Preferences and Social Influence*

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Abstract

Interaction between decision makers may affect their preferences. We consider a setup in which each individual is characterized by two sets of preferences: his unchanged core preferences and his behavioral preferences. Each individual has a social influence function that determines his behavioral preferences given his core preferences and the behavioral preferences of other individuals in his group. Decisions are made according to behavioral preferences. The paper considers different properties of these social influence functions and their effect on equilibrium behavior. We illustrate the applicability of our model by considering decision making by a committee that has a deliberation stage prior to voting.

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1 Introduction

Consider a person sitting by himself in an empty restaurant, looking over the menu in order to decide what to order. Now consider a slightly different scenario in which the same person is sitting to a long table together with

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other people, each of them in the process of ordering their meals. They may comment about their preferences, but as they don't have any information about the dishes they do not make remarks regarding the menu.[1] Do we expect the diner to order the same dish? Standard analysis seems to suggest that the choice should be the same in both situations and that each individual will choose the dish that he likes best. Yet, Ariely and Levav [1] provide a convincing experiment that suggests that this is not the case and that the presence of a group (even of complete strangers) affects the choice of meals. Specifically, they found a larger variance in the dishes ordered by individuals that were part of a group than by individuals that were sitting by themselves.

Consider now two possible situations for a decision maker who is trying to decide whether to accept or reject a lottery. In the first, he is making his decision in isolation, while in the second scenario he is part of a group of individuals, all of them facing a similar problem. Moreover, assume that the lottery determines only the decision maker's individual payoffs and does not affect the well-being of anyone else. Assume further that all choices are observable. Will the different environments lead to different decisions? Following the restaurant example we assume they do, and our aim is to investigate the structure and consequences of these influences.

Our setup captures situations in which individuals interact very closely with other individuals in their social influence group. We may think either of family members, individuals that sit together for a long period in a committee or a directorship board, or even members of the same academic department when preferences are defined over academic activities like research, promotion policy, etc.

We assume that each individual is characterized by two sets of preferences: his true core preferences and his behavioral preferences, where actual choice is determined by the behavioral preferences. These latter preferences are observable by all other players and each player has a group influence function that determines his behavioral preferences as a function of his core preferences and the observed behavioral preferences of other individuals. Clearly, if he is not influenced by others, then his behavioral preferences are the same as his core preferences. We do not assume a model of preferences evolution, as individuals' core preferences do not change as a result of social interaction. Rather, individuals change their behavior in different social environments

[1] So obviously we have in mind more of a Le Pain Quotidien's environment rather than watching Sally in Katz's Deli.

given the behavioral preferences of other individuals in their relevant social group. When a person moves to a different social environment he may change his behavior, which is now the outcome of the same core preferences and a different profile of other people's preferences. We emphasize that our interpretation of the social influence function is of interaction, and not of aggregation. That is, an individual is influenced by (and influences) others' behavior, but he does not try to behave as a social planner by taking an average (or another combination) of his and other people's preferences. Moreover, even if he is aware of the fact that other decision makers are influenced by his behavior, he does not behave strategically.

We discuss conditions on the social influence functions that guarantee the existence of such an equilibrium of interdependent behavioral preferences. We investigate properties of the social influence function which induce simple adjustments. In particular, we offer conditions under which the core utility of person i is transformed by a function h_i that depends on the *average* behavioral utilities of everyone else. According to our analysis, the social influence does not necessarily imply regression to the mean. It may, for example, induce all group members to behave as if they are all more (or all less) risk averse than they really are according to their core preferences.

This analysis may shed some light on the role of deliberation in committees. We consider a committee that needs to decide on a certain issue but prior to voting there is a deliberation stage. During this stage, members argue, express and explain their opinion, and try to convince other committee members. We do not consider deliberations that involve an exchange of information or strategic negotiations, but situations in which committee member try to affect the preferences of other members. We use our setup of social influence to show how the voting of the committee would be changed as a result of different procedures of deliberation.

The different effects of group behavior were discussed both in the economic and in the social psychology literature. In a recent discussion, Hoff and Stiglitz [19] claim that preferences and behavior are endogenous and are influenced by actions and beliefs of individuals around the decision maker. In Economics the focus is on social learning, externalities and coordination. When individuals do not have perfect information about the characteristics of elements in their choice set, conditioning their choice on the choices of other individuals may be beneficial (for a survey of this literature, see Chamley [7]).

The recognition that individuals care about their relative position or their status in society has appeared already in the work of Veblen [24]. Such social concerns also introduce an interdependence between the actions chosen by individuals that belong to the same social group. The literature have dealt with this social concerns (like social status, esteem, or popularity) by introducing them explicitly into the utility function (see for example Bernheim [3], Fershtman, Murphy and Weiss [15], and Frank [16]). In this approach the action chosen by an individual affects direcly his social status (for example, attending college) or it affects the perceptions about his type which determines his status (e.g., driving a Porsche).[2] When actions signal individuals' type and social status is an important concern, Bernheim's individuals converge to a conformist behavior. In other cases individuals would like to choose a product that other people do not choose simply because they want to be fashionable or different (see for example Karni and Schmeidler [20]).

There is a difference between our setting of "social influence" and the familiar concept of "social preferences" or "interdependence preference"(see Charness and Kuhn [8], Fehr and Gächter [13], Sobel [23] and Fehr and Schmidt [14]). Social preferences imply that the utility of an individual is exogenously given and does not change, but it may depend on other people's outcomes, on the distribution of payoffs, or on the action taken by other people. By assuming such interdependent preferences the literature focuses for example on altruism, fairness concerns, reciprocity, or inequality aversion.[3] In our setting individuals may have social preferences or preferences that are defined only with respect to their own payoffs. But what we assume is that when these individuals need to make decisions their preferences may be affected by the preferences of other individuals even when those individuals have no direct economic or strategic interaction with the decision makers. For example, the decision maker's degree of risk aversion or level of altruism may be influenced by other people attitude to risk or altruism.

Our setting focuses on the formation of endogenous behavioral preferences that are subject to social influence. There is an extensive literature on preferences formation and on endogenous preferences. One approach, which is based on evolutionary sociobiology (see Becker [2], Dawkins [11], and Frank [17]), assumes that people are influenced by "successful" individ-

[2]As an exception to this approach, see Cole, Mailath, and Postlewaite [9], where incentives to get a higher status do not enter directly into the utility but affect the probability of getting a good matching.

[3]See also Gul and Pesendorfer [18] who consider interdependence preferences when individuals care about the intentions of those they interact with. The focus of their paper is on modelling intentions and how these intentions affect behavior of other individuals.

uals and that they eventually adopt their preferences. For an overview of this literature, see Samuelson [22]. In this approach, the meaning of "successful" is exogenously given and typically takes the form of higher monetary payoffs. The second approach for endogenous preferences is the dynamic cultural transmission framework (see Bisin and Verdier [4], Boyd and Richardson [5], and Cavalli-Sforza and Feldman [6]). This setting assumes a two stage socialization process. The first is a direct socialization, where parents try to teach their children to adopt their own cultural identity. Whenever direct socialization fails, children adopt the cultural identity of a random role model. In our approach we assume that individuals are influenced by all members of their social group regardless of their relative success, a concept which may be meaningless, for example, when choosing a meal. Our approach therefore captures social influence without introducing any strategic, altruistic, or evolutionary purpose for such an influence.

The paper is organized as follows. In section 2 we set up our model of social influence functions and establish the existence of equilibrium of behavioral preferences. In section 3 we consider different properties of social influence functions and of behavioral preferences. Section 4 presents a simple environment in which preferences are represented by a single parameter (like risk aversion) and shows under what conditions social influence makes players become more or less extreme. In section 5 we provide a direct application of our social influence setup and consider decision making by a committee. We show how different deliberation rules may affect the voting decision of the committee. Section 6 provides some concluding comments.

2 Preliminaries

We assume n individuals. Each person i has two continuous vNM utility functions on outcomes in $[a,b]$: The first utility, u_i, represents his core preferences. The second, v_i, represents his behavioral preferences.

Let $B = B_L([a,b])$ be the set of increasing and continuous real functions from $[a,b]$ onto $[0,1]$ which are Lipschitz with the same constant L. That is, for all $g \in B$ and $x, y \in [a,b]$, $|g(x) - g(y)| \leqslant L|x-y|$ (this property is called equi-Lipschitz). We assume throughout that all the functions u_i and v_i are in $B_L([a,b])$ for some given finite L. In particular, they are all 0 at a and 1 at b. We use throughout the supremum metric $d(w_1, w_2) = \sup_{x \in [a,b]} |w_1(x) - w_2(x)|$.

The behavioral preferences of individual i depend on his core preferences and on the behavioral preferences of all other individuals. Formally, the *social influence functions* are defined as

$$v_i = f_i(u_i, \mathbf{v}_{-i})$$

Where $\mathbf{v}_{-i} = (v_1, \ldots, v_{i-1}, v_{i+1}, \ldots, v_n)$. We assume that the functions f_i are continuous for every i. If $f_i(u_i, \mathbf{v}_{-i}) \equiv u_i$, then there is no social influence and individual i behaves according to his core preferences, but in general the behavioral function v_i will be different from the core utility u_i. At this point we do not put any further restrictions on the social influence function.

Definition 1 For the profile of core utilities $\mathbf{u} = (u_1, ..., u_n)$ and social influence functions $\mathbf{f} = (f_1, \ldots, f_n)$, equilibrium behavioral utilities $\mathbf{v}^*(\mathbf{u}) = (v_1^*(\mathbf{u}), ..., v_n^*(\mathbf{u}))$ are such that for every i, $v_i^*(\mathbf{u}) = f_i(u_i, \mathbf{v}_{-i}^*(\mathbf{u}))$.

In other words, a vector of behaviroal utilities is an equilibrium if when person i observes the behavioral utilities of everyone else, and given his core preferences u_i, he does not want to deviate from this behavioral utility.

For a given profile $\mathbf{u} = (u_1, ..., u_n)$ and social influence function $f_i(u_i, \mathbf{v}_{-i})$, define the following transformation:

$$\mathbf{f}(\mathbf{u}, \mathbf{v}) \equiv (f_1(u_1, \mathbf{v}_{-1}), ..., f_n(u_n, \mathbf{v}_{-n})) \in B^n$$

Claim 1 *For every profile of core utilities* $\mathbf{u}$ *there is a profile of behavioral utilities* $\mathbf{v}^*(\mathbf{u})$ *such that* $\mathbf{v}^*(\mathbf{u}) = \mathbf{f}(\mathbf{u}, \mathbf{v}^*(\mathbf{u}))$.

Proof: First note that $B = B_L([a, b])$ is a convex compact subset of $C([a, b])$, the set of continuous functions on $[a, b]$. To show this claim we use the Arzelà-Ascoli theorem (Dunford and Schwarts [12]), stating that if M is compact, then a set in $C(M)$ is conditionally compact iff it is bounded and equicontinuous. Let $M = [a, b]$ and $C(M) = B$. Equi-Lipschitz implies equicontinuity of B. The Theorem can be applied to B which is conditionaly compact. Since converging sequences of equi-Lipshitz functions converge to a Lipshitz function with the same constant, it can be shown that B is closed and convex.

Schauder-Tychonoff Theorem [12] states that if A is a compact subset of a locally convex linear topological space then every continuous mapping from A into itself has a fixed point. The mapping is continuous since the function $\mathbf{f}(\mathbf{u}, \mathbf{v})$ is continuous. ■

3 The Influence Function

Our aim in this section is to present axioms that will lead to a specific form of the influence functions: A profile of behavioral preferences of everyone but i leads to a function that depends only on the average utility of that profile, and the behavioral preferences of person i are obtained by the composition of this function with his core utility u_i. We assume throughout that for all i, $u_i(a) = v_i(a) = 0$ and $u_i(b) = v_i(b) = 1$.

3.1 The Average Profile

Symmetry Let π be a permutation of $\{1, \ldots, i-1, i+1, \ldots, n\}$ and let $\mathbf{v}^{\pi}_{-i} = (v_{\pi(1)}, \ldots, v_{\pi(i-1)}, v_{\pi(i+1)}, \ldots, v_{\pi(n)})$. Then $f_i(u_i, \mathbf{v}_{-i}) = f_i(u_i, \mathbf{v}^{\pi}_{-i})$.

In other words, person i looks for the profile of other people's behavior and does not care about who is holding these preferences. In particular, this assumption rules out the existence of gurus, or even the possibility that each person has his own reference group.

Betweenness If $f_i(u_i, \mathbf{v}_{-i}) = f_i(u_i, \mathbf{w}_{-i})$, then $f_i(u_i, \mathbf{v}_{-i}) = f_i(u_i, \frac{1}{2}\mathbf{v}_{-i} + \frac{1}{2}\mathbf{w}_{-i})$.

The meaning of this assumption is the following. Suppose that given his true utility u_i, observing the profiles $\mathbf{v}_{-i}$ and $\mathbf{w}_{-i}$ will lead decision maker i to update his behavioral preferences in the same way. Then these will also be his updated preferences if he observes $\frac{1}{2}\mathbf{v}_{-i} + \frac{1}{2}\mathbf{w}_{-i}$ which is the profile where the behavioral utility of person $j \neq i$ is $\frac{1}{2}v_j + \frac{1}{2}w_j$. The rationale for this axiom is this. The vNM utility v_j, representing the observed preferences of person j, can be defined at x as that probability for which he is indifferent between receiving x with probability 1 and the lottery $(b, v_j(x); a, 1 - v_j(x))$, paying b with probability $v_j(x)$ and a with the complementary probability. (To see why, recall that $v_j(a) = 0$ and $v_j(b) = 1$).

Suppose now that person i does not know whether person j is using v_j or w_j. In fact, he believes that there is an equal chance he is using each of them. With probability $\frac{1}{2}$ person j is indifferent between the outcome x and the lottery $(b, v_j(x); a, 1 - v_j(x))$ and with probability $\frac{1}{2}$ he is indifferent between x and $(b, w_j(x); a, 1 - w_j(x))$. Assuming the reduction of compound lotteries axiom (that is, a multi-stage lottery is indifferent to its one-stage probabilistic reduction) we obtain that

$$\left((b, v_j(x); a, 1 - v_j(x)), \tfrac{1}{2}; (b, w_j(x); a, w_j(x)), \tfrac{1}{2}\right) \sim \left(b, \tfrac{v_j(x)+w_j(x)}{2}; a, 1 - \tfrac{v_j(x)+w_j(x)}{2}\right)$$

Which means that this uncertainty is in a way equivalent to the situation where the behavioral preferences of person j are expected utility with the vNM utility $\frac{1}{2}v_i + \frac{1}{2}w_j$. A possible interpretation of the betweenness axiom is therefore that if $\mathbf{v}_{-i}$ and $\mathbf{w}_{-i}$ lead person i to the same behavioral preferences, then being unceratain about which of these two profiles is the correct one leads person i to the same behavioral preferences.

For a profile $\mathbf{v} = (v_1, \ldots, v_n)$, let $\overline{\mathbf{v}}_{-i}$ be the profile of preferences of all but i, where the preferences of person $k \neq i$ are represented by the vNM utility $\overline{v}_k = \frac{1}{n-1}\sum_{j \neq i} v_j$. That is, $\overline{\mathbf{v}}_{-i}$ is the profile of utilities of all but i, where the utility of each person $j \neq i$ is the average behavioral utility of all individuals except for i.

Claim 2 *Assume the symmetry and betweenness axioms. If* $\overline{\mathbf{v}}_{-i} = \overline{\mathbf{w}}_{-i}$, *then* $f_i(u_i, \mathbf{v}_{-i}) = f_i(u_i, \mathbf{w}_{-i})$.

Proof: The set $\{k2^{-m} : k = 0, \ldots, 2^m, m = 1, \ldots\}$ is dense in $[0, 1]$. It thus follows by betweenness and the continuity of f_i that if $f_i(u_i, \mathbf{v}_{-i}) = f_i(u_i, \mathbf{w}_{-i})$, then for all $\alpha \in [0, 1]$, $f_i(u_i, \mathbf{v}_{-i}) = f_i(u_i, \alpha\mathbf{v}_{-i} + (1 - \alpha)\mathbf{w}_{-i})$.

Assume for simplicity that $i = n$ and define $(v_1, \ldots, v_{n-1}) \approx (v'_1, \ldots, v'_{n-1})$ iff $f_n(u_n, v_1, \ldots, v_{n-1}) = f_n(u_n, v'_1, \ldots, v'_{n-1})$. Also, let $\tilde{\mathbf{v}}_j = (v_j, \ldots, v_{n-1}, v_1, \ldots, v_{j-1})$. Then by symmetry $\tilde{\mathbf{v}}_1 \approx \ldots \approx \tilde{\mathbf{v}}_{n-1}$. Let $(s_1, \ldots, s_{n-1})$, $s_1 + \ldots + s_{n-1} = 1$ stand for $\sum_{j=1}^{n-1} s_j\tilde{\mathbf{v}}_j$, and obtain as before

$$\begin{aligned}&(1, 0, \ldots, 0) \approx (0, 1, 0, \ldots, 0) \approx \ldots \approx (0, \ldots, 0, 1) \approx \\ &(\tfrac{1}{2}, \tfrac{1}{2}, 0, \ldots, 0) \approx (\tfrac{1}{3}, \tfrac{1}{3}, \tfrac{1}{3}, 0, \ldots, 0) \approx \ldots \approx (\tfrac{1}{n-1}, \ldots, \tfrac{1}{n-1})\end{aligned}$$

It thus follows that

$$f_i(u_i, \mathbf{v}_{-i}) = f_i(u_i, \overline{\mathbf{v}}_{-i}) = f_i(u_i, \overline{\mathbf{w}}_{-i}) = f_i(u_i, \mathbf{w}_{-i})$$

Hence the claim. ■

By this claim, the behavior v_i of person i is a function of his core preferences u_i and the average behavioral preferences of everyone else. This is a big simplification as the social influence function f_i is a lot easier to analyze.

3.2 Probability Equivalents

Next we offer assumptions that further restrict the nature of the functions f_i. Although what follows can be expressed in terms of preferences, it is sometimes easier to do it with representation functions. In all cases, $X, Y, Z, \ldots$ denote lotteries and $x, y, z, \ldots$ denote outcomes. By $u(X)$ we mean the expected utility of X with respect to the utility u etc. The preferences that are represented by u and v are $\succeq_u$ and $\succeq_v$. δ_x is the lottery that yields x with probability 1.

Consider two utility functions u_i and $\tilde{u}_i$, and let x and x' have the same "probability equivalences" with respect to these utilities. That is, there exists a probability p such that $u_i(x) = u_i(b, p; a, 1-p)$ and $\tilde{u}_i(x') = \tilde{u}_i(b, p; a, 1-p)$. Given a residual profile $\mathbf{v}_{-i}$ the corresponding behavioral utilities are $v_i = f_i(u_i, \mathbf{v}_{-i})$ and $\tilde{v}_i = f_i(\tilde{u}_i, \mathbf{v}_{-i})$. The next axiom assumes that x and x' still have the same probability equivalences (which may be different than before). Formally:

Influence Probability Equivalence If $u_i(x) = u_i(b, p; a, 1-p)$ and $\tilde{u}_i(x') = \tilde{u}_i(b, p; a, 1-p)$, then for every $\mathbf{v}_{-i}$, $v_i(x) = v_i(b, q; a, 1-q)$ iff $\tilde{v}_i(x') = \tilde{v}_i(b, q; a, 1-q)$, where $v_i = f_i(u_i, \mathbf{v}_{-i})$ and $\tilde{v}_i = f_i(\tilde{u}_i, \mathbf{v}_{-i})$.

Claim 3 *The influence probability equivalence assumption holds iff there exists a function* $h^i_{\mathbf{v}_{-i}} : [0, 1] \to [0, 1]$ *such that*

$$f_i(u_i, \mathbf{v}_{-i}) = h^i_{\mathbf{v}_{-i}} \circ u_i$$

That is, the core utility function u_i of person i is transformed by a function h^i which depends only on $\mathbf{v}_{-i}$, the vector of the behavioral utility functions of everyone else. Observe that this claim does not require the symmetry or the betweenness assumptions.

Proof: To simplify notation, we omit the index i throughout this proof (except for $\mathbf{v}_{-i}$). Let $u^*(x) = \frac{x-a}{b-a}$, and let $v^* = f(u^*, \mathbf{v}_{-i})$. Define $h_{\mathbf{v}_{-i}} : [0, 1] \to [0, 1]$ by

$$h_{\mathbf{v}_{-i}}(y) = v^*([b-a]y + a) \tag{1}$$

We now show that for every u, the transformed function $v = f(u, \mathbf{v}_{-i})$ is given by $v = h_{\mathbf{v}_{-i}} \circ u$. That is, we want to show that for all u and x,

$$v(x) = h_{\mathbf{v}_{-i}}(u(x)) \tag{2}$$

By definition, this holds for u^* and v^*.

Pick $x \in [a, b]$. We assumed that $u(a) = 0$ and $u(b) = 1$, hence

$$\delta_x \sim_u (b, u(x); a, 1 - u(x))$$

By the definition of u^*,

$$\begin{aligned} &\delta_{x'} \sim_{u^*} (b, u(x); a, 1 - u(x)) \iff \\ &\frac{x' - a}{b - a} = u(x) \iff \\ &x' = (b - a)u(x) + a \end{aligned} \tag{3}$$

By the Influence Probability Equivalence assumption,

$$\delta_x \sim_v (b, q; a, 1 - q) \iff \delta_{x'} \sim_{v^*} (b, q; a, 1 - q)$$

That is, $v(x) = q$ iff $v^*(x') = q$. By eq. (3), $v(x) = q$ iff $v^*([b-a]u(x)+a) = q$. By eq. (1) we get that

$$\begin{aligned} &h_{\mathbf{v}_{-i}}(u(x)) = q \iff \\ &v^*([b - a]u(x) + a) = q \iff \\ &f(u^*([b - a]u(x) + a), \mathbf{v}_{-i}) = q \iff \\ &f(u(x), \mathbf{v}_{-i}) = q \iff \\ &v(x) = q \end{aligned}$$

Since all functions are strictly increasing this implies eq. (2). ■

The results of this section are summarized by the following theorem:

Theorem 1 *Preferences satisfy the symmetry, betweenness, and influence probability equivalence iff they can be represented by* $v_i = h^i_{\mathbf{v}_{-i}} \circ u_i$.

Theorem 1 expresses the social transformation function in terms of the average behavioral preferences of the other individuals in the group. So far we've assumed that the size of the group is fixed, but the size of the influence group may matter. A conformist will probably put more weight on the behavioral preferences of others when the size of the group is larger. On the other hand, some people may ignore mass behavior and will concentrate on a small reference group. Since these effects are beyond our discussion, we just note here that the transformation function h^i may be indexed by n in order to capture the effect of the group size.

Following Theorem 1, all the information regarding the rest of the group is summarized by the average of their observed behavioral utilities. For a given n we can therefore consider the influence function as if there are two persons only, and index the adjustment rule $h^i_{\overline{\mathbf{v}}_{-i}}$ by the size of the group $n-1$.

It is important to note that even though we adopt the betweenness assumption, and therefore for every particular individual the transformation of his preferences depends only on the average behavioral preferences of the other individuals, the equilibrium behavioral preferences do depend on the distribution of core preferences (and not just on average preferences). The reason is that every individual sees a different average behavior of a different subset of individuals and therefore the distribution of the averages $\overline{\mathbf{v}}_{-i}$ does depend on the distribution of preferences and not just on the averages. The different $\mathbf{v}_{-i}$ vectors affect other members of the group and indirectly the behavioral preferences of individual i himself.

4 Does social influence make individuals more extreme?

Suppose that a person finds out that he is not alone in his core preferences which are represented by the utility u. Everyone else behaves according to this utility (recall that he can observe others' behavior, but not their core preferences). How should he react? The answer depends of course on the reason other people's behavior affects his behavior. If he wants to serve as a representative of this reference group, then the unanimity assumption of social choice theory seems appropriate. If all preferences are the same, then the social aggregator should agree with this preference relation. But the social interaction modeled here is different. Our story is of a decision maker who is uncertain what preferences he shold have. For example, if he believes that he hates risk more than other people, then when he observes that everyone he knows behaves in a way that is similar to his true preferences, his reaction may well be to become more risk averse, in the same way that a person who knows that he enjoys action movies will make sure not to miss a new 007 movie that did well in the box-office on the first weekend. Other reactions are also possible — the decision maker may become less risk averse when everyone else behaves according to his true preferences, or his updated preferences may depend on how risk averse are his true preferences.

To simplify the analysis, we assume in this section that all core and behavioral utility functions belong to a single-parameter set of functions $\mathcal{W} = \{w_\alpha : \alpha \in [0,1]\}$. For concreteness we focus on risk averse agents whose risk aversion is captured by the single parameter α, where a higher α represents a higher level of risk aversion. In order to utilize theorem 1, we assume that for all i, $\overline{\mathbf{v}}_{-i} \in \mathcal{W}$. This implies that there are w_0 and w_1 such that $\mathcal{W}$ is given by $w_\alpha = \alpha w_1 + (1-\alpha)w_0$.

Claim 4 *Let $\mathcal{W} = \{w_\alpha : 0 \leqslant \alpha \leqslant 1\}$ such that*

1. *$\forall\alpha$, $w_\alpha(0) = 0$, $w_\alpha(1) = 1$, w_α is increasing and continuous.*
2. *$\forall x$, $\alpha_n \to \alpha$ implies $w_{\alpha_n}(x) \to w_\alpha(x)$.*
3. *$\forall \alpha, \beta \in [0,1]$ and $\forall \delta \in [0,1]$, $\delta w_\alpha + (1-\delta)w_\beta \in \mathcal{W}$.*
4. *$\forall x$, $\alpha < \beta \Longrightarrow w_\alpha(x) \leqslant w_\beta(x)$.*

Then $\mathcal{W} = \{\gamma w_1 + (1-\gamma)w_0 : \gamma \in [0,1]\}$.

Proof: Suppose not. Then $\exists w \in \mathcal{W}$ and $\exists x, y \in (0,1)$ such that $w(x) = \gamma w_1(x) + (1-\gamma)w_0(x)$ and $w(y) = \gamma' w_1(y) + (1-\gamma')w_0(y)$ where $\gamma \neq \gamma'$. By the third assumption, for all (a,b) in the triangle

$$A := \triangle\{(w_1(x), w_1(y)),\ (w_0(x), w_0(y)),\ (w(x), w(y))\}$$

there is $\tilde{w} \in \mathcal{W}$ such that $\tilde{w}(x) = a$ and $\tilde{w}(y) = b$. But then

$$A \subset \{(w_\alpha(x), w_\alpha(y))\}$$

a contradiction, as $\{(w_\alpha(x), w_\alpha(y))\}$ is a continuous mapping of $[0,1]$ into $\Re^2$. ■

In the sequel, we assume that $w_\alpha = \alpha w_1 + (1-\alpha)w_0$ (and not, for example, that $w_\alpha = \sqrt{\alpha}w_1 + (1-\sqrt{\alpha})w_0$). In particular, if for all j, $v_j = \beta_j w_1 + (1-\beta_j)w_0$, then $\overline{\mathbf{v}}_{-i} = \overline{\boldsymbol{\beta}}_{j\neq i} w_1 + (1-\overline{\boldsymbol{\beta}}_{j\neq i})w_0$, where $\overline{\boldsymbol{\beta}}_{j\neq i} = \frac{1}{n-1}\sum_{j\neq i}\beta_j$.

The above analysis describes an adjustment rule where for each person, his core α_i is transformed by the observed profile $\boldsymbol{\beta}_{-i}$ of the other individuals into a new parameter β_i. Formally, $\beta_i = \tilde{g}^i(\alpha_i, \boldsymbol{\beta}_{-i})$ which by claim 2 and the previous argument equals $g^i(\alpha_i, \overline{\boldsymbol{\beta}}_{j\neq i})$. Such a function can be represented as in Theorem 1, as we can define $h_\beta : [0,1] \to [0,1]$ by $h_\beta(\alpha) = g(\alpha, \beta)$. Our present analysis is therefore consistent with the structure of the previous section.

We suggest two assumptions regarding the adjustment rules. *1.* When his true preferences become more risk averse, the decision maker's behavior will become more risk averse (that is, $g_1 = \frac{\partial g}{\partial \alpha} > 0$); and *2.* When the average of the observed preferences of the others becomes more risk averse, the decision maker's behavior will not become less risk averse (hence $g_2 = \frac{\partial g}{\partial \beta} \geqslant 0$). We also assume that $g_2 < 1$. This assumption needs some clarification. When $\mathcal{W}$ is a general parameterized set, the index α is purely ordinal and no information beyond its sign can be deduced from the derivative with respect to it. But in our structure, where $u_\alpha = \alpha w_1 + (1-\alpha) w_0$, α has some cardinal properties, and therefore the magnitude of derivatives with respect to it are also meaningful. The assumption $g_2 < 1$ means that when the average of the behavioral functions of all other players moves ε in the direction of w_1 of w_0, the behavioral function of i will move by less than ε in the same direction.

Given the adjustment rules $\beta_i = g^i(\alpha_i, \overline{\boldsymbol{\beta}}_{j\neq i})$, $i = 1, \ldots, n$, an equilibrium is a vector $(\beta_1, \ldots, \beta_n)$ solving

$$\beta_i = g^i(\alpha_i, \overline{\boldsymbol{\beta}}_{j\neq i}), \quad i = 1, \ldots, n \tag{4}$$

This equilibrium is depicted in fig. 1 for the case $n = 2$. Curve A represents the value of β_1 as the response of person 1 to possible observed values β_2 of person 2, and curve B represents the response of person 2 to β_1. The equilibrium point is r.

Claim 5 *The equilibrium point of eq. (4) is uniqe.*

Proof: Suppose that for a given vector $\boldsymbol{\alpha}$ there are two different equilibrium vectors $\boldsymbol{\beta}$ and $\boldsymbol{\beta}'$. There is j^* such that $|\beta'_{j^*} - \beta_{j^*}| \geqslant |\overline{\boldsymbol{\beta}}'_{j\neq j^*} - \overline{\boldsymbol{\beta}}_{j\neq j^*}|$. To see why, observe that $\overline{\boldsymbol{\beta}}'_{j\neq j^*} - \overline{\boldsymbol{\beta}}_{j\neq j^*} = \frac{1}{n-1}\sum_{j\neq j^*}[\beta'_j - \beta_j]$. If $\overline{\boldsymbol{\beta}}'_{j\neq j^*} > \overline{\boldsymbol{\beta}}_{j\neq j^*}$, then there is j^* such that $\beta'_{j^*} - \beta_{j^*} \geqslant \overline{\boldsymbol{\beta}}'_{j\neq j^*} - \overline{\boldsymbol{\beta}}_{j\neq j^*}$, and if $\overline{\boldsymbol{\beta}}'_{j\neq j^*} < \overline{\boldsymbol{\beta}}_{j\neq j^*}$, then there is j^* such that $\beta'_{j^*} - \beta_{j^*} \leqslant \overline{\boldsymbol{\beta}}'_{j\neq j^*} - \overline{\boldsymbol{\beta}}_{j\neq j^*}$. The adjustment rule for persion j^* stands in contradiction to the assumption that $g_2 < 1$, since $\beta'_{j^*} - \beta_{j^*} = g(\alpha_{j^*}, \overline{\boldsymbol{\beta}}'_{j\neq j^*}) - g(\alpha_{j^*}, \overline{\boldsymbol{\beta}}_{j\neq j^*})$. ■

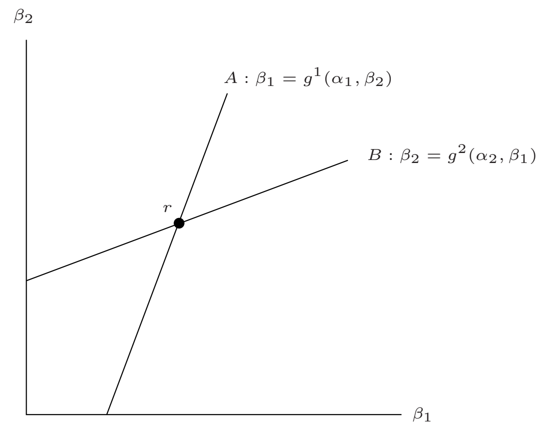

Figure 1: Equilibrium

We now analyze some specific situations in order to get a better insight into the nature of the function g.

4.1 Identical Agents

We say that two agents are identical if they have the same social influence function and the same core preferences. Our assumptions imply that two identical agents will have the same behavioral preferences. For example, if $\alpha_i = \alpha_j$ but $\beta_i > \beta_j$, then by the assumption that $g_2 \geqslant 0$ it follows that $\beta_j = g(\alpha, \frac{1}{n-1}(\beta_i + \sum_{k \neq i,j} \beta_k)) \geqslant g(\alpha, \frac{1}{n-1}(\beta_j + \sum_{k \neq i,j} \beta_k)) = \beta_i$, a contradiction.

Define $G(\alpha)$ to be the behavioral equilibrium when all agents' core preferences are α, that is, $G(\alpha)$ satisfies

$$G(\alpha) = g(\alpha, G(\alpha)) \tag{5}$$

(Recall that when each of the other $n-1$ behavioral index is $G(\alpha)$, then so is the average of these indexes). The properties of g at the point (α, α) determine the location of $G(\alpha)$, above or below α. If $g(\alpha, \alpha) = \alpha$, then so is $G(\alpha)$. That is, if for each player i, the fact that the average behavioral index of all others is identical to his core preferences does not push him to deviate from these core preferences, then in equilibrium all players will use their core preferences. Otherwise,

Claim 6 *$G(\alpha) \gtreqless \alpha$ iff $g(\alpha, \alpha) \gtreqless \alpha$.*

Proof: Suppose that $g(\alpha,\alpha) > \alpha$ but $G(\alpha) < \alpha$. Since $g_2 < 1$, it follows that

$$\beta < \alpha \Longrightarrow g(\alpha,\beta) > \beta \tag{6}$$

Otherwise, if $g(\alpha,\beta) \leqslant \beta$, we get that $g(\alpha,\alpha) - g(\alpha,\beta) > \alpha - \beta$. Note that since $G(\alpha)$ is an equilibrium, it follows as in eq. (5) that $G(\alpha) = g(\alpha, G(\alpha))$. Since $G(\alpha) < \alpha$ we get by eq. (6) that $g(\alpha, G(\alpha)) > G(\alpha)$, a contradiction. Moreover, if $G(\alpha) = \alpha$, the equation $G(\alpha) = g(\alpha, G(\alpha))$ contradicts the assumption $g(\alpha,\alpha) > \alpha$.

Similarly, if $g(\alpha,\alpha) < \alpha$, $G(\alpha)$ cannot be above α , and it must be strictly below it. ■

4.2 Same Influence Functions, Different Core Preferences

We now turn to discuss the assymetric case in which agents have different core prefereces. First, we show that the influence process does not reverse the order of the agents' risk aversion. That is, if the core preferences of person j are more risk averse than those of person i, then he will also behave in a more risk averse pattern. Formally:

Claim 7 The vectors $\boldsymbol{\beta}$ and $\boldsymbol{\alpha}$ are comonotonic. That is, for all i, j, $(\alpha_i - \alpha_j)(\beta_i - \beta_j) \geqslant 0$.

Proof: Suppose, for example, that $\alpha_i < \alpha_j$ but $\beta_j < \beta_i$. Then, since $g_1, g_2 > 0$,

$$\beta_i = g(\alpha_i, \tfrac{1}{n-1}(\beta_j + \textstyle\sum_{k\neq i,j}\beta_k)) < g(\alpha_j, \tfrac{1}{n-1}(\beta_i + \textstyle\sum_{k\neq i,j}\beta_k)) = \beta_j$$

A contradiction. ■

We want to show that it cannot be the case that the less risk averse agents will become even less risk averse while the more risk averse agents will move in the opposite direction. This follows from the stronger claim 8 below.

Definition 2 The social influence makes agents i and j more extreme if $\alpha_i < \alpha_j$ and $\beta_i < \alpha_i$ while $\alpha_j < \beta_j$.

We now show that it is never the case that two agents will move away from each other. Formally:

Claim 8 It is never the case that the social influence makes agents i and j more extreme.

Proof: Consider the two profiles $\boldsymbol{\alpha} = (\alpha_1, \ldots, \alpha_n)$ and $\boldsymbol{\alpha'} = (\alpha'_1, \ldots, \alpha'_n)$ together with the corresponding behaviral profiles $\boldsymbol{\beta} = (\beta_1, \ldots, \beta_n)$ and $\boldsymbol{\beta'} = (\beta'_1, \ldots, \beta'_n)$, where

1. For $k \neq i, j$, $\alpha_k = \alpha'_k$ and $\beta_k = \beta'_i$,
2. $\alpha'_i = \alpha'_j = \alpha^*$ and $\beta'_i = \beta'_j = \beta^* := \frac{\beta_i + \beta_j}{2}$,
3. α^* is chosen such that $\beta^* = g(\alpha^*, \frac{1}{n-1}[\sum_{k \neq i,j} \beta_k + \beta^*])$.

The existence of α^* is guaranteed by continuity and monotonicity. The profile $\boldsymbol{\beta'}$ corresponds to $\boldsymbol{\alpha'}$ because for $k \neq i, j$, his core preferences are the same and the average behavioral coeeficients of everyone else is the same in both profiles.

Suppose first that $\beta^* \geqslant \alpha^*$ and that $\alpha_i \leqslant \alpha^* \leqslant \alpha_j$. Since $0 < g_1 \leqslant 1$ and $g_2 \geqslant 0$,

$$
\begin{aligned}
&g(\alpha_i, \tfrac{1}{n-1} \textstyle\sum_{k \neq i} \beta_k) \geqslant \\
&g(\alpha_i, \tfrac{1}{n-1}[\textstyle\sum_{k \neq i,j} \beta_k + \beta^*]) \geqslant \\
&g(\alpha^*, \tfrac{1}{n-1}[\textstyle\sum_{k \neq i,j} \beta_k + \beta^*]) - [\alpha^* - \alpha_i] = \\
&\beta^* - [\alpha^* - \alpha_i] \geqslant \alpha_i
\end{aligned}
$$

The proof of the case $\beta^* < \alpha^*$ is similar. ■

Suppose that $\alpha_1 \leqslant \ldots \leqslant \alpha_n$. By claim 8, there are three possible types of equilibria:

1. For all i, $\alpha_i \leqslant \beta_i$
2. For all i, $\alpha_i \geqslant \beta_i$
3. For all $i \leqslant i^*$, $\alpha_i \leqslant \beta_i$, for all $i > i^*$, $\alpha_i \geqslant \beta_i$.

We cannot give exact conditions for each of the three types to emerge, but some sufficient conditions follow. First, by claim 6, if for all α, $g(\alpha, \alpha) > \alpha$ and all agents have the same core preferences α, then they will all have the same behaviroal preferences $\beta > \alpha$. If for a sufficient small ε, $\overline{\alpha} - \varepsilon \leqslant \alpha_1 <$

$\ldots < \alpha_n \leqslant \overline{\alpha} + \varepsilon$, then by claim 7 and continuity, $\alpha_n < \beta_1 < \ldots < \beta_n$ (case 1 above). Case 2 is likewise obtained when for all α, $g(\alpha, \alpha) < \alpha$.

If, when the average of the observed behavior of everyone else and the decision maker's core preference coincide the decision maker behaves according to his core preferences, then the equilibrim (for all distributions of core preferences) is of the third type. This follows by the fact that if $g(\alpha, \alpha) \equiv \alpha$, then when $\alpha_1 \leqslant \ldots \leqslant \alpha_n$, $\beta_1 \geqslant \alpha_1$ and $\beta_n \leqslant \alpha_n$. To see why this is the case, denote $\hat{\beta} = \frac{1}{n-1} \sum_{i>1} \beta_i$. By claim 7, $\beta_1 \leqslant \beta_i$ for all $i \geqslant 2$, hence $\alpha_1 \leqslant \hat{\beta}$. By Claim 2, the behavioral preferences of person 1 are the same if the behavioral preferences of all other individuals are replaced by $\hat{\beta}$. But $g_2 \geqslant 0$, $\alpha_1 = g(\alpha_1, \alpha_1) \leqslant g(\alpha_1, \hat{\beta}) = \beta_1$. The proof for the case $\beta_n \leqslant \alpha_n$ is similar.

5 Application: Committee Deliberation

In this section we offer an application of our approach to the analysis of deliberation by committees or juries. Starting from Condorcet [10] there are numerous studies on decision making by committees, but the focus of this literature has been on the importance of pre-voting debates and deliberation on information aggregation. Given that committee members have different goals and preferences, this literature considers the incentives they have to reveal their private information or to acquire information (for a recent survey of this literature see Li and Suen [21]). However, efforts to convince and to persuade others are not done only by providing new information, but also by efforts to change others' preferences regarding the subject being deliberated.

Consider a committee that needs to vote on a certain issue, but prior to voting there is a deliberation stage. During this stage committee members explain, argue, and try to convince and influence each other. The effect of deliberation can be captured by our social influence procedure where each individual votes according to his behavioral preferences which depend on his core preferences and the behavioral preferences of committee members that participate in the deliberation.

Committees may have different voting and deliberation procedures. In some cases members do not have to express their opinion before the voting stage, i.e., they may choose only to listen without expressing their opinion. Or the rules may be that members must explain their decision (e.g., judges that sit together on the bench). There are committees in which members do not have to attend meetings — they may just send their written ballots or they may even decide not to vote at all. Voting can be done simultaneously or sequentially (and in a different order). Adopting our setup the different procedures may affect the formation of the behavioral preferences and therefore the outcome of the committee's voting.

Consider for example an investment committee that needs to vote on accepting or rejecting different investment projects. Suppose that before the voting there is a deliberation stage. While each committee member has his own preferences, they may be affected by the deliberation process. We consider the case in which all the information regarding the investment projects is known to all and the deliberation is only about influencing the preferences and the voting of committee members. Using our framework we can compare decisions that are made by a committee that vote without deliberation, where members vote according to their core preferences, and committees that vote after a deliberation where behavioral preferences are formed as a result of social influence. One can compare the voting of a committees in which all members deliberate with committees with limited or partial deliberation or use our setup and discuss the implication of a sequential procedure in which there is a specific order and committee members explain their opinion one by one and vote.

To illustrate this point suppose that an investment committee consisting of three members needs to vote on whether to accept or reject risky projects. We consider two possible voting procedures. The first is a majority rule in which a project is accepted only when the majority of the committee vote to accept it. The second is a unanimous rule in which a project is accepted only when all committee members approve it. As before, risk aversion is captured by a single parameter: α (for the core preferences) and β (for the behavioral preferences). Higher values of α and β imply higher levels of risk aversion. Each new project is characterized by a risk index γ such that individuals with $\beta \leqslant \gamma$ vote to accept the project and those with $\beta > \gamma$ reject it. A higher γ implies that the project is less risky and that individuals with a higher risk aversion would still vote to accept it.

Suppose that the core preferences are given by $\alpha_1 < \alpha_2 < \alpha_3$ with the behavioral preferences $\beta_1, \beta_2, \beta_3$. As we show below, different types of social interaction may affect the formation of these behavioral preferences.

Denote by $\gamma_m^*(\beta_1, \beta_2, \beta_3)$ and $\gamma_u^*(\beta_1, \beta_2, \beta_3)$ the critical risk indeces under the majority and the unanimity rules such that all projects characterized by values of γ higher than these values will be accepted by the different rules. Clearly, $\gamma_m^* \leqslant \gamma_u^*$, as there are less projects that would be acceptable under the unanimity rule.

We start by comparing two cases. The first one is when there is no deliberation and voting is according to the core preferences (i.e., when $\beta_i = \alpha_i$). The second is when there is a deliberation by all committee members and behavioral preferences are formed in the way we described in Section 4. By claim 7, $\beta_1 < \beta_2 < \beta_3$, therefore $\gamma_m^*(\beta_1, \beta_2, \beta_3) = \beta_2$ and $\gamma_u^*(\beta_1, \beta_2, \beta_3) = \beta_3$.

In order to simplify our analysis we assume that the social influence is such that $g(\alpha, \alpha) = \alpha$ which means that when the core preferences and the average behavioral preferences of other individuals are the same, then so are the resulting behavioral preferences. As we show in the discussion following claim 8, under this assumption equilibrium behavioral preferences move towards the average such that $\beta_1 > \alpha_1$, $\beta_3 < \alpha_3$, but the relationship between β_2 and α_2 is unclear. We can therefore conclude that if a committee employs the unanimity rule then $\gamma_u^*(\beta_1, \beta_2, \beta_3) < \gamma_u^*(\alpha_1, \alpha_2, \alpha_3)$, which implies that as a result of deliberation and social influence there is a larger set of projects that will be acceptable by the committee. However, if a committee uses the majority rule then the effect of deliberation is unclear as both $\beta_2 > \alpha_2$ and $\beta_2 < \alpha_2$ are possible.[4]

Consider now the case in which one of the committee members, person i, does not take part in the deliberation stage, sending his vote according to his core preferences, while the other two members communicate with each other. We continue to assume that $g(\alpha, \alpha) = \alpha$ and denote the behavioral preferences of person j by β_j^i. The analysis of this situation depends on the identify of the non-participating individual i.[5]

Claim 9 *1. If person 1 does not participate in the deliberation, then* $\beta_2^1 >$

[4]If $g(\alpha, \alpha) \neq \alpha$, then social influence may imply that for all i, $\beta_i < \alpha_i$, in which case under both majority and unanimity rules the set of acceptable projects becomes larger. Similarly, if for all i $\beta_i > \alpha_i$, then the set of acceptable projects declines for both the unanimous and the majority rule.

[5]When a committee member does not participate in the deliberation he is not part of the social influence procedure and the second variable of the function $g(\cdot, \cdot)$ is computed with respect to the interaction between the remaining two committee members. Note that our setup assumes for simplicity that g depends on one's core preferences and the average behavioral preferences of the rest without specifying how many other individuals there are in the influence group. One can modify this assumption by indexing the g function according to the number of individuals in the influence group. This would be a natural extension of our setup, but the analysis of this section does not assume this added flexibility.

β_2 and $\beta_3^1 > \beta_3$. Hence both unanimity and majority rules will accept less projects than the case in which all members participate in the deliberation.

2. *If player 3 does not participate, then $\beta_3^3 = \alpha_3 > \beta_3$ while $\beta_2 > \beta_2^3$ and $\beta_1 > \beta_1^3$. Hence the unanimity rule will accept less projects than the case of full deliberation while the majority rule will accept more projects.*[6]

Proof: If $\beta_2 \leqslant \alpha_2$, then $\beta_2^1 > \alpha_2 > \beta_2$. Suppose that $\beta_2 > \beta_2^1 > \alpha_2$. Since $\beta_1 < \beta_3$,

$$\begin{aligned}
&\beta_2 = g(\alpha_2, \tfrac{1}{2}[\beta_1 + \beta_3]) > \beta_2^1 = g(\alpha_2, \beta_3^1) \Longrightarrow \\
&\tfrac{1}{2}[\beta_1 + \beta_3] > \beta_3^1 \Longrightarrow \\
&\beta_3 > \beta_3^1
\end{aligned}$$

Also, since $g_2 < 1$,

$$\left.\begin{aligned}
&\beta_2 = g(\alpha_2, \tfrac{1}{2}[\beta_1 + \beta_3]) > \\
&\beta_2^1 = g(\alpha_2, \beta_3^1)
\end{aligned}\right\} \Longrightarrow$$
$$\beta_2 - \beta_2^1 < \tfrac{1}{2}[\beta_1 + \beta_3] - \beta_3^1 \tag{7}$$

Similarly,

$$\left.\begin{aligned}
&\beta_3 = g(\alpha_3, \tfrac{1}{2}[\beta_1 + \beta_2]) > \\
&\beta_3^1 = g(\alpha_3, \beta_2^1)
\end{aligned}\right\} \Longrightarrow$$
$$\beta_3 - \beta_3^1 < \tfrac{1}{2}[\beta_1 + \beta_2] - \beta_2^1 \tag{8}$$

Combining inequalities (7) and (8) together and recalling that $\beta_1 < \beta_2$, we get

$$\begin{aligned}
&2\beta_3 - 2\beta_3^1 < \beta_1 + \beta_2 - 2\beta_2^1 < 2\beta_2 - 2\beta_2^1 < \beta_1 + \beta_3 - 2\beta_3^1 \Longrightarrow \\
&\beta_3 < \beta_1
\end{aligned}$$

[6] The case where person 2 does not participate is more involved and the analysis depends on whether β_2 is above or below the average of β_1 and β_3.

A contradiction, hence $\beta_2^1 > \beta_2$. And since $\beta_1 < \beta_2$, it follows that $\beta_2^1 > \frac{1}{2}[\beta_1 + \beta_2]$, hence $\beta_3^1 > \beta_3$.

The proof that if person 3 does not participate then $\beta_3^3 = \alpha_3 > \beta_3$, while $\beta_2 > \beta_2^3$ and $\beta_1 > \beta_1^3$ is similar. ■

In the above analysis we allowed one of the committee members not to participate in the deliberation stage so he is not influenced by other committee members nor does he influence them. We can use similar approaches to discuss other situations, for example when all committee members show up for the deliberation stage but one (or some) of them do not express their opinion or reveal their preferences. In this case these individuals do not influence the preferences of other committee members but they are influenced by them.

Our setup does not consider strategic motives during deliberations. Such considerations take us beyond the scope of this paper.

6 Discussion and Concluding Comments

The approach taken in this paper is that humans are social animals that keep interacting with one another. The interaction does not affect only payoffs but also preferences. We depart from the approach that takes humans as given with fixed preferences and adopt a framework in which preference changes depend on social interaction and social influence. Our approach tries to capture the effect of social interaction on preferences and behavior without introducing any strategic or evolutionary purpose for such an influence.

There are two important assumptions in the our setup: symmetry and observability. One can extend our setup and consider a model in which each individual is affected only by a subset of individuals. This can be captured by mapping the details of social influence into a directed social net- work such there is a directed link between player i and j only if player i affects the preferences of player j. We can go further and assume that the weight of each link in the sphere of social influence is different. The social influence equilibrium for this case can be defined in the same way as in Definition 1 while restricting the formation of behavioral preferences to the specific structure of the weighted directed network. The sensitivity of the distribution of behavioral preferences to the structure of the social network is potentially interestings.

Our second assumption of full observability can also be modified. One can assume that individuals have beliefs about the behavioral preferences of other individuals and they update those beliefs whenever they observe behavior. The influence function is then defined as a function of one's core preferences and his beliefs about the preferences of others.

Finally, our social influence approach may give rise to a dynamic model of preferences evolution. Individual preferences evolve over time depending on the preferences of the individuals they interact with. The evolution can also be with respect to the core preferences, and they too may change over time. In such a model preferences may reflect the history of social interaction of individuals.

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