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AN ORGANIZATION THAT TRANSMITS OPINION TO NEWCOMERS

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An organization that transmits opinion to newcomers

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Abstract

We aim to identify the conditions under which social influence enables emergence of a shared opinion orientation among members of an organization over time, when membership is subject to continuous but partial turnover. We study an intra-organizational advice network that channels social influence over time, with a flow of joiners and leavers at regular intervals. We have been particularly inspired by a study of the Commercial Court of Paris, a judicial institution whose members are peer-elected businesspeople and are partly replaced every year.

We develop an agent-based simulation of advice network evolution which incorporates a model of opinion dynamics based on a refinement of Deffuant's "relative agreement", combining opinion with a measure of "uncertainty" or openness to social influence. We focus on the effects on opinion of three factors, namely criteria for advisor selection, duration of membership in the organization, and new members' uncertainty.

We show that criteria for interlocutor choice matter: a shared opinion is sustained over time if members select colleagues at least as experienced as themselves. Convergence of opinions appears in other configurations too, but the impact of initial opinion fades in time. Duration has an impact to the extent that the longer the time spent in the group, the stronger the possibility for convergence towards a common opinion. Finally, higher uncertainty reinforces convergence while lower uncertainty leads to coexistence of multiple opinions.

Keywords: social influence, advice networks, intra-organizational networks, opinion dynamics, agent-based simulation.

1 Introduction

With this paper, we aim to identify the conditions that allow persistence of a shared opinion orientation between members of an organization over time, under the assumption that one fraction of membership is renewed at regular intervals. Such continuous, but partial turnover characterizes many firms that renew part of their workforce every year because some of their employees retire (or move to another job) and need to be replaced by new recruits. It also applies to political councils, assemblies, or boards where members have a fixed-term mandate and are nominated or elected at different times, thereby generating flows of entry and exit of an equal number of members. Sharing and transmission of "opinion" —a term that we take, very broadly, to designate any norm, value, representation, practice, or aspect of organizational culture that might be subject to social influence — can be expected to take place extensively as members interact with one another; agreed opinions, especially in reference to common activities, help members orient their behaviors. The opinions we focus on are not those aspects of organizational culture and values that are formal, codified and explicitly communicated to members; rather, we are interested in the possible emergence of shared views through informal advice ties in cases in which formal structure and rules leave some room for discretion. This possibility is all the more likely in the case of knowledge-intensive organizations that thrive on innovation and are frequently confronted with new challenges for which there is no established solution, so that only advice-seeking and internal discussion may provide some guidance. It may also apply to communities of practice, where heavy reliance on advice and information exchanges accompanies limited formal structure. Be that as it may, over time and with changing membership composition, persistence of a non-codified opinion in an organization depends crucially on the (informal) process of social influence through which it is passed on to new members; in principle, divergences and polarization around different views may eventually appear.

Our reflection on this topic has been originally inspired by the real case of the Commercial Court of Paris, a judicial institution in charge of a large proportion of business litigation and bankruptcy cases in France, whose members are not career magistrates but peer-elected businesspeople acting as unpaid volunteers, and are partly replaced every year —with a turnover of about 10% (Lazega and Mounier, 2003; Falconi et al., 2005; Rouchier et al., 2007; Rouchier and Tubaro, 2010). This organization is of particular interest as it is an example of "joint regulation" of markets, integrating representatives of the private sector with the public sector.

Exchanges of information and knowledge between judges are crucial to the life of the Court, which thrives on its capacity to pool knowledge and expertise from members' diverse professional and educational backgrounds. Our previous paper (Rouchier and Tubaro, 2010) focused on the dynamics of the advice networks through which information circulates between them, and endeavored to reproduce an empirically observed correlation between members' approach to judging and tenure in the institu-

tion: indeed those who have been members for a longer period of time tend to share a more tolerant view of how to judge than juniors and newcomers. Two hypotheses can be made to explain this observation: either individuals learn in time that being tolerant is better to judge fairly or efficiently, or the influence of other members of the group induces a change in point of view. The general organization of the Court with its intense advice-seeking activity supports the latter hypothesis and makes it particularly interesting to investigate: for this reason, we focused on it in our research. We provided evidence that the hierarchy of the Court which distinguishes seniors and those who hold formal responsibilities from juniors and low-status judges, shapes advice relationships and ultimately produces a shared "opinion", or general orientation on how to judge, which reproduces itself over time.

More precisely, the agent-based model with which we first studied this process initialized senior agents with a given, uniform opinion and let the system evolve over time with entry and exit of an equal number of members at each step. We considered different criteria for advisor selection and studied their implications on opinion-sharing. We found that despite heterogeneities at the moment of joining, in many cases few time steps were enough for social influence to operate, so as to align all agents on the same opinion. In addition under some conditions, this opinion was shown to remain remarkably stable over time, persisting for many years after the departure of those agents who initially held it (Rouchier and Tubaro, 2010). In this sense the agent-based computer simulation in combination with fieldwork data, contributed to better understand the social dynamics that generated these data. Though interesting in itself, this result could not be generalized as it was, because of the complexity of the model: indeed to ensure good fit with empirical data, we included constraints that reproduced the particular structure of the Court, especially annual rotation of judges from one Chamber to another and existence of hierarchy and formal roles such as Presidents of Chambers.

The present paper sets out to investigate the conditions under which the persistence of opinion observed at the Court can be found in a wider range of organizations or bodies with regular flows of entry and exit of members. Specifically, we generalize our work by relaxing the original constraints and removing hierarchical structure, rotation rule, and formal roles. We thereby endeavor to account for organizations with changing composition independently of their specific functioning rules and organizational chains. The element we keep from the previous version is the communication structure, here defined through criteria for advisor selection. We present here the resulting models: several versions of the same structure with differing rules defining the possible forms of interlocutor selection. Once basic properties are established, we also test the level to which variations in the flow of entry and exit of members (or equivalently, changes in the duration of membership in the organization) affect opinion transmission and persistence. Finally, we explore the extent to which results are sensitive to newcomers' openness to social influence. Our findings identify combinations of conditions under which newcomers gradually come to adopt an opinion that they subsequently transmit

to more junior agents through social influence, in a very general setting. Possible future applications to real-world cases other than the Commercial Court include firms that renew part of their workforce every year, political councils and other organizations with membership turnover and also, tentatively, more informal groups such as discussion forums on the Internet.

That these organizations and bodies may indeed exhibit similar properties in terms of social influence and shared opinion formation, is due to the fact that flows of newcomers and leavers contribute to differentiating the roles and positions of senior and junior members, thereby establishing an implicit hierarchy related to tenure in the group. This is a general property that is due to turnover only and holds independently of the extent to which the hierarchy of the organization, if any, is based on seniority. The sociological and organizational literature has highlighted that the socialization process through which a new member acquires the knowledge necessary to participate in collective activities is often mediated by interactions with more experienced members (Comer, 1991; Settoon and Adkins, 1997; Slaughter and Zickar, 2006). It is well acknowledged that advice from seniors to juniors may transmit not only specialized information and knowledge but also agreed attitudes, beliefs and values (Hill and Carley, 2008; Morrison, 2002), to which members refer in their common activities, both internally and in relation to external stakeholders (Pettigrew, 1979; Schein, 1990; Martin, 1992). This literature, however, studies these processes mostly empirically with emphasis on specific case studies, rather than with abstract, generally applicable models as we intend to do in this work.

To ensure tractability together with generality, we adopt a deliberately simplified representaition of opinion that leaves aside the multi-dimensionality of newcomers' socialization, the relationship between formality and informality, the specific contents that members discuss. We interpret opinion in the broad sense of a shared understanding on a matter that is relevant for the organization's activities, and on which members have some degree of discretion. We focus on how opinion can be transmitted from existing members to new ones, so as to be sustained in the long run. This definition stresses the potential durability of an opinion and its possible acceptance by the whole membership, while allowing for minor variations at individual level.

The remainder of the paper is organized as follows. Section 2 discusses the agent-based modeling literature that studies the apparition of conformity or, on the opposite, of the definitive separation of opinions or cultures. The following section 3 presents our research questions and hypotheses in detail. Subsequently, we describe our model, tested with different types of internal network formation rules for agents. Section 4 illustrates the dynamics of the model and, with the help of a sensitivity analysis, defines the limits within which the property of interest holds. In the final section, we discuss our model by comparing it to the results of other researchers, and we conclude.

2 Approaches to diffusion of opinion

Our work builds on previous results obtained with agent-based models of social influence and opinion dynamics. A milestone in this literature is an article by Robert Axelrod (Axelrod, 1997). He adopts a broader approach with focus on culture rather than opinion, and defines it generally as the set of individual attributes that are subject to social influence ("Culture is what social influence influences"); accordingly, he adopts a multi-dimensional representation of culture as a string of features (dimensions) with a number of possible traits (values) in each feature. Initial traits are attributed at random for each agent in a population. At each step, a randomly selected agent will change one of its features by adopting the trait of a randomly chosen neighbor, with a probability equal to their "cultural similarity", i.e. the number of shared traits; as a result, their similarity increases. On this basis, Axelrod shows that separate "regions" (or areas within which all traits are equal) tend to emerge, in parallel with a correlation among different traits that stabilize so as to form THE culture of a whole region. Extensions of this model make the probability of interaction between two neighbors dependent on factors other than similarity (Kennedy, 1998; Parisi et al., 2003). These models have been mostly applied to problems involving large populations of agents, for which a multi-faceted definition of culture is appropriate: for instance social cleavages, ethnic segregation, and spread of languages.

Contrary to Axelrod's approach, opinion dynamics models tend to represent social influence as a scalar variable rather than a n-dimensional vector. There are two broad families of one-dimensional models: those that represent the attribute that is subject to influence as a binary variable (see e.g. (Galam et al., 1982; Galam and Moscovici, 1991)), and those that allow for a continuous representation, with two opposite positions and a continuous range of intermediate values between them ((Deffuant et al., 2001, 2002; Hegselmann and Krause, 2002)). The latter models allow individual positions to vary smoothly between extremes; thus nuances can be accounted for, and the modeler can define a notion of "distance" between two different positions, measuring the extent to which they are close to each other but without requiring them to be identical. These models have often been used to study the conditions that allow emergence of extremisms rather than moderation in political opinion.

Among the continuous models, the "relative agreement" model (Deffuant et al., 2002) has been widely used in the agent-based literature since it was first proposed, and a number of theoretical results have already been found and accumulated. A detailed presentation of it is outside the scope of this paper, but its basic principles are worth mentioning. The model is based on two continuous variables representing, respectively, a value of opinion in the acceptable range, and a measure of "uncertainty", or openness to influence by others (which can also be interpreted as lack of individual self-confidence). Each agent in a model is endowed with an opinion and an uncertainty, and can be influenced by another only if their opinions are not too

far apart, more precisely, if the distance between them is lower than the uncertainty, which acts as a threshold. If there is influence, an agent changes both its opinion and its uncertainty. The mechanism is relative in the sense that an agent will be more strongly influenced if its partner is more self-confident/less uncertain than itself; relativity makes the mechanism non-symmetric.

To ascertain the extent to which the social influence dynamics leads to consensus or to formation of separate sub-groups with differing understandings, it is necessary to identify clusters of individuals who share similar, though not necessarily identical, views. A method outlined by Deffuant (Deffuant, 2006) consists in defining a minimum distance between the opinions of two agents, below which they are said to belong to the same cluster. The clusters are computed as sub-groups of agents such that between any couple of agents in the sub-group, the distance is below the minimum. Within this framework, emergence of one cluster corresponds to consensus of all agents around a common view, while two or more clusters will indicate fragmentation into sub-groups within which members tend to think alike, while divergences between sub-groups are insurmountable. This method has the advantage of relying solely on endogenous criteria for the definition of clusters, without requiring the modeller to arbitrarily specify reference values of opinion.

For the purposes of our paper, it seems appropriate to refer to approaches that represent social influence on one dimension only. Indeed models derived from Axelrod's are little suited to represent relatively small groups and organizations as the Commercial Court —which is composed of about 150 judges. In such cases, social influence is more likely to concern a small number of features closely related to common activities, rather than culture in its multiple dimensions. Among one-dimensional models, continuous representations are better suited to our case study than binary representations. Continuous models enable the researcher to detect, and account for, variations and discrepancies in agents' views even when they are small, and allow interpreting social influence as a process that gradually unfolds over time. In particular, Deffuant's relative agreement approach is a most promising starting point for our research. By making influence non-symmetric, it allows for an appropriate treatment of differences that may arise in an organization with changing composition, particularly between juniors and seniors.

Hence, our work remains close to the literature on opinion dynamics with continuous representations, inspired by Deffuant's work. [1] The main difference is the particular structure of the population we focus on, with fixed size but changing composition. Another difference is that we consider groups of relatively limited size rather than entire populations, unlike most of the literature. Finally, our particular context suggests the need to take into account the cognitive factors that likely inform social influence in an organization, where opinion is transmitted as a result of com-

[1] This is the main reason why we adopt the term "opinion" which, despite having a possible interpretation in reference to organizations, is less commonly found in the organizational literature than in the political opinion-related works of Deffuant and followers.

plex processes of knowledge-sharing and advice-seeking. Hence, we do not limit our study to complete networks or fixed neighbourhoods, as is typically done in the agent-based literature, but also consider logics of tie formation that reflect agents' search for knowledgeable interlocutors, in particular based on their experience in the institution, their reputation among co-workers, and their similarity to themselves. To our knowledge, no other study so far has attempted to model opinion transmission as a result of advice ties formation in a network of this type, with entry and exit of members, small-to-medium size, and knowledge-related forms of interaction.

3 Under which conditions is opinion sustained over time?

We explore our model under three different dimensions to establish the properties that enable an opinion to be transmitted over time. Each dimension in the model is related to a different research question and hypothesis.

Network. The first dimension is the type of network formation logics that are adopted by individuals when seeking advice, knowledge and information from others. We partly explored this issue in our previous paper. Along the same lines, we test here five different rules for choosing whom to interact with for our agents; they are all inspired by our work on the Court but in principle, can be extended to any organization. One criterion is to ask advice to those who are very central in the network, that is, those to whom many people ask advice already, and hence can be said to have a high "reputation". Indeed with imperfect information, reputation can be taken as an indicator of the competency of an advisor: the fact that an individual is consulted by many others suggests that he or she presumably provides valuable insight, so that one can infer a good degree of expertise. Another criterion is linked to the opinion that individuals can perceive from others: they will ask only to those they know are quite close to themselves. This method reflects a tendency towards homophilous choices, i.e. to form ties to similar others, well documented in the sociological literature (McPherson et al., 2001). We focus on similarity of opinions but various other dimensions of homophily have been investigated, for instance based on gender, education, or nationality. A possible problem is that both the homophily and reputation criteria require restrictive assumptions in terms of the amount of information about others that an agent needs for decision-making. It is true that these assumptions are less unrealistic in the context of a small or medium organization (such as the Parisian Court), and that for reputation, we only require agents to know the most central among them, not the whole network from top to bottom; yet it is worth considering alternative criteria too. In particular, less constraining in this respect is the idea that individuals seek advice from members who are no less experienced than they are, that is, those that have been in the institution at least as long as themselves or even longer, assuming that time spent in the institution increases knowledge and expertise. Eventually the

least constraining way of making decisions is to randomly pick an advisor among other members. The latter option may seem less relevant to study real-world organizational life, but it is useful to take it as a benchmark, all the more so as it is used in most of the theoretical, abstract literature on opinion dynamics; and it is a major intended contribution of this paper to compare the existing findings of this literature with a larger variety of selection rules. Finally, we also combine the homophily rule with the experience rule because, as will be shown later (see 5.1), homophily is strictly speaking not a rule in itself, but simply increases the number of interactions and drives influence to reach 100%. It is in fact a random rule with a locally accelerating factor that completely transforms the global results. [2]

Duration. The second dimension can be seen as the core of our research. We intend to ascertain the impact of duration of membership on cultural transmission. Notice that with fixed size, duration of membership is perfectly equivalent to membership renewal rate: indeed a low number of entries and exits at each step implies that it takes relatively long before the initial population is entirely replaced, and members remain in the group for a relatively long time; with the same group size, higher flows of joiners and leavers imply a shorter duration of membership. In the latter case, the process of social influence is likely to be less effective in harmonizing members' view, and a shared opinion may not emerge, or not be stable. Accordingly, we aim to identify the different cases and the conditions under which an agreed opinion persists over time (see 5.2).

Uncertainty of newcomers. The third dimension is also dealt with in other papers, like the seminal (Deffuant et al., 2002). We endeavor to assess the impact of the value of what we call agents' "uncertainty", a variable that measures agents' lack of confidence in their own views and/or their willingness to be influenced by others. Overall, lower levels of uncertainty presumably result in a smaller amount of influence in the system, which in turn decreases the likelihood of a common opinion. Yet these effects cannot be entirely predicted from start in the context we are interested in, with a flow of incoming and outgoing agents; hence, a more precise analysis is desirable (see 5.3). Possible interpretations of this aspect are about the level of specificity of the institution in which newcomers are integrated. For example in the Commercial Court, judges are not professionals and may have very diverse ideas about legal disputes when they join, so that presumably, they can be easily convinced of a new idea. It may not be the same in other organizations, where newcomers' experiences are closer to their new roles. This parameter is thus institution-dependent, and cannot be fully controlled, apart from the moment of selection of newcomers.

Accordingly, we test three hypotheses:

- H1: Criteria of advisor selection different from Random choice, will lead to

[2] In our previous paper, we also considered an "Authority" rule according to which members seek advice from those higher up in the hierarchy. This rule is not included here because the authority structure is organization-specific, and it would be difficult to identify a sufficiently general form that would hold for many different organizations.

different dynamics of opinion;

- H2: Longer duration of membership (or equivalently, lower turnover rate) is favorable for social influence to occur, and improves convergence;
- H3: Higher uncertainty of newcomers favors social influence and improves convergence.

4 Model

4.1 Agents and interactions

The model represents a fixed-size group of Agents, who leave after a certain length of time and are replaced by newcomers. The flow of Agents is updated every time-step, called a "year". Agents can perform one type of action: to seek advice from another Agent, and potentially be influenced by the other's opinion. This communication takes place ten times a year and follows a variation on the "relative agreement" model of social influence developed by Deffuant (Deffuant et al., 2002). The attributes of an Agent are hence:

- "age": the number of years that the Agent already spent in the Group; when the Agent spent less that half the maximum time it is considered as a Junior and otherwise it is considered as a Senior Agent;
- "opinion": a continuous value between 0 and 1;
- "uncertainty": a continuous value between 0 and 1;
- "centrality": defined as the number of other Agents that contacted the Agent in question during the past year.

The influence model is as follows. Suppose an Agent i has opinion o_i and uncertainty u_i, and communicates with an Agent j with opinion o_j and uncertainty u_j. Their "opinion segments" are defined as the segments of length $2.u_j$ (resp. $2.u_i$) around x_j (resp. x_i). The possibility to be influenced depends on the distance between opinions o_i and o_j and on the uncertainty of the influencing Agent u_j. If there is influence, it is both in opinion and uncertainty, and it is proportional to the overlap between the two Agents' opinion segments (the agreement), divided by the uncertainty of the influencer (expressing relativity in the sense that a more confident advisor has stronger influence). In the standard relative agreement model, influence can be reciprocal, whereas it is not in our model. [3]

At each time-step the Agent has to choose an advisor, and four different functions define this choice:

[3] This hypothesis reflects our vision of the organization as being split into two groups of different seniority, which affects the possibility of being influenced, but it has to be noted that the results do not differ much qualitatively when the standard relative agreement model is applied.

- Experience: the Agent chooses among Agents that have been in the group for at least the same time as itself, hence whose age is equal to, or higher than, its own;
- Homophily-Experience: Among equally and more experienced Agents, the Agent chooses one who can influence it (in the sense of the relative agreement model) or has already influenced it in the past.
- Reputation: the Agent chooses among the 10% most central Agents of the group;
- Homophily: the Agent chooses among Agents that can influence it (in the sense of the relative agreement model) or that have already done so;
- Random: the choice of an Agent is completely random in the group.

The underlying structure of the network within which Agents can contact other Agents is what defines a choice.

4.2 Simulation and observed indicators

A simulation consists of a succession of time-steps. Initially, 200 Agents are created in the group and are given an age, an opinion and an uncertainty. The choice of the number of members of the group reflects our focus on small-to-medium sized organizations in which the assumption that individuals have considerable information about others and that in principle, they may access anyone else are relatively more plausible. Considering the question we are addressing, the initial setting is such that all Agents considered as Senior (with an age higher than half the maximum time) are given an opinion near one extreme (here 0.2) whereas the opinion of Junior Agents is randomly picked up between 0 and 1 following a uniform probability distribution. Initial Senior Agents are also defined by an uncertainty, which is lower than, or at most equal to, the one of initial Junior Agents. Once defined, Agents run a first year: each of them chooses another Agent to communicate with by following the rule that is used in the simulation, and then updates its opinion and uncertainty. After ten interactions, the year is over, age is updated, and the centrality of all Agents is computed. Agents who stayed long enough in the group leave; they are replaced by new Junior Agents of age 0, characterized like initial Junior Agents. Table 1 gives the parameters that define one simulation and the values we use for our experiments.

We take the parameter values used in our previous paper on the Commercial Court of Paris as a benchmark because they have led to results that fit remarkably well with the empirical data. In that case, membership turnover was 10%; the initial opinion and uncertainty of Senior members were both set at 0.2, while the uncertainty of Juniors was 0.7 and their initial opinions varied uniformly between 0 and 1. Consistently with fieldwork observations, we interpreted low values of opinion as tolerance in interpretation of the law, and low values of uncertainty as a form of self-confidence arising from longer practice in the institution.

We observe several indicators in this model. The main one is based on the final opinions of Senior Agents, those who have had enough time to be influenced by others.

Table 1: Parameters and their values. Note that from membership duration, one can deduce the percentage of Agents that leave and are replaced at each time-step.

Parameters	**Values**
Criterion for advisor selection	Experience, Homophily-Experience, Homophily, Reputation, Random
Group membership duration	2, 4, 8, 10, 20, 50
Uncertainty of Junior Agents	0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1

We thus observe the average and the mean square deviation of Senior Agents' opinion, and the number of "groups of opinion", or clusters, in which Senior Agents are situated at the end of a simulation run.

The groups of opinion are defined in the same way as in Deffuant (Deffuant, 2006). They are sets of Agents such that if one takes any two Agents in the group, either the difference between their two opinions is lower than 0.05 or there exist Agents in the group with intermediary opinions of distance less than 0.05. For example, if we have 5 Senior Agents of opinion 0.24, 0.28, 0.29, 0.32 and 0.34, one can consider that there is one group, whereas if Agents have opinions 0.24, 0.28, 0.29, 0.35 and 0.38, there are two groups. This proxy of observation is necessary to establish if, for a given average opinion, it is possible to identify one, two or more opinions that characterize Senior Agents.

We are interested in observing the properties of the system in the **medium** run (about 5 times the maximum membership duration, or 5 "generations"), but we believe that it is also important to observe the long-run effect of the influence process (50"generations").

5 Results

5.1 A typical setting: impact of the criterion for advisor selection

Our first result is that in all our simulations, Agents who join the group are influenced towards an opinion that they are not the only ones to share. Opinions can converge to one value or several, but the influence process itself takes place with any set of parameters. This result is in line with all the literature on the topic, though none of the previous articles refers to groups with turnover. In our context as in theirs, simple dyadic interactions lead to a macro convergence, which is in itself interesting. The main parameter that affects the convergence process is the type of rule for choosing advisors. How convergence takes place also differs widely depending on the type of rule. In Figure 1, we show the final value of opinion of each Agent, as a function of

its age. The data is captured after 50 time-steps in a simulation with 200 Agents who stay for 10 time-steps in the group. The Agents we are interested in are the ones who stayed in 6 to 10 years, that is, long enough to be influenced. In all cases, most Agents converge towards one value of opinion.

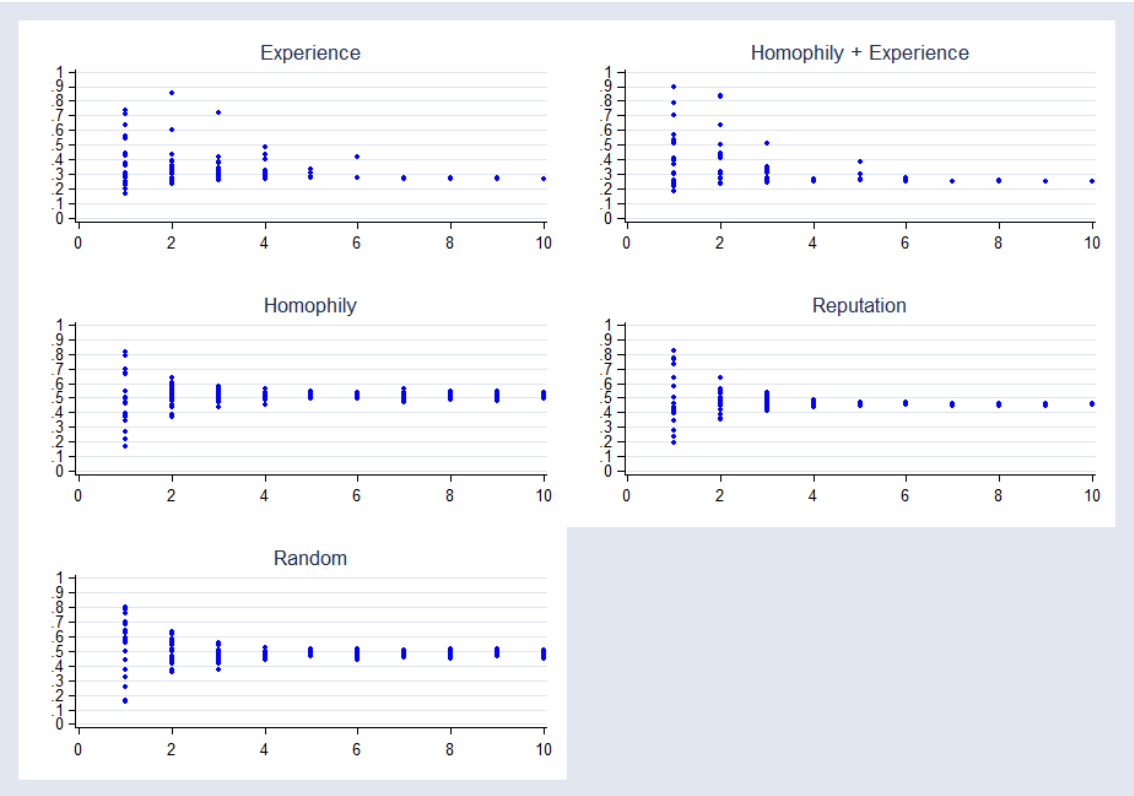

Figure 1: Final opinion of each Agent as a function of age in the case of simulations with 200 Agents staying for 10 steps in the group, with initial opinion of Senior Agents of 0.2, initial uncertainty of Senior Agents of 0.2 and uncertainty of Juniors of 0.7. The results are given after 50 time-steps. It is clear that Agents who arrived recently are still very squattered in opinion, whereas Senior Agents' opinions are more structured.

Experience. What can be said at first sight is that the case of Agents who follow the rule "ask to an equally or more experienced Agent", whether or not in combination with Homophily, allows alignment on the opinion which is closest to the one that was given initially to Senior Agents. In fact the Experience and Homophily-Experience rules do not allow initial Senior Agents to be influenced by Junior ones, while thank to their large uncertainty, Juniors are highly influenceable, so that their opinions will gradually tend to get closer to those of Seniors. The injection of newcomers at each time step does not counter this process as they will themselves choose to contact those who have been longer in the organization than themselves, so that they will also be driven towards the same value of opinion. Their uncertainties (not represented here) also tend to establish themselves at a level that is close to initial Senior uncertainty. This result suggests that if experience matters as a proxy for knowledge, Agents who

stay for a sufficiently long time in the organization are led to have the same opinion as those who left it several generations before.

Reputation. Reputation yields convergence towards a value of opinion that increases in time to reach the mid-point of the distribution. One reason for this result is that this rule does not distinguish between Senior and Junior Agents at initialization; yet at each subsequent step, it gives a slight advantage to insiders relative to newcomers as by definition, the latter enter with nil centrality. This is the reason why the influence of initial value of opinion impacts a little longer than in the case of Homophily and Random as will be seen just afterwards.

Homophily. It has been already mentioned that homophilous choice is not a very strong criterion of selection of partners in our context (see 3). It is actually very close to random choice, but includes a limitation to interactions where influence can take place. Put differently, homophily appears to be mainly an accelerator of the process, and still implies a totally random choice. It is for this reason that we study Homophily in conjunction with Experience as well, as discussed above. Without Experience, Homophily makes both Junior and Senior Agents subject to influence and allows even newcomers to exert an influence, so that the effect of the initial opinion of Seniors fades away over time, and opens the way to a mechanism of selection of interlocutors that is close to randomness: indeed the high uncertainty of all newcomers and Juniors makes the vast majority among them influenceable by virtually every other member of the group. Our results show that with the same values of uncertainty and group membership duration, there is convergence to a single value that tends to coincide with the center of the distribution and does not depend on the initial opinion value of Seniors. As in the case of randomness, uncertainty (not shown here) remains close to the level attributed to initial Juniors and subsequent newcomers, around 0.7.

Random. As pure Homophily, the Random rule yields central convergence. This result is consistent with what the literature shows to happen in a randomly formed network with fixed composition, if all Agents start with the values of opinion and uncertainty of our Juniors.

These first results suggest that initial opinion has an impact, and so does the way of choosing who to communicate with. There is high stability in the results: from one initial condition, the resulting dynamics are qualitatively identical.

Figure 2 provides the average value of opinion and uncertainty for Senior Agents along a simulation that lasts for 500 time-steps (hence 50 generations of 10 time-steps), so as to understand more precisely the dynamics that lead to the transmission of opinion in our case. Both elements, opinion and uncertainty, are very interesting to observe.

It appears that the choice to seek advice from a more experienced agent is the one that eventually reproduces the initially shared opinion at best, not only in the short run, but also in the very long run. It is also true when the Experience rule is associated to the Homophily rule. In the two following subsections, we show that this is generally true but also depends on the other parameters that describe our

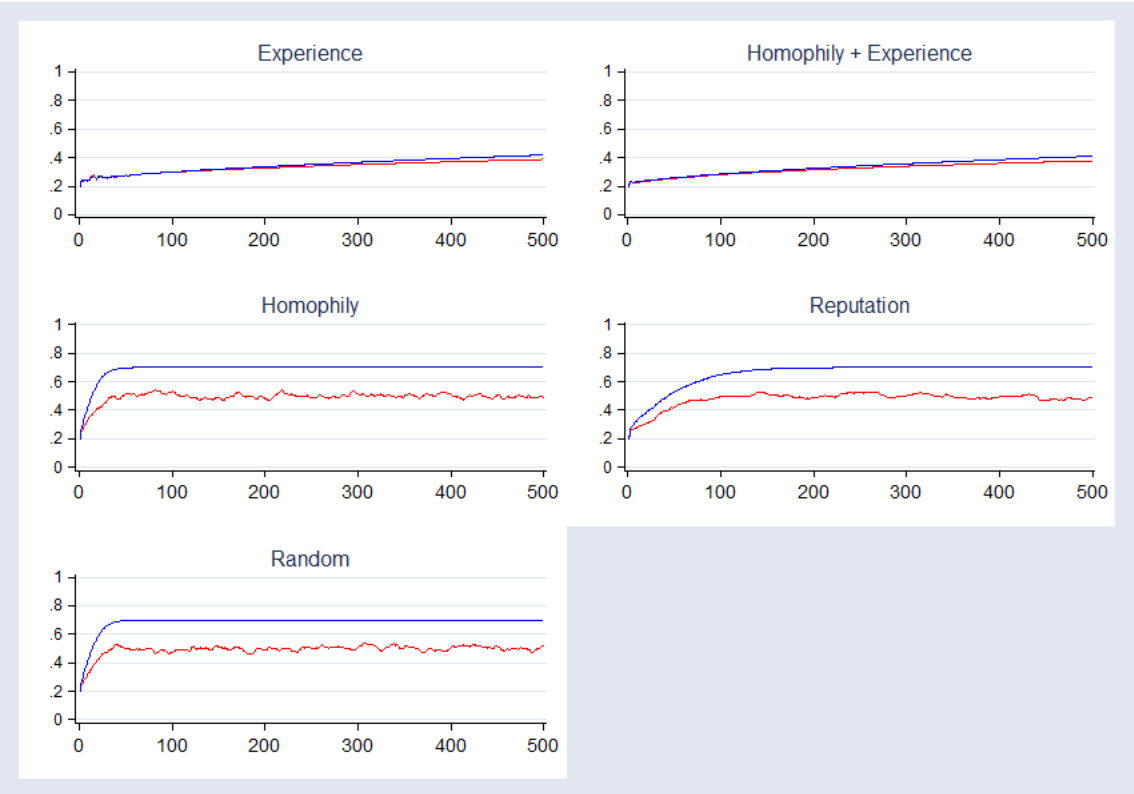

Figure 2: Evolution of opinion (red) and uncertainty (blue) of Senior Agents over 500 time-steps for each interaction rule. These images refer to one simulation; with the chosen parameters, simulations are extremely stable and always display the same pattern of global behavior. As in the previous figure, the simulations were run with 200 Agents staying for 10 time-steps, with initial opinion of Senior Agents of 0.2, initial uncertainty of Senior Agents of 0.2 and uncertainty of Juniors of 0.7.

organization, especially the impact of the length of time spent in it.

5.2 Effects of duration of membership (or turnover rate)

We study changes in membership duration only for one value of uncertainty, 0.7, which is the one we also used in subsection 5.1. In the simulations presented here, the number of generations is always the same, 5, a length that appears to be appropriate to observe transmission processes in our system.

The idea behind this sensitivity check is to see if, for the same uncertainty and number of generations, the maximum time spent in the group has an impact on the possibility to transmit opinion to newcomers. As briefly mentioned in 3, a way of thinking about membership duration is the renewal rate of the population. To stay for 10 years, or time-steps (the value we first chose because it is the renewal rate of the Paris Court, the real-world case we initially explored) means that 10% of agents change at every step. To stay for 2 time-steps means that 50% of the population is renewed at each time-step, for 4 time-steps - 25%, for 8 time-steps - 12,5%, for 20 time-steps - 5% and for 50 time-steps 2%. This parameter is in principle likely to have a huge impact, and our results reveal that it also depends on the criterion with which agents make their interaction choices. Simulations are conducted conditional to the assumption that agents have the opportunity to communicate with others ten times a year.

Three results hold for all types of simulations. First, the renewal of 25% or 50% of the population (2 or 4 time steps spent in the group) does not enable the initial opinion of initial Senior Agents to be transmitted to newcomers, and convergence cannot take place (see table 2). Second, increasing duration always implies more convergent opinions (with a smaller mean square deviation, MSD). Third, when time spent in the group increases (above 20 steps) the Agents who join get influenced so quickly that after four time-steps they all stay in a range of +/- 0.02 around the convergence value[4]. The longer Agents stay, the quicker newcomers get influenced. Apart from these three very general results, each model of interaction displays different characteristics.

Table 2: The value of the MSD of Senior opinions for each type of simulation in case of time durations of 2 and 4 (turnover rate of 50 and 25 %). The average opinion is always close to 0.5.

Membership duration	**Experience**	**Homophily**	**Homo-Expe**	**Reputation**	**Random**
MSD - 2	0.14	0.2	0.16	0.11	0.23
MSD - 4	0.03	0.01	0	0.02	0.03

[4]As will be seen, this result is slightly less strong for Experience simulations.

Experience and Homophily-experience. For these two cases, the final opinion of Senior agents decreases as group membership duration increases, and tends towards 0.2 (i.e. the value of initial Seniors) for almost all, as soon as 20 time-steps are spent in the group. Even more striking is that Junior agents have an opinion that is very close to 0.2 after just three time-steps spent in the group. Uncertainty is also quite homogeneous and close to the initial uncertainty of Seniors, i.e. 0.2.

There is however a difference between these two cases. With Experience only, longer durations enable some Senior Agents to keep a "high" opinion (neatly different from 0.2) and enable Junior Agents coming in with a high opinion to keep it as well. A subgroup of Agents whose opinion is initially around 0.9 increases it as time spent in the group increases. This is one of the rare situations where, with high uncertainty of Juniors, two groups of opinion can be observed. The high-opinion group is small, including about 10 % of agents. Figure 3, table 3 and table 4 show the different results.

Inclusion of the homophilous feature in interaction, which is defined such as only "useful" interactions take place (those that do lead to a change of opinion), actually changes qualitative results in our system. When no homophilous selection takes place, a Junior Agent coming in the system with an opinion higher than 0.9[5], most of its interactions with more experienced Agents will lead to no influence. Indeed the vast majority of more experienced Agents, those who arrived only 3 time-steps earlier up until 50, have an opinion of 0.2. Only when this Junior meets Agents with opinion higher than 0.9 will it be influenced, and thus stay with a high value of opinion. This can explain that these Agents constitute a subgroup whose share is stable over time and represents about 10% of Senior Agents at the end. To make sure this explanation is right, we have run simulations with an uncertainty of Juniors of 0.7, and a turnover of 2% and 5%, expecting the emergence of a subgroup of 19-20 Senior Agents. This is the result we get on average, although the size of the subgroup can get up to 29 in some simulation runs. This can be explained by the fact that Agents with a high opinion can also influence newcomers with intermediate values of opinion, increasing their share. Once the proportion is established, it reproduces itself over time since the probability to meet each type of more experienced Agent generates a probability to be influenced, and hence attraction of a part of newcomers.

This situation is unlikely to arise in simulations where Agents interact only with Agents that can influence them[6], since they necessarily do get influenced as soon as they join, and that can be either by high values or by intermediate values of opinions. As soon as a newcomer is influenced by an intermediate value of opinion, its opinion decreases and it becomes subject to influence by Agents with opinion 0.2, i.e. the vast majority, so that its opinion goes quickly to 0.2. To force Agents to communicate with others only when they can get influenced tends to homogenize the group rather than segregate it, which is a pretty counterintuitive result [7]

[5]Which represents on average 10% of newcomers with the uniform distribution we use.
[6]So unlikely we have not witnessed it in any Homophily-Experience simulations.
[7]This result also holds when comparing Homophily and Random simulations, to a much smaller extent.

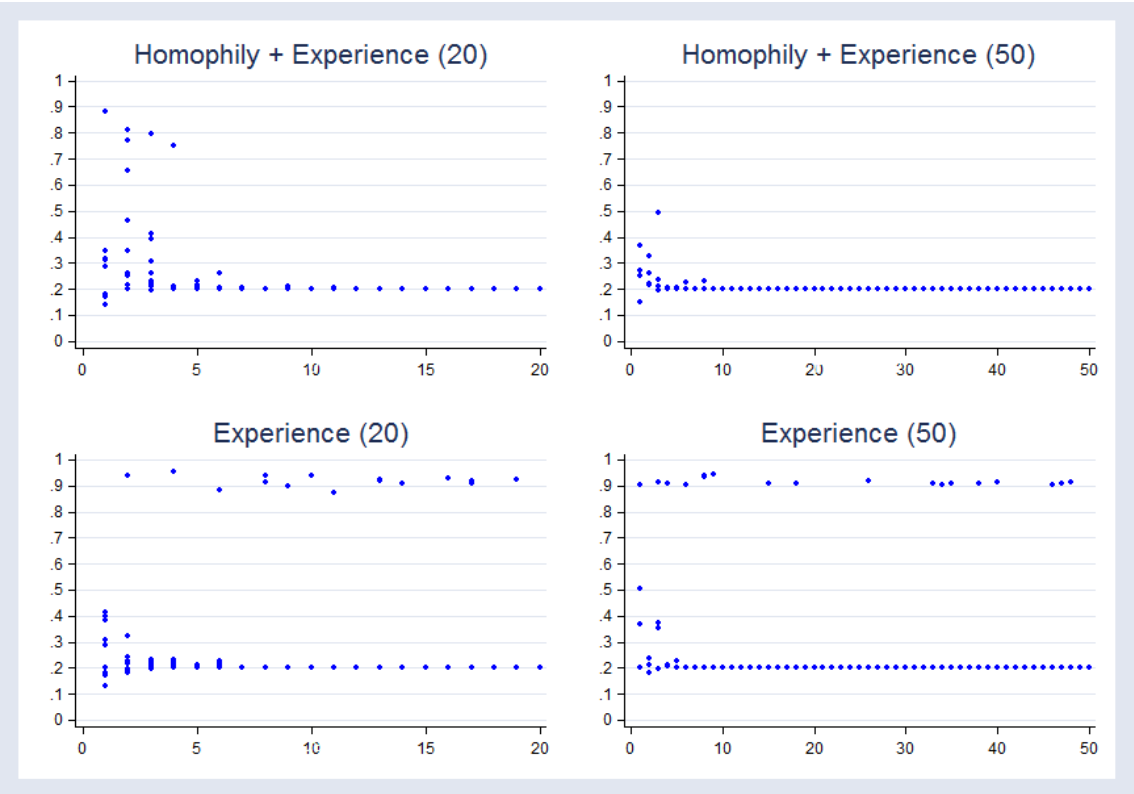

Figure 3: Opinions of Agents depending on age, when Agents stay 20 or 50 time steps maximum. In all simulations, almost all Agents end up with an opinion of 0.2, even after having been in the group for a relatively short time. In Experience simulations, a subgroup with very high opinion is established in the long run.

Table 3: For increasing maximum membership duration (and related turnover) in Experience simulations, the average values of opinion and uncertainty tend to 0.2. A group of Agents with high opinion also appears with this increase.

Membership duration	**2**	**4**	**8**	**10**	**15**	**20**	**25**	**50**
Average Opinion	0.51	0.48	0.34	0.26	0.25	0.2	0.2	0.2
opinion MSD	0.14	0.03	0.002	0.01	0	0	0	0
Uncertainty	0.7	0.7	0.37	0.27	0.24	0.2	0.2	0.2
Nb of Agents in high-opinion group	0	0	0	0	7 (6.6%)	9 (9%)	6 (6%)	10 (10%)

Table 4: For increasing maximum membership duration (and related turnover) in Homophily-Experience simulations, the average value of opinion and uncertainty tend to 0.2.

Membership duration	**2**	**4**	**8**	**10**	**15**	**20**	**25**	**50**
Average Opinion	0.49	0.49	0.31	0.25	0.2	0.2	0.2	0.2
Opinion MSD	0.16	0	0	0	0	0	0	0
Uncertainty	0.7	0.67	0.34	0.25	0.2	0.2	0.2	0.2

Reputation, Homophily and Random. These three types of simulations give very similar results in the long run. The longer Agents stay in the group, the less squattered their values of opinion, and most strikingly, convergence to a collective value is visible at an early stage: after only 5 time-steps spent in the group, the opinion of all Agents is at about the same level. The value to which opinions converge is somewhat affected by the initial opinion of Senior Agents but this form of influence progressively fades away, and disappears entirely after a few generations. In the long run, the system tends towards the central value of 0.5 —as in our benchmark simulations with a 10% turnover in the group. More precisely, the final value of opinion of Senior Agents varies between 0.48 and 0.52, and is hence not completely stable with flows of entry and exit; yet it can be considered as sufficiently stable when it comes to reproduction of opinion. This fact takes approximately the same time to appear for Homophily and Random simulations, but a much longer time for Reputation, meaning that the latter rule preserves the initial shared value of opinion for longer. Finally, Homophily simulations give values of opinion with a slightly higher MSD than Random ones, but the difference is not significant. In Figure 4 it is possible to detect discrepancies among average opinions in time.

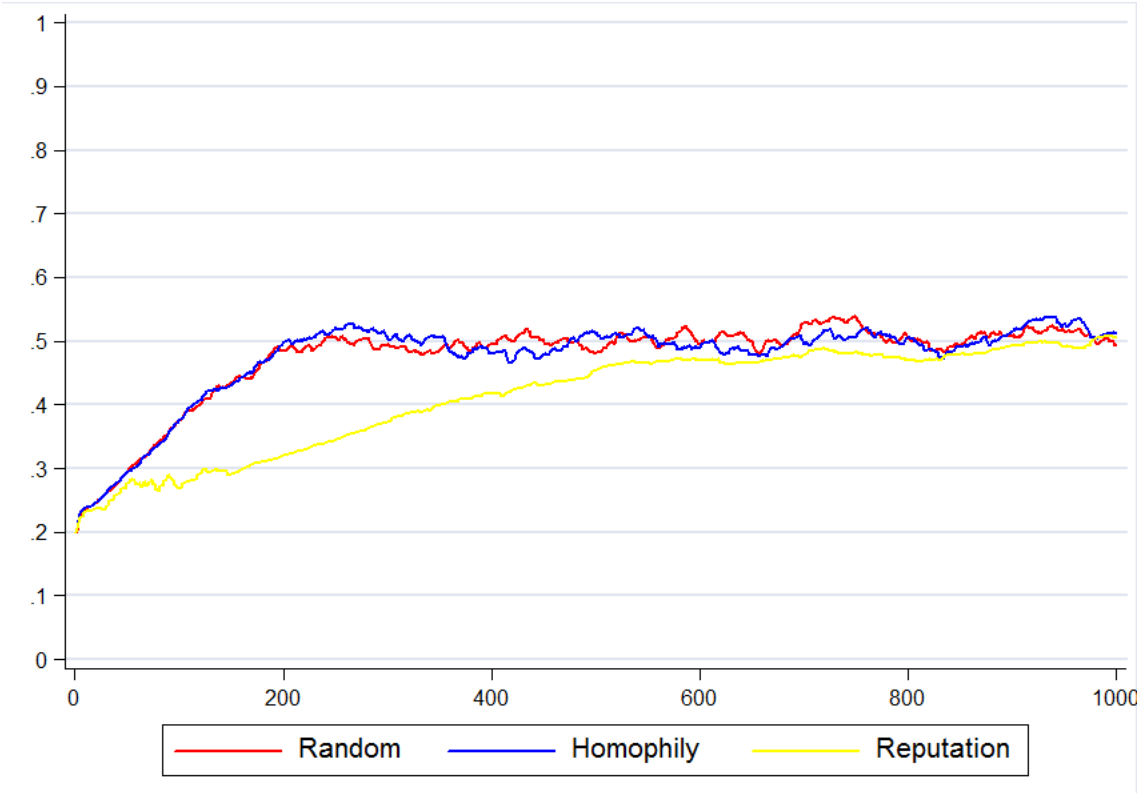

Figure 4: Average opinion of Senior Agents over 1000 time-steps. Choices of interaction partners are based on the Reputation, Homophily, and Random rules. Time spent in the group is 50 time-steps, which means that the turn-over is 2%. In this particular simulation, and in all other simulations we ran, Reputation implies a convergence of opinion to 0.5 which is much slower than the other two.

5.3 Effects of uncertainty

Figure 5 shows that the impact of differences in Junior Agents' uncertainty depends on the type of choice Agents make. This variation is in particular a way to attain situations in which two or three opinions attract separate groups of agents. In this case, the production of interesting phenomena is not only linked to what we already know of the Experience criterion, but also the Homophily one.

Experience. When Junior Agents join the Group with the same (low) value of uncertainty as Senior Agents, opinions remain very dispersed over time. Only when there is an initial difference between Juniors and Seniors does some convergence occur. Slightly increasing the uncertainty of newcomers produces two groups, one being quite compact around the Senior opinion of 0.2 and the other, more dispersed, around a value of opinion at a distance higher than the uncertainty of newcomers. Eventually, the higher the uncertainty of Juniors, the less likely this second group is to appear and when Junior uncertainty exceeds 0.8, we obtain a situation in which all Senior Agents have a final opinion extremely close to 0.2.

Reputation and Random. Differences in Junior uncertainty have a similar impact on Reputation and Random simulations, except that, as in all other cases, the convergence of opinions generated by these criteria is a central convergence in the long term. Situations where two groups co-exist are much rarer since the groups must be separated by at least the value of initial uncertainty —otherwise one group is ultimately absorbed by the other. As a result, there is no convergence when everyone in the group has the same uncertainty of 0.2, there is polarisation around two different opinions when the uncertainty of newcomers is 0.3, and there is convergence to one opinion in all other cases. Generally speaking, the higher the uncertainty the faster the convergence and the less dispersed the opinions. As in previous cases, the Reputation criterion implies a convergence less dispersed than Random, and much slower to reach the central opinion of 0.5.

Homophily and Homophily-Experience. For these settings, when the uncertainty of newcomers is similar to that of Senior Agents there is convergence of opinions, though not to a single value but to three different ones. It is the restriction of interactions only to Agents that can exert an influence that leads to convergence to multiple opinions. When uncertainty increases to 0.3, only two groups of opinion form (with a difference of opinion that is higher than 0.3, as in preceding cases). As the uncertainty of newcomers rises further, the two cases behave differently: with Homophily, central convergence appears and no second group can be created with a difference of uncertainty that is too large (0.4). From this value until 0.9, the impact of increases in initial Junior uncertainty is just to slightly improve convergence, reducing the MSD. In contrast, the Homophily-Experience criterion enables to keep two groups until the value of uncertainty is very large; above 0.7 there is only one opinion for all Agents, and group behavior is very close to the Experience situation.

It is interesting to note that it was possible to anticipate the impact of the 0.2

uncertainty level for newcomers, since it is very similar to what is witnessed in the case of a stable population (with no entry and exit of members) as in the original Deffuant model (Deffuant et al., 2002). The reason why here, it appears only with Homophily is that our model does not leave time to Agents to interact enough to achieve the predicted convergence, unless there is an accelerating factor - the Homophilous choice which as already mentioned, raises the number of influencing interactions.

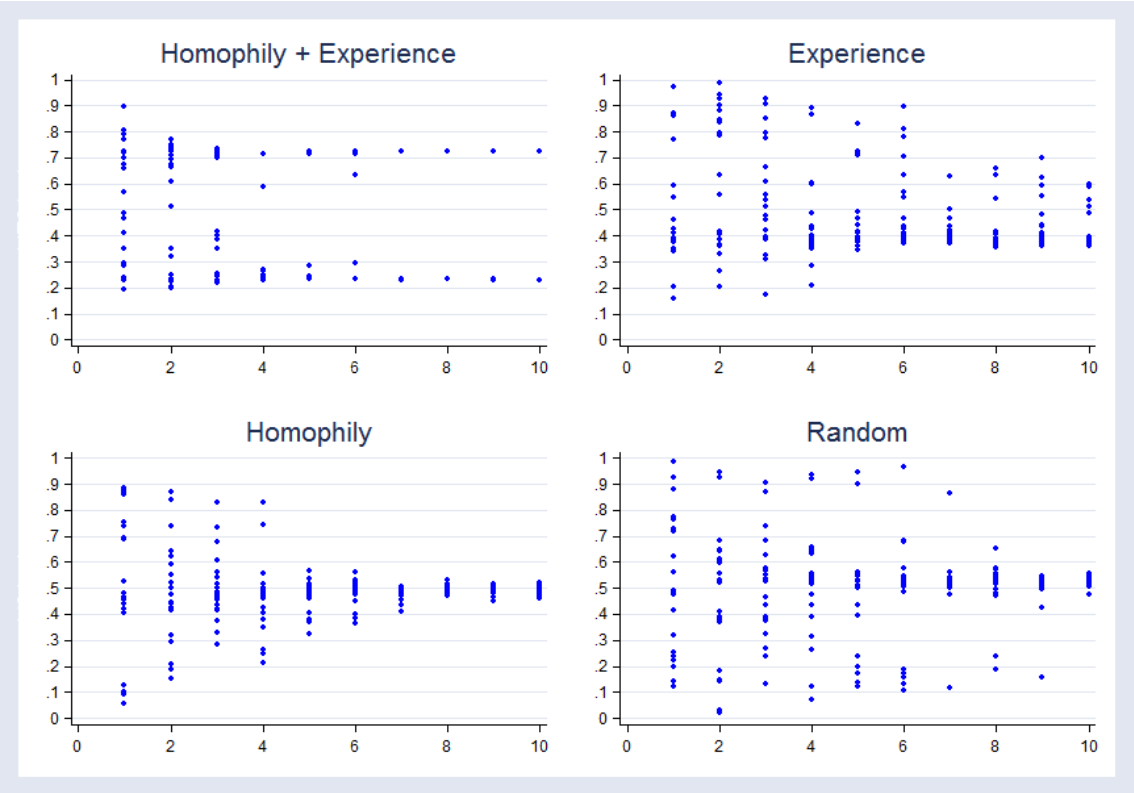

Figure 5: Opinions after 50 simulation runs, for Agents who are allowed to stay in the group for 10 years. The uncertainty of newcomers is 0.4. The combination of Homophily and Experience enables conservation of the initial Senior opinion together with an alternative, the two being far apart from each other. With Experience only, opinions remain dispersed. Homophily and Random yield central convergence, albeit slowly.

5.4 Summary of cases

The three factors we have observed, namely rule for selecting advisors, duration of membership (and related turnover rate), and initial uncertainty of newcomers, indeed have a huge impact on the system. Only for certain values of parameters can a given opinion be transmitted to joiners, and some of the interaction choice criteria do not enable any conservation of opinion. Two types of behaviour can be observed, those created with parameters that define hardly relevant limit cases, and those that match our goals at least to some extent. In particular, two types of dynamics are of little

interest:

- No convergence at all.
- Very light convergence in time: opinions are centered around 0.5 with minimum and maximum close to 0.5, but variation among agents is always large. This case arises with parameter values that can be considered as limit cases, that is, when membership duration is low (less than 4), and/or turnover rate is high (more than 25%).

There is another set of situations, much more interesting for our purposes, which are usually generated with values of parameters that are similar to those that fit with our case study, with a definition of Junior Agents and a turnover rate that are intuitively close to what is commonly found in real-world organisations.

- All agents constitute one group of opinion around 0.5 - which means that there is convergence to one value without any historical impact of the initial value of the opinion of Seniors.
- All agents constitute one group of opinion that is significantly lower than 0.5 - which means that the initial value of the opinion of Seniors has an impact in the long run, although such an impact slightly decreases over time.
- Two groups (or more depending on the uncertainty of newcomers) co-exist and newcomers can be driven towards the one or the other depending on their initial opinion. In this case, one group is clearly linked to the initial opinion of Seniors and the other group is far enough so as not to be absorbed by the former.

One important fact to note in our system is that there is no unique way to attain a certain equilibrium. This might be considered as a problem by those modelers who aim to provide a unique solution or path to reach a given goal. For us on the contrary, it is evidence that the system we have designed can be controlled through various parameters, or even that an observed situation can find several competing explanations. This is not incoherent with the definition of "complex system" per se.

To summarize in terms of choice criteria, we can take Random as our reference, where the network underlying interactions is the complete network. Referring to the Random criterion has the advantage of allowing for comparison with results already obtained in the agent-based literature. In our particular system, the Random case generates situations in which all final values of opinion (for Senior Agents of the group) are very close to 0.5 after a few generations. A common opinion hence exists in the group but it is not influenced by the initial value of Seniors. Based on that, the other criteria can be assessed comparatively:

- The tendency of the Reputation rule is to make the group around 0.5 more compact than Random and to allow for the value of opinion being affected by the initial Senior value for much longer than Random.
- The tendency of the Homophily rule is to make the group around 0.5 more dispersed than Random but with a speed of convergence that is almost equal

to it in all situations ; Homophily-Experience also makes values slightly more dispersed than Experience, but with similar timing of convergence.

- The tendency of the Experience rule is to influence newcomers in the long run, having all opinions lower than 0.5, that is, closer to initial Senior value.

We can thus conclude that H1 is broadly confirmed. Regarding the other dimensions it can be said that overall, longer membership duration improves convergence and allows for greater impact of the initial opinion; higher uncertainty of Junior Agents also increases convergence and reproduction of the initial opinion. Hence, H2 and H3 are also confirmed.

It has to be noted that we have not tested the sensitivity of our model to the number of interactions the Agents experience at every step (always equal to 10). This is another variable an organization can control in principle. Devising incentives to reduce the number of interactions could be hard, but increasing it, for instance with formal meetings, may be easier. We aim to deal with these elements in an extension of the present model.

6 Discussion - Conclusion

While remaining highly abstract, our research benefits from joint use of agent-based simulation and fieldwork data, and innovates with respect to existing models of opinion dynamics. It takes into account a more realistic setting, specifically adapted to organizations with regularly changing composition and intense internal communication or advice-seeking. Our study, originally inspired by data on the Commercial Court of Paris, is also suited to describe firms, political councils, communities of practice, and other bodies.

Within this framework, we have provided evidence that ceteris paribus, reliance of members on more experienced colleagues as advisors is essential to ensure transmission and persistence of a shared opinion. This finding does not lead to advocate strict hierarchical rules that give prominence to senior members relative to junior ones: indeed for it to obtain, it suffices that members seek advice from those who are no less senior than they are themselves, a category that also includes same-seniority peers.

Our work also shows that seniority in itself —and reliance on it as a criterion to select advisors— does not automatically lead to preservation of opinion. Indeed, this result also depends on new members' willingness to absorb the organization's orientation as they join, and on the length of time they are given to understand it in depth and to transform their views accordingly. Without these conditions, the "wisdom" of seniors may not be sustained over time; in particular, it may end up as one of various alternatives, which will coexist and will be available for future newcomers to choose from. Hence, a hierarchical structure valuing seniority does not per se produce transmission of shared understandings.

Another way to see our results is that each of the three dimensions investigated

here —advisor selection criterion, membership duration (turnover rate), and openness to influence by others— is a factor upon which an organization may choose to act. Of course, each dimension gives rise to differing dynamics; yet they all play a role in bringing about preservation of shared orientations, and all offer some scope for intervention. In this sense, our work can be of interest for any organization wishing to preserve its shared values —or to change them.

Future extensions of our work may concern the broader issue of organizational culture, taking into account the distinction between codified and non-codified values, beliefs, and representations, and the multiplicity of aspects and meanings that pertain to culture. In particular one possible technical evolution of the model would be to redefine opinion over two dimensions, allowing the opinions of two interacting agents to be close along one dimension and distant on the other. Depending on the case under study, homophily on one dimension could have a positive influence or on the opposite, being far away on one opinion could reduce the possibilty to get influenced. Whatever the correlation between the two dimensions, one can expect new dynamics to emerge. Other research may explore cases in which the flow of entry and exit of members is not given exogenously but depends on participation in collective activities and/or on exchanges of information and advice; communications networks on the web are a case in point.

References

R. Axelrod. The dissemination of culture. a model with local convergence and global polarization. *Journal of conflict resolution*, 41(2):203–226, April 1997.

D.R. Comer. Organizational newcomers' acquisition of information from peers. *Management Communication Quarterly*, 5:64–89, 1991.

G. Deffuant. Comparing extremism propagation patterns in continuous opinion models. *Journal of Artificial Societies and Social Simulation*, 9(6): http://jasss.soc.surrey.ac.uk/9/3/8.html, 2006.

G. Deffuant, D. Neau, F. Amblard, and G. Weisbuch. Mixing beliefs among interacting agents. *Advances in Complex Systems*, 3:87–98, 2001.

G. Deffuant, F. Amblard, G. Weisbuch, and T. Faure. How can extremism prevail? a study based on the relative agreement interaction. *JASSS*, 5(4), 2002. URL `http:jasss.soc.surrey.ac.uk/5/4/1.html`.

A.M. Falconi, K. Guenfoud, E. Lazega, C. Lemercier, and L. Mounier. Le contrôle social du monde des affaires : une étude institutionnelle. *L'année sociologique*, 55 (2):451–484, 2005.

S. Galam and S. Moscovici. Towards a theory of collective phenomena: consensus and attitude changes in groups. *European Journal of Social Psychology*, 21:49–74, 1991.

S. Galam, Y. Gefen, and Y. Shapir. Sociophysics: a mean behavior model for the process of strike. *Journal of Mathematical Sociology*, 9:1–13, 1982.

R. Hegselmann and U. Krause. Opinion dynamics and bounded confidence: models, analysis and simulation. *JASSS*, 5(3):http://jasss.soc.surrey.ac.uk/5/3/2.html, June 2002.

V. Hill and K.M. Carley. Win friends and influence people: relationships as conduits of organizational culture in temporary placement agencies. *Journal of Management Inquiry*, 17:369–379, 2008.

J. Kennedy. Thinking is social: Experiments with the adaptive culture model. *Journal of Conflict Resolution*, 42(1):56–76, February 1998.

E. Lazega and L. Mounier. Interlocking judges: On joint external and self-governance of markets. In V. Buskens, W. Raub, and C. Snijders, editors, *Research in the Sociology of Organizations*. 2003.

J. Martin. *Cultures in organizations: three perspectives*. Oxford University Press, Oxford, UK, 1992.

J.M. McPherson, L. Smith-Lovin, and J.M. Cook. Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, (27), 2001.

E.W. Morrison. Newcomers' relationships: the role of social network ties during socialization. *The Academy of Management Journal*, 45(6):1149–1160, 2002.

D. Parisi, F. Cecconi, and F. Natale. Cultural change in spatial environments: the role of cultural assimilation and internal changes in cultures. *Journal of Conflict Resolution*, 47(2):163–179, April 2003.

A.M. Pettigrew. On studying organizational cultures. *Administrative Science Quarterly*, 24:570–581, 1979.

J. Rouchier and P. Tubaro. Can opinion be stable in an open network with hierarchy? an agent-based model of the commercial court of paris. In *Procedia: Proceedings of the 4th and 5th UK Social Networks Conference*, volume in press. Elsevier - Procedia, Social and Behavioral Sciences, 2010.

J. Rouchier, E. Lazega, and L. Mounier. Articulation of hierarchy and networks as an evolving social structure. In T. Terano, H. Kita, H. Deguchi, and K. Kijima, editors, *Agent-Based Approaches in Economic and Social Complex Systems IV*, pages 97–104. the AESCS International Workshop 2005, Springer, 2007.

E. Schein. *Organizational culture and leadership*. Jossey-Bass, San Francisco, 1990.

R.P. Settoon and CL. Adkins. Newcomer socialization: The role of supervisors, coworkers, friends and family members. *Journal of Business and Psychology*, 11 (4):507–516, 1997.

J.E. Slaughter and M.J. Zickar. A new look at the role of insiders in the newcomer socialization process. *Group Organization Management*, 31:264–290, 2006.