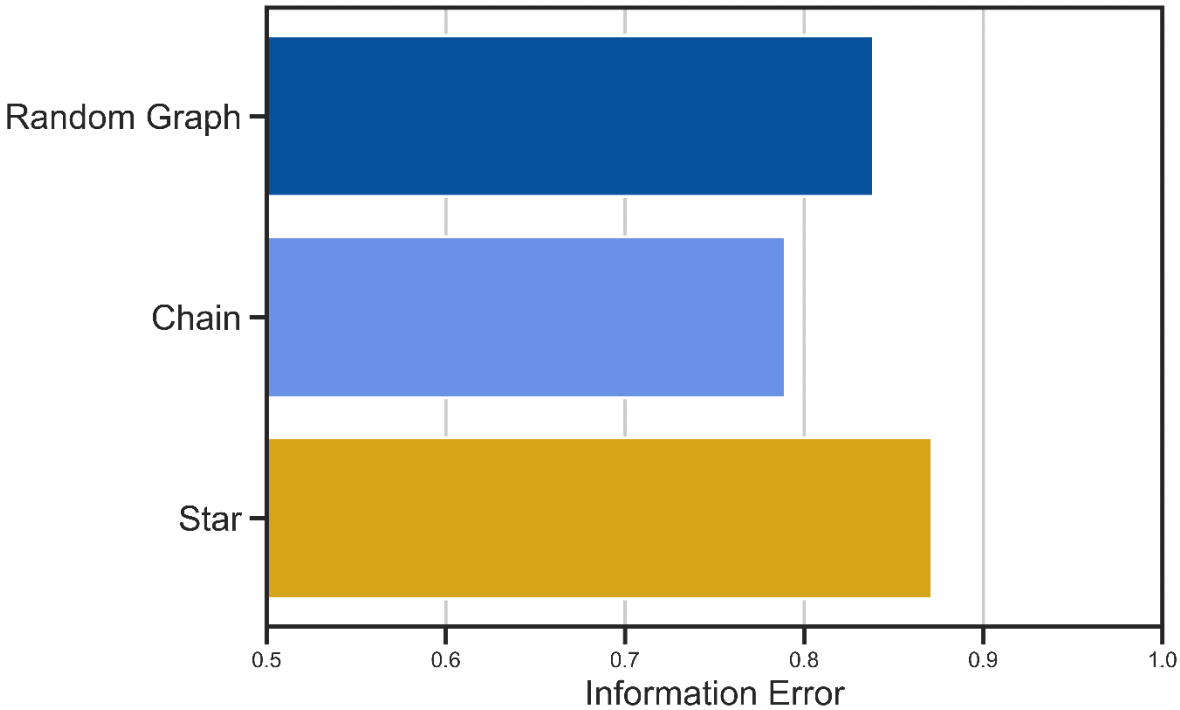
Note: The figure starts at  $\rho = 0.2$  to highlight the effect of censoring. At lower levels of density, the deliberation ends prematurely because nobody updates their information due to lack of ties.

**Figure 5: Average individual information error (city-block distance) and structural network properties.**



Note: To measure clustering we use the average of the local clustering coefficients of all the vertices.

Figure 6: Information error of three structures with same density



Note: To maintain a consistent density across all network structures ( $\rho = 0.2$ ), the chain is modeled as open-ended, i.e., the first and last group members are not connected.

Figure 7: A model of social influence and deliberation

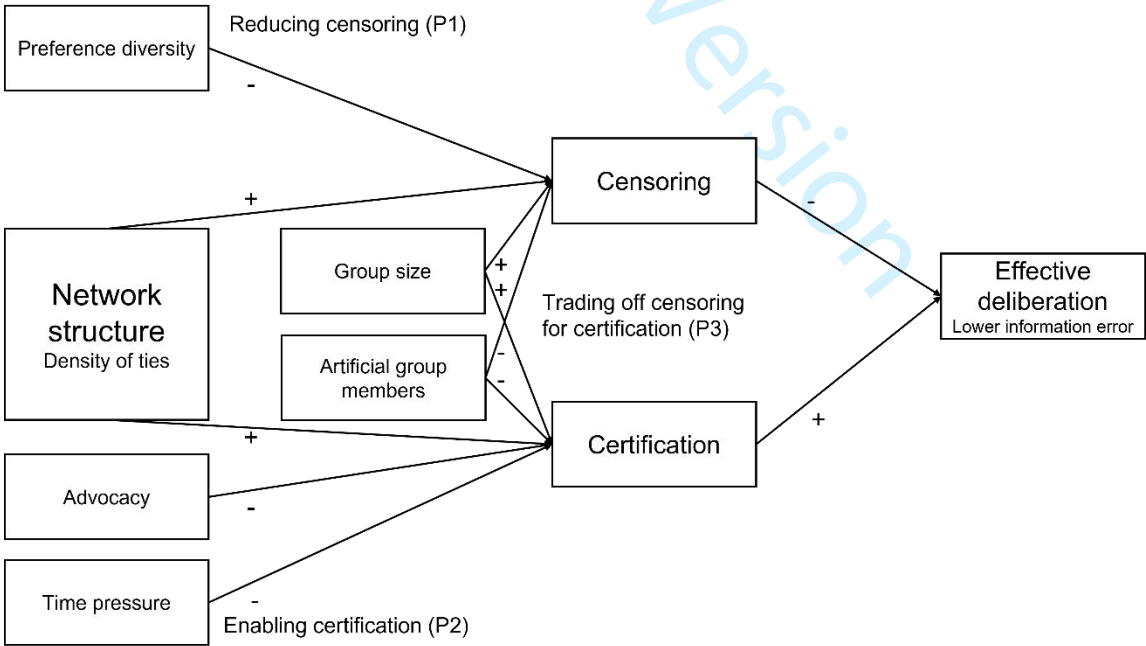


**Figure 8: Average individual information error dependent on social influence density and preference diversity (number of factions).**

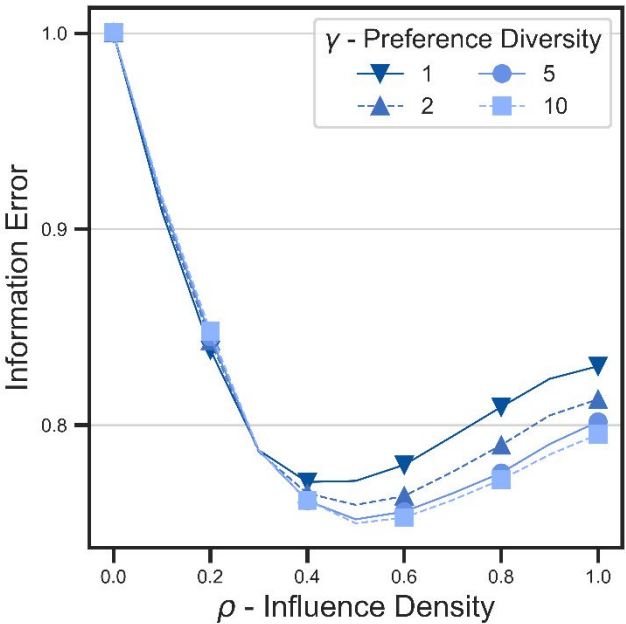


**Figure 9: Average individual information error dependent on share of within-faction ties ( $\rho = 0.2$ ).**

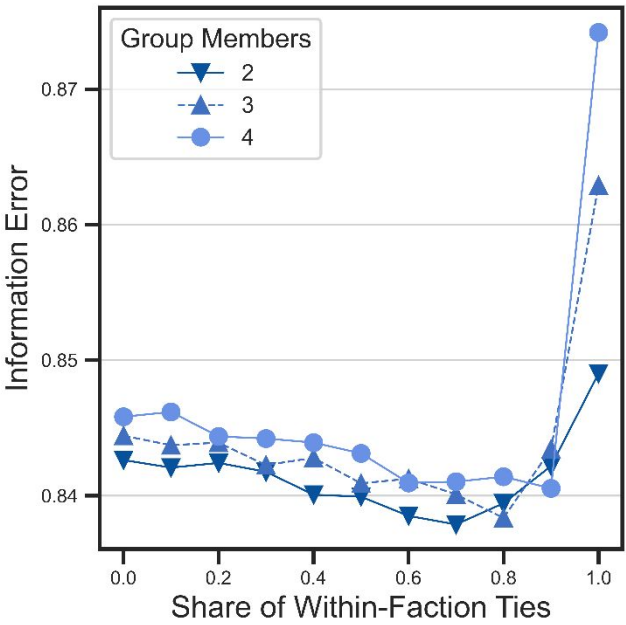


Figure 10: Average individual information error dependent on social influence density and time pressure.

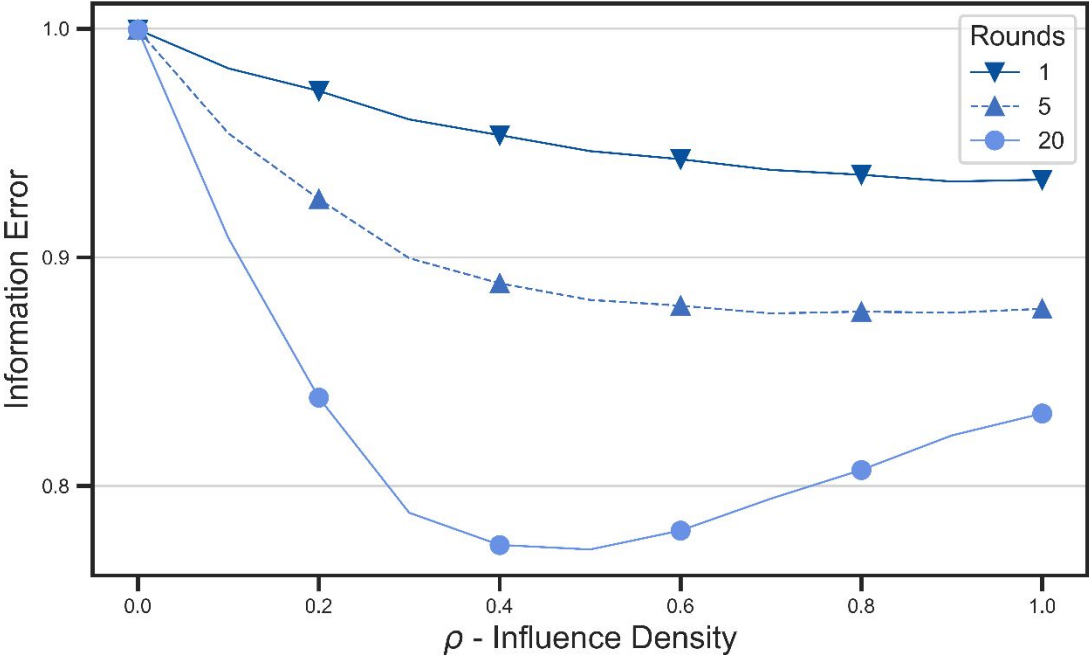


Figure 11: Share of discussed alternatives (a) and average individual information error (b) dependent on social influence density and degree of advocacy ( $\tau$ ).

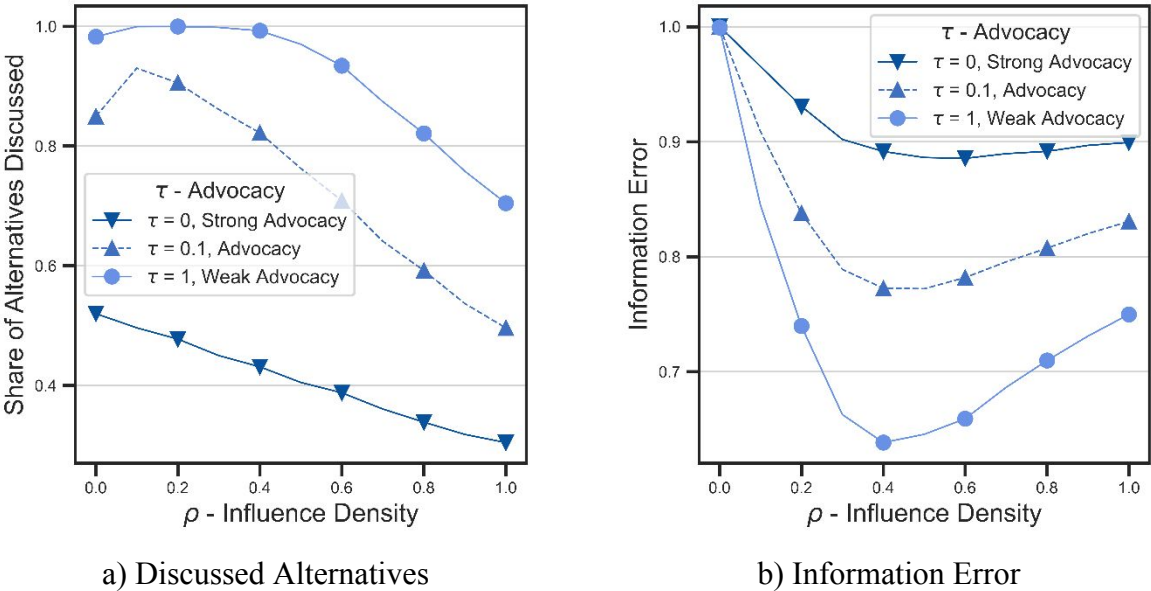


**Figure 12: Average individual information error dependent on social influence density and number of group members.**

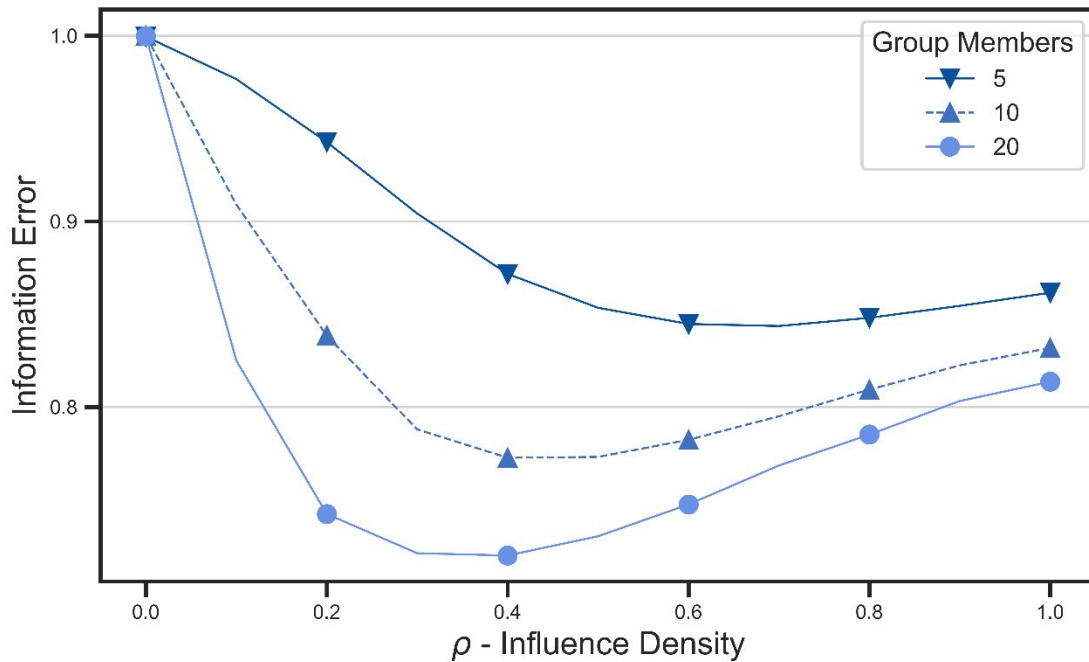


**Figure 13: Network characteristics dependent on social influence density and number of group members.**

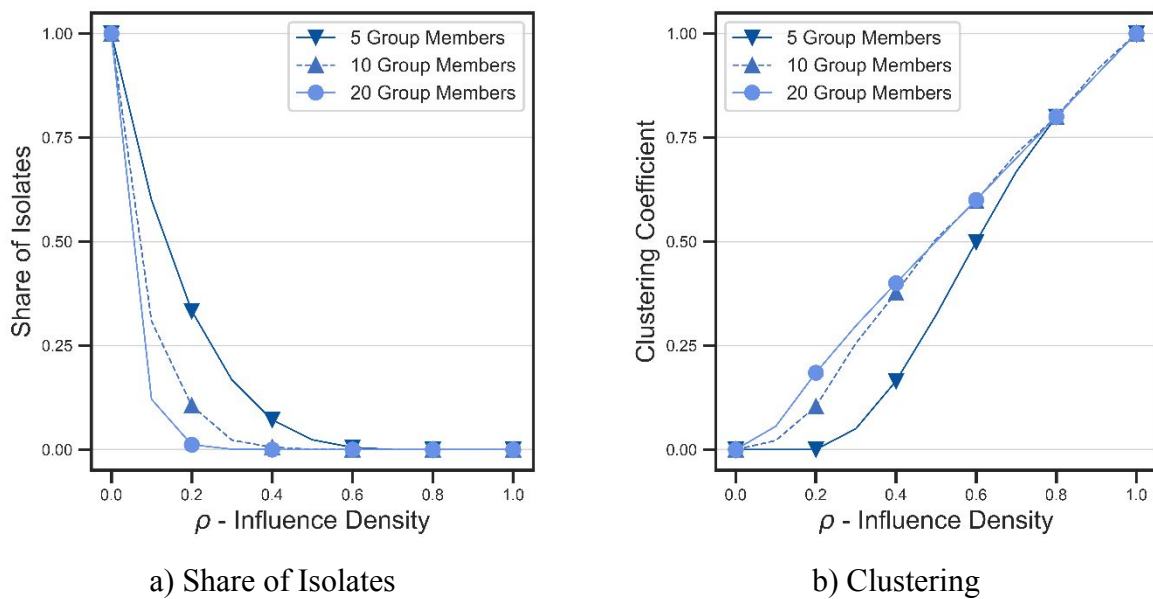
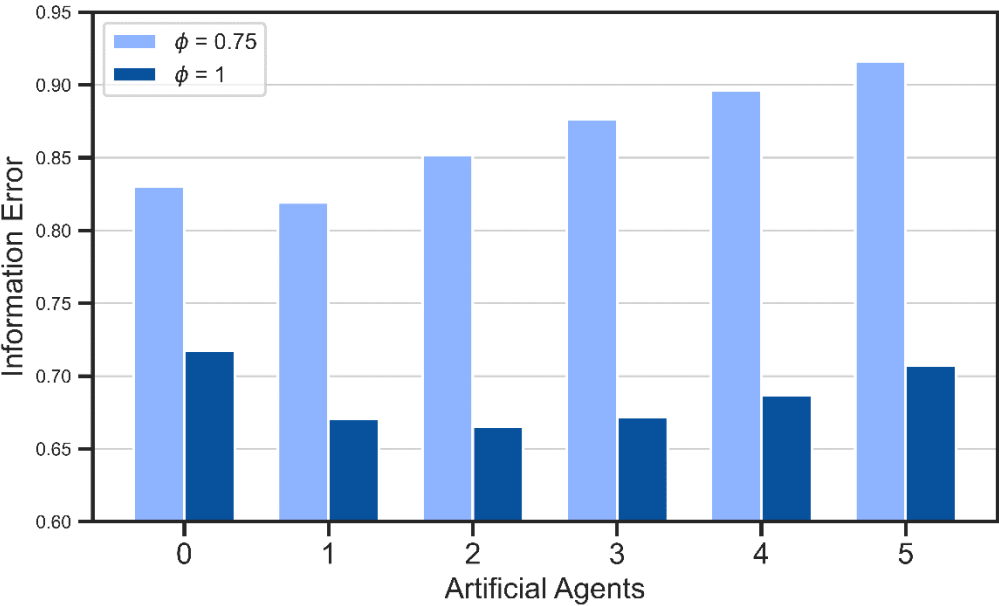


**Figure 14: Average individual information error when adding artificial agents (no expertise recognition, no conformity) to network ( $\rho = 1$ ).**



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## Appendix

The code and further details can be found at: <https://github.com/helgeklapper/deliberation>

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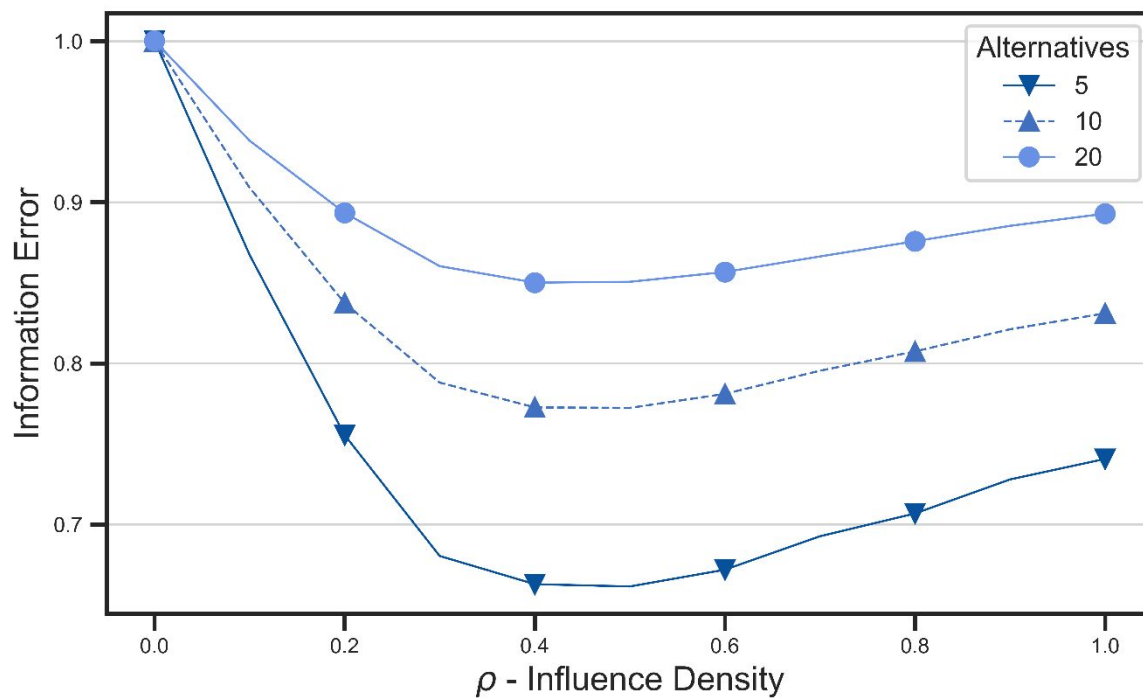
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3 **§1 ROBUSTNESS CHECKS**  
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6       This section shows the result of varying any of the main parameters of the model that we have  
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8 set to a specific value and have not varied in the main analysis. The figures show how much  
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10 information error changes due to the variation in parameters. Importantly, the core results remain  
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12 robust across number of alternatives (M), number of attributes (L), attribute weights ( $\beta$ ), and  
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14 conformity value. All figures depict the simulation after R=20 rounds.  
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### §1.1: Number of alternatives

Adding more alternatives increases the information error for all structures (Figure T1). If the number of alternatives increases, there is a lower likelihood that all alternatives will be discussed in a finite discussion period. This offsets the higher likelihood that many agents prematurely agree and create conformity cascades.

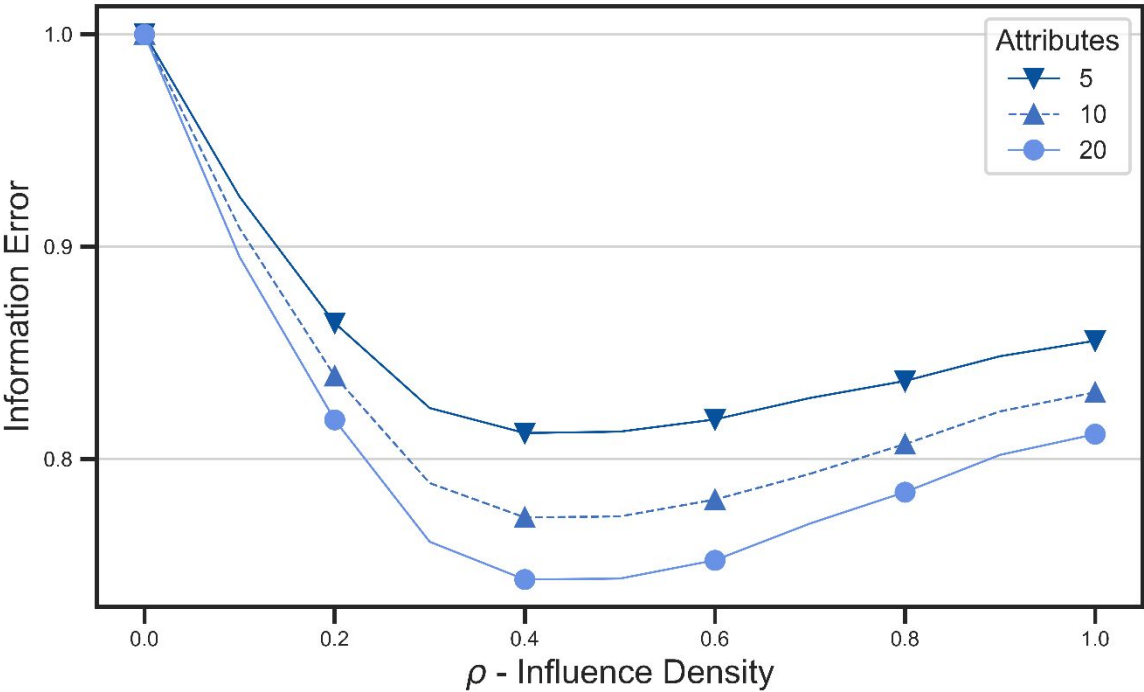
**Figure T1: Average individual information error (city-block distance) dependent on network density and number of alternatives**



§1.2: Number of attributes

While the main result remains robust, the number of attributes has a positive effect on information error (Figure T2) for all structures. More attributes make it less likely that uninformed agents agree too quickly. Consider the extreme case with one attribute. If one agent shares information on alternative A, she could convince all other agents to prefer alternative A, even erroneously. If there are multiple attributes, it becomes less likely that one agent has superior information on all dimensions. Therefore, the discussion will last longer with more attributes.

Figure T2: Average individual information error (city-block distance) dependent on network density and number of attributes

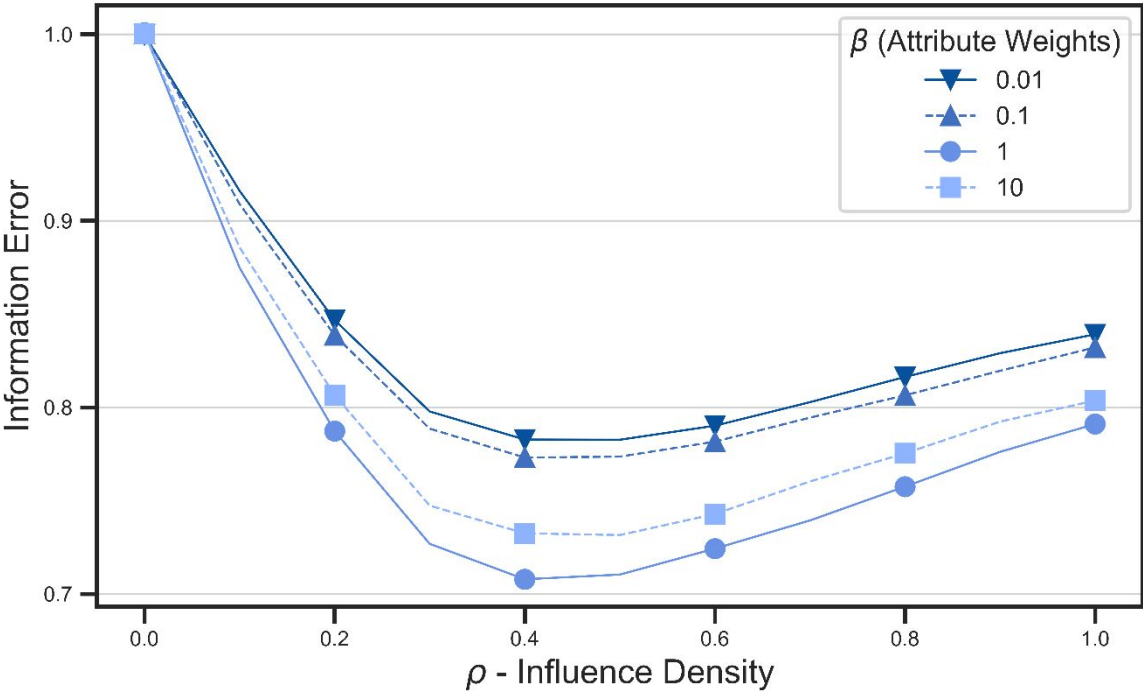


### §1.3: Attribute weights and preference distribution

In order to allow for different preferences among agents, we vary their individual weight. Formally, the elements of the weighting vector are drawn from an  $L$ -dimensional Dirichlet distribution with a tunable concentration parameter  $\beta$ . This parameter allows us to specify whether agents only care about few dimensions (low  $\beta$ ), about many dimensions (high  $\beta$ ), or all possibilities in between. In the baseline analysis we assume weights are distributed over a moderate number of attributes (with a concentration parameter set to 0.1).

The robustness check shows that the more agents weigh dimensions equally, the less likely they will have strong opinions going into the discussion and are therefore more likely to continue the discussion (Figure T3). The main result remains robust at different levels of this concentration parameter.

**Figure T3: Average individual information error (city-block distance) dependent on network density and distribution of preferences**



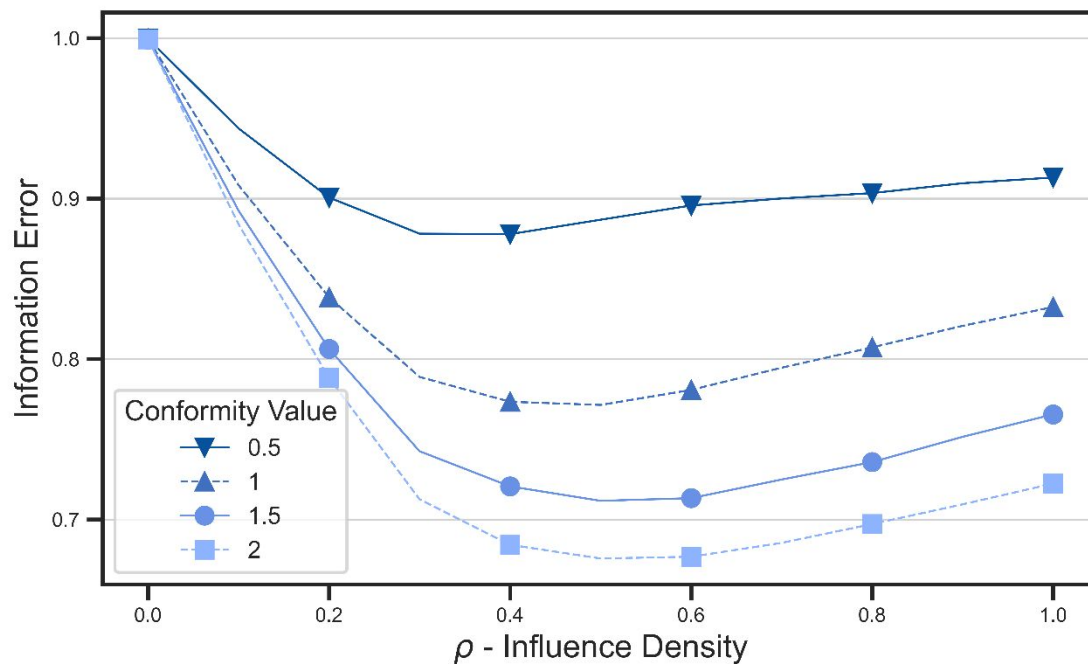
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### §1.4: Normative influence – Conformity cascades and censoring

The conformity value tunes the conformity pressure of the relative majority that has influence over a group member. As the conformity value increases, the pressure decreases. Group members become less likely to conform to the majority and are more likely to continue to share information (Figure T4). This also shifts the optimal density to higher levels of density.

Interesting, there is not a linear relationship between the strength of dyadic normative influence and the resulting conformity cascades. While decreasing the susceptibility to conformity initially has a large marginal effect on decreasing information error, further decreasing susceptibility to conformity does not change error much.

**Figure T4: Average individual information error (city-block distance) dependent on network density and conformity value**

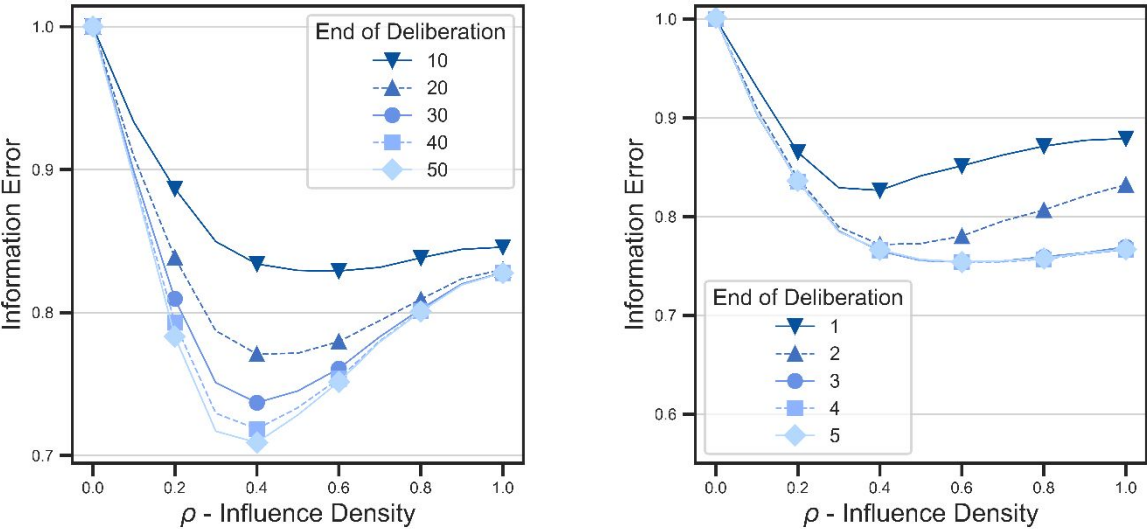


§2: TIME TO CONVERGE AND STOPPING RULE

As discussed in the Model Description, the discussion ends endogenously when the information sharing has stalled. We ran our result with up to 20 rounds. In order to confirm that results have converged within 20 rounds and we have not biased the results by ending the simulation prematurely, we show the average information error after 10, 20, 30, 40, and 50 rounds (Figure T5a). The main result, information error is optimal for minimal clustering and minimal isolates, does not change. After about 30 rounds the information error for virtually all density levels has become constant or only changes marginally, i.e., there is on average less than 1 percent difference in information error between rounds.

We also test whether the endogenous stopping rule affects our core results. We vary the number of rounds where no group member shares information before deliberation is ended (Figure T5b). Increasing the number of rounds reduces information error, in particular for lower density groups, as those groups are most likely to continue sharing information. The main result does not change.

Figure T5: Average individual information error (city-block distance) dependent on density after end of deliberation.



1. a) Exogenous stopping rule

b) Endogenous stopping rule