



Università degli Studi di Ancona
Dipartimento di Economia

How Do Collective Agents Think?

Antonio G. Calafati

In: Università degli Studi di Ancona
Dipartimento di Economia
Quaderni di ricerca, n. 131 (aprile 2000¹, November 2000²)
© by the author

Summary

In economics prominence has been given to a peculiar reductionist view according to which 'collective thinking' is the straightforward result of the work of a specific *algorithm* – the social welfare function – by means of which any set of potential collective decisions may be ranked. The mental process is seen as the product of the work of a software. The question of which kind of hardware can support this software has been traditionally regarded as unimportant. In this paper the attempt is made to put forward a framework to explain public decisions which builds upon the hypothesis that 'collective mind' should not be analysed by abstracting from the features of collective brain. Indeed, collective mental processes will be interpreted as 'caused' by the structure of the collective brain that sustains them. It is suggested that the analysis of the collective brain ought to be the starting point in the search for a theory of public decisions.

By defining collective brain as a 'specialised network of individuals' it will emerge that collective thinking is based on an 'institutional base' which is its fundamental causal factor of public decisions. But addressing the question of the 'institutional base' of collective thinking requires a new set of concepts and theoretical statements if one wants to give a meaning to the empirical evidence.

A further step in the analysis will be the observation that in modern democracies collective brain is usually 'partitioned' and the collective mental process segmented. This segmentation has been historically accompanied by a remarkable increase in the specialised production of knowledge functional to collective decision-making. Collective brains become more differentiated as a result of the fact that they incorporate 'technical units' devoted to the production of knowledge.

A further consequence of having a segmented mental process is the intrinsic 'co-evolutionary nature' of collective thinking. Although to various degrees, each decision-maker is (or ought to be) a system which is open in terms of informational flow. If collective decision-makers want to be up to their moral canons they have to use the relevant knowledge that is dispersed in the environment in their decision process. Co-evolutionary collective thinking is both an observed phenomenon and a standard of collective behaviour.

Antonio G. Calafati
Università degli Studi di Ancona
Dipartimento di Economia,
Piazzale Martelli, 8
I- 60121 Ancona
calafati@deanovell.unian.it
<http://calafati.econ.unian.it>

I. Introduction*

Public decisions may be understood as ‘products of collective thought’. In turn, thought is a mental process. Hence to relate the causal history of a public decision – that is, to explain it – means to reconstruct the ‘collective mental process’ which has led to that decision. But mental processes take place in brains, and if there is a collective mental process there must be some kind of ‘collective brain’ that causes it.

To take a decision individual agents need to think¹. To take a *collective* decision collective agents think too. But what is the meaning of expressions like ‘collective mental process’ or ‘collective brain’ and the like? As one might expect there is no simple answer. Indeed, the difference between the existing approaches to the explanation of public decisions boils down to a difference in the model of collective mind that is implicitly or explicitly relied on.

In economics prominence has been given to a peculiar reductionist view according to which ‘collective thinking’, that is an ongoing system of mental processes, is the straightforward result of the work of a specific *algorithm* – the social welfare function – by means of which any set of potential collective decisions may be ranked. The mental process is seen as the product of the work of a software. The question of which kind of hardware can support this software has been traditionally regarded as unimportant.

In this paper the attempt will be made to put forward a framework to explain public decisions which builds upon the hypothesis that collective mind should not be separated from collective brain². Indeed, collective mental processes will be interpreted as actually determined by the features of the collective brain. If this is the case the analysis of the collective brain ought to be the starting point in the search for a theory of public decisions. But since the institutions that govern the work of the collective brain are spatially-temporally specific – that is, collective brains are different in time and space, much in the same sense in which human brains are different –, collective agents are heterogeneous and evolving human systems.

Addressing the question of the ‘institutional base’ of collective thinking requires a new set of concepts and theoretical statements if one wants to give a meaning to the empirical evidence. Even in the most simple case, when the collective brain is conceptualised as a collection of human brains, there is no way to avoid addressing the issue of the role played by *communication*, and *learning* in the public decision process. In fact, only making the

* A preliminary version of this paper was presented at the ‘Workshop on Realism and Economics’ (King’s College, Cambridge, 20.XI.1995) conducted by Tony Lawson, whom I wish to thank. I wish also to thank St Antony’s College for its hospitality during Michaelmas Term 1995. Further research into the theme as been conducted in the context of the research project ‘Dynamic Competitive Advantages in Local Systems’ (Murst 1999) Financial support from C.N.R. and Murst is gratefully acknowledged.

¹ Not every action is based on conscious mental activity but many are. However, unconscious mental activity too is supported - or caused - by a brain (see Searle 1984).

² Collective mental processes are quite specific in character. But ‘decisions to act’ are not the only kind of mental processes. A further fundamental mental process is given by the formulation of interpretations of the state of the world – that is the agent’s environment (cf. Bateson 1979).

assumption that individuals are endowed with 'substantive rationality', which renders communication and learning unnecessary, would mean that the brain does not matter³.

Both communication and learning are processes deeply shaped – or made possible – by the system of formal and informal norms which regulates different fields of social interaction. In most cases collective brains should be seen as networks of organisational units which operate in an 'institutional field'⁴. Institutions evolves over time in part spontaneously and in part as the result of modification designed by collective agents themselves (Ayres 1951, North 1990). As a result collective brains are not only highly specific systems but also evolving systems.

II. Brains and minds

If having observed a public decision E one wants to explain it, he is likely to turn to the following three general categories in our search for the explanation: a. the available options (I); b. the consequences of the options (C); c. the ranking criteria of the options (R). To devise a *logical* structure that links these categories is not a relevant question. That the option chosen is – or should be – the best option is tautological. Indeed, to explain a decision one has, firstly, to understand it as the final state of a *process*, and produce a pattern model of that process. In other words, it is necessary to discover its *causal* structure (Lewis 1996; Lawson 1998) The relevant differences among the frameworks used to address the issue of explaining public decisions are rooted in different ways of understanding or modelling the *decision process*.

To conceptualise the social welfare function as an 'algorithm', whose independent variables are the social effects of the options, was an obvious step in the search for symmetry which has characterised the Neo-classical tradition in economics. In devising and using algorithms as ranking procedures the Utilitarian tradition postulates, in fact, the existence of a generalised social substitutibility which allows the 'decision-maker' – an entity as abstract as a computer software – to work with a *meta-objective* that by definition is the 'maximum amount of welfare for all'. (Both individual and collective agents operate according to this paradigm on the basis of a meta-objective.)

Within this framework the notion of 'collective thinking' has a straightforward meaning. It simply refers to the activity of ranking the set of options, that is *of projecting onto a given set of options a social welfare function*⁵. If the circularity of the economic process is considered, options take the form of a temporal flow, that may change or not over time. Then the mental process takes the form of a repeated run of the relevant algorithm, which in turn produces a stream of public decisions.

³ Bounded rationality is a consequence of the features of the brain – of the way in which actual brains work (Simon 1978, 1983; Sanford 1987). The introduction of 'bounded rationality' in the discourse on collective decision making is already in Simon (1959).

⁴ On the notion of 'institutional field' see Dopfer (1994).

⁵ The impossibility of deriving a social welfare function from a set of given individual utility functions does not in fact imply much. After all the social welfare function may be chosen by voting (Dunleavy 1991, van den Doel & van Velthoven 1993)

The activity of ranking the given set of options may turn out to be somewhat different if one is not able to devise the needed 'objective algorithm'. In fact, it may prove impossible to derive logically – or extremely difficult to reach an agreement by voting – a social welfare function. To find a way to link by specific rates of substitution all the social effects of the options is not an easy task indeed in practice. To overcome this impasse, options – understood by the decision-maker in terms of their consequences – have to be voted on *directly*. In this case, the collective agent's mental process can be interpreted as *the activity of voting* according to the majority rule⁶.

These two conceptions of collective thinking have been prevailing during the last decades, even though remarkable attempts to build an institutional theory of public decisions were made (see for instance Lindblom 1963, 1977; Douglas 1987). Although different in many respects, the two prevailing conceptions of collective thinking are very much similar with regard to the character of the collective mental process they imply: *the mental process has no 'physical' or 'institutional' dimension*. The mental process is seen as a sequence of steps that can be directly understood in their abstract or symbolic form. Therefore no reference whatsoever to the brain which supports the mental process is considered necessary. *Where* information on options, on the consequences of options, on the form of algorithm or on the voting procedures is *physically* stored and through which channels information flows are kinds of questions that, however elemental, are not raised.

Indeed, it seems hard to refuse the principle that the activity of thinking, being a mental phenomenon, needs a brain that supports or produces it (see Searle 1988, Ch. 1). In fairness, for many economists more than a matter of refusing this obvious principle the dichotomy was the result of assigning to the individual brain an unconstrained capacity.

If one focuses on the activity of voting the most obvious answer to this question is that *it is individual brains which support collective thinking*. If one takes an extreme position, and conceptualise collective decision-making as an activity performed by a computer, one has to accept the fact that information and algorithms have to be transferred into the computer's memory from individuals' memories.

Indeed, if the brain and the physical dimension of thinking enter the picture there are two general strategies to be followed to tackle the ensuing questions. The first strategy concentrates on the model of the mental process, and it is based on the assumption that whatever model of mental process is put forward the brain will support it. The second approach tries to embed the model of mind into a model of brain. *Only models of mental processes that may be supported by real brains are taken into account* (Simon 1976).

The scant attention devoted in social science to how collective agents think is a reflection of our having relied for so long on 'substantive rationality' (Simon 1976, 1983). If it is assumed that individual brains contain all the required information and are able to cope with any kind of algorithm, there is no need to encompass in the notion of collective thinking anything other than the voting procedures or the algorithm. Knowledge loses any physical dimension and, hence, *the collective mind and the option's ranking criteria are the same thing*. When individuals meet to vote, the entire spectrum of the direct and indirect effects

⁶ How a majority emerges among the members of the collective agent becomes then the most relevant issue (Stevens 1993). This shift of interest from social welfare functions grounded in individual utility functions towards the process of majority formation is of much relevance, and can be accomplished in different ways (see Dunleavy 1991; van den Doel & van Velthoven 1993).

of any single option is known to them. If a computer is used to select the optimum option given the social welfare function, information stored in the hard-disk and used in the process of optimisation is simply the information already stored in every single brain.

If the second kind of strategy is adopted, and individuals are assumed to be endowed with bounded rationality, somehow the notion of 'collective brain' has to be introduced. Then an analysis of its 'physical' features has to be performed if one wants to understand its mental process, that is collective thinking. From this perspective a different conception of the collective decision process will emerge.

III. The 'institutional base' of collective thinking

There is a second issue that the introduction of bounded rationality changes deeply, namely the way in which the structure that links the vector of options to the matrix of the social or economic effects of those options is conceptualised. As a matter of fact, to rank a vector of potential public decisions is not the same as to rank a set of options consisting of a *given* state of affairs or *given* baskets of commodities. The difference lies in the fact that the ranking criteria have to be applied to a matrix of effects which exists only as a *product of theoretical investigation*.

A public decision generates actions which, through a chain of causal effects, bring about given states of affairs. The values of the variables which are used to describe the resulting state of affairs are the *consequences* of the public decision.

The matrix of consequences has a fundamental *conjectural dimension*, being based either on common sense or scientific reasoning. Once the conjectural dimension of the consequences of the options is considered, the activity of choosing the structure that links the options to their consequences emerges as a crucial step. The formal structure of the decision-making process may be represented as in Fig. 1.

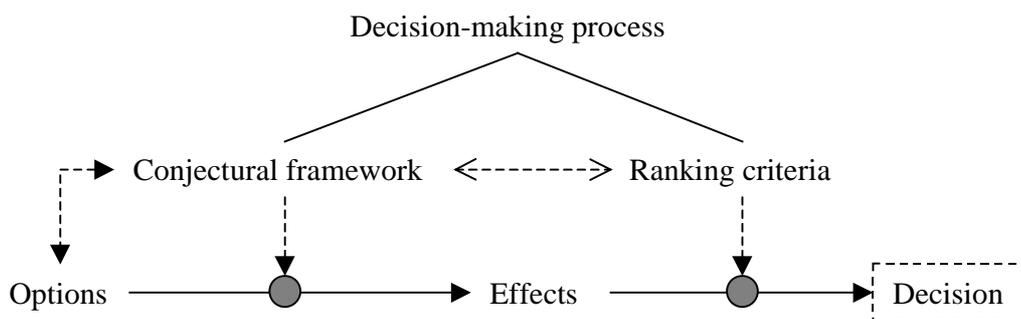


Fig. 1 - Structure of the decision-making process

In the context of individual decision-making this may be a trivial question in many cases. The decision for a given conjectural system may be taken simultaneously with the

choice of the preferred option. And the individual may not even realise that his thought process is associated with the search for, and the choice of, a theoretical framework used to derive the consequences of the options⁷. But when it is a *group of individuals* that has to choose *one* theory to be used to generate the matrix of consequences, the choice of the theory becomes a conscious activity and assumes the nature of a step in the overall (mental) process which leads to the choice of the socially preferred options⁸.

As a consequence of the necessity to perform this step, any mental process has a characteristically circular dimension (Bandura 1977; Bateson 1979). Firstly, the decision-maker may want to have a conjectural system which produces information on a set of variables that he regards as relevant. When the decision-maker is a collective agent the targeted consequences must be collectively chosen. On the other hand, the set of ranking criteria is constrained by the results of the applied theorising process, which may not provide the decision-maker with information which is relevant for the criteria which are being followed.

General equilibrium theory *and* utilitarianism have produced a peculiar solution for this circularity. By claiming that all the consequences of a decision can be derived, and claiming that all the consequences of public decisions are commensurable it has been possible to remove from the study of collective mental process the issue of how the collective agent comes to interpret the social world in which it operates and how it comes to the ranking criteria. Yet general equilibrium theory and utilitarianism, when used in the context of public policy-making, imply mental processes that may be produced only by fantastic brains.

From the perspective of 'bounded rationality' the starting point to analyse how collective decisions are taken is the structure of the 'collective brain'. In modern democracies collective thinking is generated by specialised networks of individuals, that is by specialised webs of institutionalised relationships. Indeed, a *'collective brain' is to be interpreted as network of individuals (mind-body units)*. It can then be described, as any other systems, in terms of 'elements' and relationships: firstly, a collective brain is a collection of individual brains; secondly, it is *an institutionalised relationships between those elements, that is individuals (individual brains)*. By design this network causes a continuous 'flow of interactions' – mainly information exchange – the expected results of which are the required theoretical framework and the ranking criteria. The flow of interaction is shaped by the institutional structure of the network, that is by the institutions that regulate the relationships among the elements of the network. This institutional structure is in fact the 'institutional base of collective thinking'.

⁷For 'relevant' decisions the individual agents may give a lot of attention to the selection of the 'theory' they are going to use to derive the consequences of their actions.

⁸The econometric models of the economic systems which have been so extensively used since the Sixties are the most remarkable example of the activity of linking options to their consequences. But macroeconomic decisions are a sub-class of public decisions. The fact that for this sub-class of decisions there was a deep awareness of the relevance of deriving consequences does not mean that the same awareness was reached for other sub-classes of decisions. Furthermore, the actual existence of competitive econometric models of the economic system is an example of how ranking options requires choosing 'theories' (see Lunghini 1981 for a reflection on the Italian experience).

The logically necessary hypothesis that the structure of the network (see Fig. 2) is more stable than the interactions, does not, obviously, exclude that it changes over time (Waddington 1977, Bateson 1979). The fact that collective thinking has an ‘institutional base’ leads to recognise the relevance of institutional change in this field of analysis too (Hamilton 1999).

The institutional base is partly formal – and designed – and partly informal (spontaneously emerged), and the relative importance of these two classes of institutions may be different in time and space (North 1990).

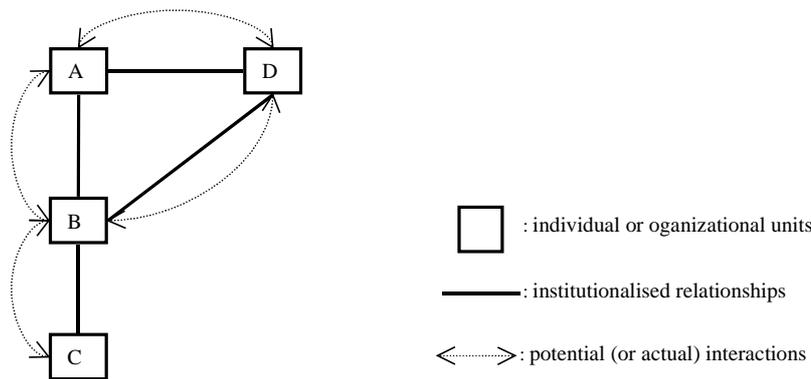


Figure 2 – Collective brain as a specialised network

IV. Collective thinking as an evolutionary process

Why do members of a collective agent *discuss before voting*? Indeed, the habit of initiating the decision process by discussing is so deep-rooted (‘natural’) that its theoretical underpinnings are hardly noted. It is worth stressing that the standard model of collective decision-making has no explanation for the elementary fact that invariably the decision process initiates with a *discussion* among the members making up the collective agent.

The concept of ‘discussion’ has to be understood in terms of the concept of *communication*: individuals transmitting and receiving symbolic signals (Devlin 1991). Indeed, the assumption of ‘substantive rationality’ (Simon 1978) leaves no room for communication not only as a category of economics but also as an activity actually performed by human beings. Why and about what should individuals engage in communication? Do not they already know everything relevant to their economic decisions?

Firstly, the phenomenon of communication in collective decision-making is the obvious consequence of (a) asymmetrical information and (b) diversity of values. Secondly, communication is a consequence of the awareness of individuals that to receive a signal (and even transmit it) may well have causal effects. Communication has the nature of *causal interaction*. Exchanging information and opinions is likely to produce a change in the

orientation and evaluation systems of individuals⁹. Direct government – particularly in the form of ‘the whole community gathering and deciding’ – is a solution not only to the problem of how to distribute decisional power but also to the problem of how to organise communication.

Communication as (causal) symbolic interaction obviously has a temporal dimension: it takes place in (historical) time. To the extent that the interaction is causal the effects of communication on the members of the collective agent (‘population’) can be described as kind of evolutionary process. Put in other terms, the effect of communication can be interpreted as giving rise to a diffusion process, and use the ‘population thinking framework’ (Witt 1989) to describe it. For however much spatially-temporally determined this process is, it is an evolutionary process taking place in historical time. During the process the relative magnitude of classes of individuals being in specific mental states changes, and this change will make the decision-process converge towards a given outcome.

Communication related to a given collective decision (or class of collective decisions) entails a diffusion of information, relevant knowledge and values. Given the initial condition the process of diffusion may lead to a great many different points – that imply different final collective decisions. Since each individual belonging to the group is endowed with a specific evaluation and orientation system, communication triggers a dynamic process in the diffusion of knowledge and values among the group – *and this is the first step in collective thinking*¹⁰.

This process of diffusion is time-constrained by the context of the decision which is often artificially created by (previous) collective decisions (‘constitutional laws’, administrative procedures, etc.). Besides, the recourse to majority rule ensures that wherever the diffusion process leads to, the ‘yes’ or ‘no’ option will produce a collective decision or a collective statement. Hence, the thinking of collective agents converges towards a specific mental state.

To explain a given collective decision involves reconstructing its ‘causal history’ (Lewis 1986) – but from a dynamic perspective to reconstruct the initial conditions is not sufficient. One has to understand what kind of diffusion process takes place among the group (population). This would not be necessary if individuals had *identical* orientation systems and evaluation systems. Indeed, communication is needed precisely because of these differences among individuals. Therefore, although the final collective decision may crucially depend on the initial conditions (distribution of knowledge and values among the

⁹ The category of ‘orientation system’ is being used here to refer to the cognitive and informational dimension and the category of ‘evaluation system’ to refer to the value system of the individual (cf. Parsons & Shill 1959).

¹⁰ Indeed, if the time dimension is stressed, there is no way to reintroduce a deterministic perspective in the modelling the diffusion process. Firstly, new knowledge may be created while communication is taking place. In this case the most relevant objects of communication are interpretative theoretical frameworks. There is probably no other ‘object’ that is more liable to creative thinking (novelty) than conjectural frameworks. Furthermore, even if one applies the frequency-dependency approach in order to model the diffusion of knowledge the specific structural form of the dynamic functions used cannot be other than historically-temporally determined.

group) it has to be explained by supplementing this information with information on the pattern of diffusion of knowledge and values which has taken place as a consequence of communication¹¹.

Introducing communication does not change the fact that a collective brain is in the first place a collection of individual brains. But it allows – indeed, forces – us to recognise that this collection of brains is in fact a ‘system of individual brains’. Yet the structure that links these parts is made up of the rules and procedures that shape communication among the individuals within a given community (society). Communication takes place within this structure, which becomes a key variable in the explanation of public decisions.

The question arises about how communication among the members of collective agents is organised. The organisation of communication related to the collective decision process is a social arrangement made up in any known society by formal and informal norms whose spatial-historical dimension is inescapable.

Therefore, to understand collective thinking requires at least two levels of analysis. Firstly, one has to consider the orientation and evaluation systems of the parts – individuals – that make up the collective agent. Secondly, one has to consider the structure through which information (or knowledge) passes from one individual to the other.

V. Direct government

The most simple and perhaps most attractive model of collective decision-making is ‘direct government’. What makes direct government attractive is not only the absence of any explicit form of delegation of the decision power. Equally important is the specificity of the institutional structure through which communication takes place, and hence the ensuing features of the collective brain – and collective mental process.

Admittedly, direct government is a very straightforward solution to the question of finding a social arrangement to create a structure for communication, and hence for building a collective brain able to produce collective mental processes. No wonder then if it is the ‘natural’ mode of deciding chosen by collective agents whenever it is possible. The fact is that this kind of collective brain – as a consequence of the way in which communication is organised and information transmitted – produces highly efficient mental processes.

The symbolic signals – whose content is knowledge transmitted in turn by each individual who wants to, everybody being entitled to do so – reach all other members of the collective agent (group). However dispersed the knowledge may be among the individuals a collective brain in which communication is organised through *general* and *direct* communication will always contain all the knowledge dispersed in society – and the mental processes produced by it will be able to use that information (see Hayek 1937,1945).

To say that given knowledge enters the mental process does not mean that it is functional to the decision. In a group that has agreed to adopt the majority rule the

¹¹Already at this stage the question may be raised of whether a holistic approach might be more useful, and hence if would not be correct to encompass in the concept of collective mental process value formation and information acquisition. An holistic approach in this field is that advocated by Luhmann (1985).

knowledge deemed as relevant is chosen by a political decision. Even though communication leads to unanimity, part of the knowledge available at the beginning of the process may still remain unused. The thinking process may lead all the members of the group to choose a given interpretation of the consequences of the options and to a given set of options among which to choose.

Although various specific situations may be envisaged in which direct communication is totally informal and unstructured, 'direct government' becomes under given conditions very easily institutionalised. In fact, it is methodologically useful to move from direct government because at this level of analysis it is possible to carve out the origins of institutionalisation of the mental process, and then the role played by norms in shaping the collective brain. But the relevant scientific issue is to address the fundamental question of the functioning of institutionalised collective brain.

The main source of the institutionalisation of collective-thinking is the diversity of the orientation systems of individuals. This diversity entails asymmetrical information and different cognitive abilities. The signals an individual can transmit and take in (that is, detect, interpret, retrieve and process) depend on his orientation system. Therefore, the right to communicate and modes of communicating that puts each individual in the (physical) position of receiving all the signals transmitted do not mean that each individual can detect and interpret the signals. Communication is therefore constrained by the structure of the population interpreted in terms of individuals' orientation systems at time $t=0$.

One of the fundamental features of societies is that the orientation systems of its individual members *partially* overlap. Individuals may have the same information or may be able to extract the same information from the same sources (see Devlin 1991, Ch. 2). The overlapping area of the orientation systems is made up of knowledge which is stable or which changes extremely slowly over time and it is what makes possible communication at all. If a collective decision falls back into the area of the overlapping knowledge, communication concerns only the individual value systems, and the process of collective thinking is only a matter of a relative diffusion of values – or individual ranking criteria – among the members of the community. But what happens when a collective decision falls back into the non-overlapping areas of the orientation system, and therefore outside some or many or all of the orientation systems of individuals?

While accepting the individualistic nature of values, members of the community tend to stress the objectivity of the outside world. Not only they tend to use or, at least, conceive identical categorial systems but they are also inclined to think that there should be a *convergence to the same conjectural systems* to trace the consequences of collective decisions. To the extent that the conjectural systems which are used to interpret the effects of collective decisions move away from 'common-sense knowledge' and the community increasingly relies on 'social science', the nature of communication, and hence the character of collective thinking, undergoes a profound change¹².

In direct government the distribution of cognitive skills and information among individuals shapes the process of communication, producing different kinds of collective mental processes. In principle, since the effects of the social decisions are the objects onto

¹² After all the emergence and consolidation in England of 'political economy' as a science was a response to the need to understand the effects of parliamentary decisions (see Mitchell 1967).

which individuals project their values, somehow these effects have to be 'translated' into signals that may be understood by any individual. Political parties and trade unions, for example, are fundamental forms of institutionalisation of communication – before being an institutionalisation of political delegation. They also act as 'focusing device' by channelling the learning process.

VI. Highly differentiated collective brains

Modern society has been able to self-organise communication in many different ways – and that against the background of the strong diversity of the orientation system and the high complexity of collective decisions¹³. However, when the complexity goes beyond a given threshold institutionalisation is associated with the fundamental phenomenon of 'partitioning' of the collective brain and 'segmentation' of the collective decision-process. Embedded in constitutional and ordinary law, in the administrative procedures and in the praxis, the partitioning of the collective brain and segmentation of collective thinking is a feature of utmost importance to the understanding of the overall process of collective thinking in modern democracies. Indeed, the institutionalisation of collective thinking is such that usually classes of public decisions are identified and the right (or obligation) to take decisions on each class is given to a sub-set of individuals¹⁴. The flow of public decisions can be described using a matrix defined by a set of decision-makers and a set of decisions (both expressed in terms of 'classes').

The emergence of a 'network of collective decision-makers' within the collective agent is based on the delegation of the power to take a decision. Yet it involves also the fundamental issue of knowledge distribution and knowledge flow within the network of decision-makers. And among decision-makers. In Fig. 3 the archetypal partitioning of collective brain in the 'community' (A), the 'parliament' (B) and the 'government' (C) is illustrated.

Each circle represents a decision-maker, that is a group of individuals (or a single individual) which has *the power to decide* or, in other words, to choose a given public policy from a set of potential public policies. One may think of the agents A, B and C as the electorate (community), the parliament and the government respectively. As long as the community (A) retains the power of taking given classes of economic decisions – this is actually the case in many countries through the device of referendums – the model of collective mental processes developed in the previous section applies. But now there are other kinds of mental processes going on within the collective brain: the mental processes of the delegated decision-makers.

¹³The rise of the environmental movement is an interesting case. The complexity of the conjectural frameworks used in the area of political communication is known. A change in the Western cultural paradigm has even been deemed necessary. Without a rapid institutionalisation of political communication, which was necessary first to solve the problem of the complexity of communication, it would not have been possible to start to think collectively in this field.

¹⁴To put forward an explanation for the prevalence of 'structured minds' is beyond the scope of this essay. Time constraint and bounded rationality, against the background of repeated collective decisions, may certainly be regarded as a cause.

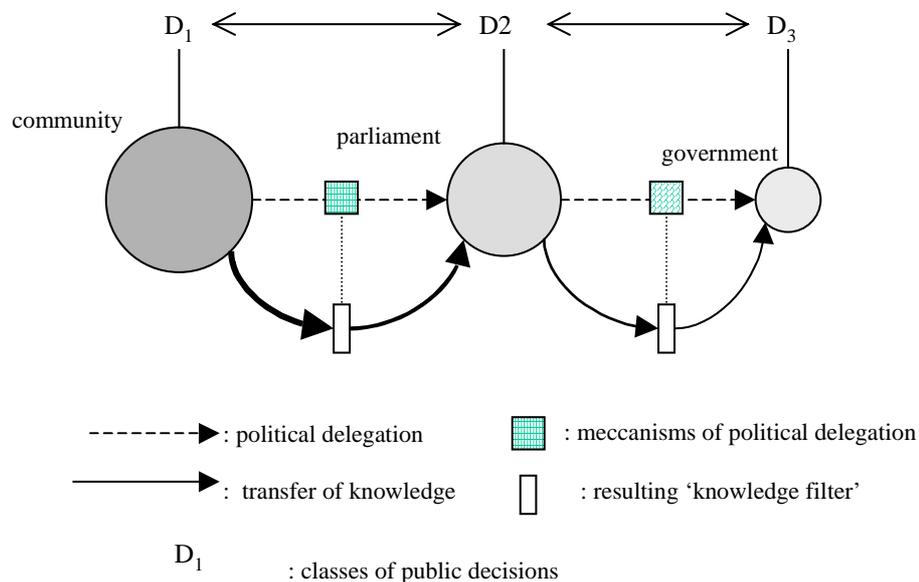


Figure 3 – Mechanisms of political delegation and knowledge transmission

The paradigm of ‘substantive rationality’ has obscured a relevant consequence of partitioned collective brains, and namely that moving from A to B (to C and so on) it is likely to generate a redistribution of knowledge among the different sections of the mind that cannot be assumed to be functional to the decision process. This is a vexed question, but what is interesting is that the brain-mind distinction that it has been previously suggested to study collective decision-making allows to move from moral concerns to the organizational dimension of the problem.

If one goes beyond the elementary partition of Figure 3 and take into consideration how the collective decision-making in modern democracies is segmented, the relevance of the issue of the ‘distribution of knowledge’ among the different sections of the collective mind – and the differences in the learning mechanisms among the sections – becomes apparent. Has communication taking place *within*, for instance, the parliament the same knowledge content as communication taking place within the community? Is the heuristic hypothesis that the knowledge contained in the community is the same as the knowledge contained in an administrative department?

This problem simply does not exist if individuals had perfect knowledge. Conversely, it becomes extremely relevant if individuals have some sort of bounded rationality. Historically (and logically) the solution to this most difficult question has been to turn collective decision-makers into organizations with a specialised part of them devoted to learning processes functional to the collective decision process itself (see Weber 1980). Moreover, this specialised part, as it will be discussed in the next section, performs the role

of interface between the decision-maker and its informational environmental – in order to use in the decision process the knowledge which is outside the boundary of the system.

Indeed, the solution to the problem of non-functional distribution of knowledge in a partitioned brain has been to increase the thinking capacity of each decision-maker, by transforming it into an ‘organised agent’ within which the production of functional knowledge is delegated to specialised parts of the organisation itself.

The collective brain is not made up only by the brains of the members of the political institution (and a set of procedures and devices to communicate). With the term collective brain one has now to refer to a more complex organization within which there are parts (sub-sets of individuals) endowed with resources which perform strings of the whole thinking process.

The collective brain is now to be interpreted as a more differentiated organization made up of parts which perform radically different even though integrated activities (see Fig. 4). One part of the individuals has the power to take decisions, the other one generates relevant knowledge functional to the decision process. Within the collective ‘brain’ there is a constant flow of instructions (orders) and information.

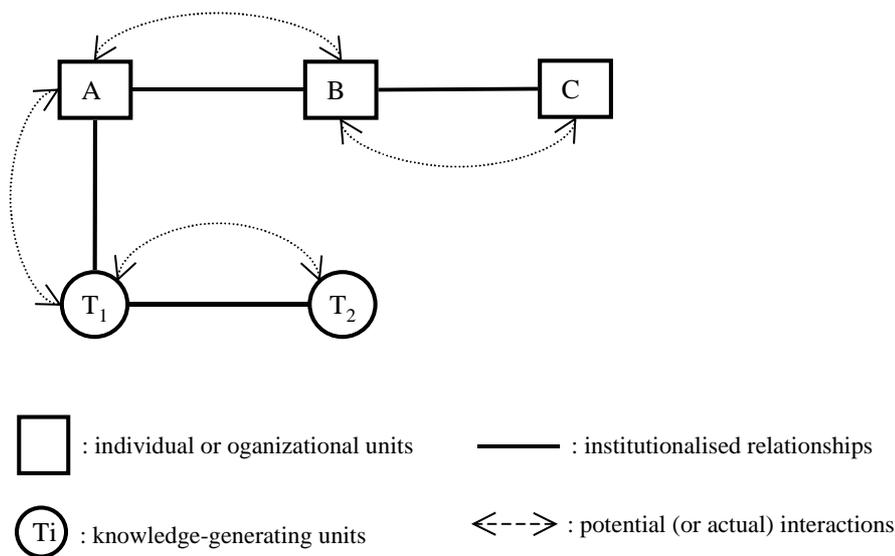


Figure 4 - Collective brains as differentiated networks

VII. Co-evolutionary collective thinking

It was previously stressed that communication within the community becomes very soon institutionalised in the sense that a set of formal and informal procedures shaping communication emerges. If a co-evolutionary overall mental process has to establish, even

the second-order communication – that is, the interaction between A and B – has to be institutionalised. The first question is that the ‘relatively small’ decision-makers – say a parliament or, even more so, a government – cannot communicate directly with the community for the reason that the bounded rationality of their members does not allow to receive and use all the information coming from the community. The delegated decision-makers have to provide themselves with an *interface* – that may simply be a procedure to exchange information with the environment – to make a co-evolutionary mental process possible. Indeed, this is one of the reasons why highly differentiated collective brains are observed. As discussed in the previous section, this kind of brains has a built-in interface that allows them – at least in principle – to link to the thinking processes going on in the community at large. The role of the interface is to embark on a *circular* interaction with the communities. It selects the relevant information available in the community on a set of options¹⁵. Then, as a response to signals it receives it may change the set of effects and evaluation criteria until the process converges towards a decision.

This interface may assume different forms. It might be informal. Some members of the decision-maker may be given the task of acting temporarily as an interface. Or it may be very strictly institutionalised, giving the task to a permanent or changing professional bureaucracy. Another relevant form is to set up a specific and temporary interface for specific decisions^{16,17}.

The need for the emergence of new relevant knowledge is a major issue in co-evolutionary collective thinking. In a complex mental process learning emerges as a result of communication between the units of the system, which entails diffusion of the relevant knowledge. But collective learning is also a consequence of learning processes performed by the single units of the system. Learning does not require that the unit be open at informational level. Each agent learns by producing knowledge from within as a result of a variety of processes.

For co-evolutionary mental thinking to be effective the two mental processes need to be *in phase*. The question here is one of extension. It is, in fact, hard to deny that for some public decisions, in some modern democracies at least, a co-evolutionary collective thinking does take places. It is, however, interesting to observe that this kind of co-evolutionary interaction is not regulated by a set of formal procedures (Van der Knaap 1996). The transition to a more and more differentiated collective brain that has been taking place over the last decades has not been accompanied by the introduction of formal communication procedures that are able to overcome the difficulties arising from the

¹⁵ The discretionary, and hence political, dimension of this role – often overlooked – has been highlighted in Moe (1990, 1991).

¹⁶ The Parliamentary hearing, for example, is a procedure to reduce the asymmetry of knowledge between the systems A and B (and asymmetry of knowledge between the members of the parliament: cf. Gilligan 1993).

¹⁷ The thinking activity of the bureaucracy should not be confused with its strictly administrative activity (see Simon 1959). Since the result of a collective decision is by definition a norm – and not an action as it is for individual agents – the decision often needs to be implemented. A system of contracts must be devised and signed. The fact that in many collective decision-makers there is no clear-cut distinction between these two very different roles is quite amazing, and may account for many collective failures.

reduction of the knowledge content of decision-making process brought about by brain segmentation.

What is interesting, however, is how much societies differ in the extension and depth of the collective thinking still going on within the community after having delegated much decisional power to other political or administrative bodies. This is a crucial issue because the 'quality' of the collective mental process depends on three factors: 1. the quality of the mental process of B; 2. the quality of the mental process of A; 3. the quality of the interactions between different parts of the collective brain.

If all sections (decision-makers) and, hence, all mental processes going on within the collective brain are considered, one can order them in relation *to their degree of integration* with the mental process going on in the community. On the one extreme there is a situation in which the collective thinking of each section of the collective brain is independent: each section of the collective brain is a closed-system. At the other extreme there is the 'integrated collective brain': the overall collective mental process is a co-evolutionary process.

The ramification of the delegation of collective decision-power may be associated with a reduction of the *scope* of decisions which are delegated. Delegated decisions may have 'only' localised effects, both in the sense that the effects are spatially and socially (and temporally) localised. In the case of 'localised decisions' the amount of knowledge that is involved may not be very large. To evaluate the effects of locating an industrial area, choosing among different sites, may be regarded as a far less complex activity than to evaluate the privatisation of the national health sector. Moreover, to decide how to regulate the inflow of tourists in a natural park or how to charge for public transport service is even less difficult than to decide where to locate an industrial area.

The canons of decision-makers' thinking are, indeed, in many cases established simply by *guidelines* handed down to a decision-maker simultaneously with the decision-making power. In devising and evaluating options a decision maker has to follow specific *procedures* that constrain the thinking process – yet these procedures cannot predetermine the final decision (Moe 1990, 1991; Macey 1992).

Decision-makers in modern societies often behave as closed-systems, the working of which is governed by procedures specifically designed for the class of decisions they are instructed to take. There are two aspects to be considered in this respect. Firstly, although each public decision of this class may have limited effects, given the fact that this class is in modern society very large indeed, this is an important section of the overall collective mental process¹⁸. For instance, if there is a pathology systematically affecting this type of collective mental activity, the consequences for overall public decision-making are bound to be very relevant.

The second aspect to be carefully considered is that collective decision-making, and the related mental processes, is delegated for this class of decision to a very small group of people (administrative departments) or indeed to a single person. In other words, there are collective decisions that are the product of mental processes generated by individual brains.

¹⁸ Many classes of public decisions ought to be taken, in principle, *on the basis of some form of welfarist consequentialism* (Scheffer 1988). Yet to apply consequentialism may prove to be much more troublesome than to discuss about it. The real challenge to a modern economic democracy is to cope with the problems posed by applying consequentialism.

Collective decision-making is then to be understood as being based on individual thinking, although this type of individual thinking is constrained by the rules that identify the 'office' – rules and procedures which are independent from the actual person occupying the 'office'.

It is one fundamental feature of modern public administration that individuals occupying an office that can take public decisions are somehow forced into a process of co-evolutionary thinking, where the units of the system that interact to produce a decision are the members of the administrative department. Again what is at stake is the rationality of the collective decision, that is the difference between the knowledge content of the mental process that leads to the decision and the knowledge available within society on that particular subject, that could have been used. This explains why 'moral failing' and 'ignorance' are so important in explaining public decision-making – and why a framework that accommodates for the explanatory role of both is required to reconstruct a meaningful causal history of public decisions. This is a further dimension of the institutionalisation of collective thinking.

Normally, what one observes is a large set of procedures governing the decision-making of a closed system. This set of procedures must be designed and re-designed. But since a closed system has less capacity of evolving, against the background of a changing environment, the procedures must be variable: information on the decision-making process of this closed system has somehow to feed back to the procedures' designer (Van der Knaap 1995). Again it is interesting to observe how scarce the attention devoted to the construction of a feedback structure for the revising of the concerned procedures has been. This corroborates the suggestion, that was previously put forward, to turn these systems into 'open-systems', establishing a co-evolutionary interaction with the 'local' community involved.

VIII. Resources for the collective mental process

The models of collective mind discussed in the previous section have an economic dimension also to the extent that collective mental processes require economic resources to be performed. One may say that, basically, they require time. The amount of required resources depends on many factors. Firstly, the number of decisions taken; secondly, the time required by each decision: the time to theorise (and learn), communicate, and vote.

One of the most obvious benefits of delegating the decision power to a relatively small subset of individuals is the large saving of economic resources it apparently determines. Nevertheless, to the extent that a given collective mental process has the co-evolutionary dimension discussed in the previous section, the cost of the decision process encompasses also the cost of the mental process of A and of the communication between A and B.

Collective thinking is a costly process. And it is difficult to deny that its quality depends on the amount of resources devoted to it and on the efficiency of the system (see Calafati 1996). But whereas there are formal procedures to allocate resources for thinking to the delegated decision-makers, there is nothing comparable for the community. The community has to self-organise in this respect. A strictly decentralised process leads to an allocation of time so that it encompasses time (and resources) for 'polity learning' and

'political communication'. Let us imagine a society in which no time (resources) is devoted to political communication. The collective thinking process would stop immediately in the case of direct government and would be severely endangered in the case of indirect government. Indeed, there would be no chance to channel the existing dispersed knowledge into the process of collective thinking. Any kind of co-evolutionary collective thinking would be blocked. But without taking the extreme position of 'no time and resources' devoted to political learning and communication, it is clear that the quality of the collective mental process depends crucially on the amount of resources devoted to political communication, which, in turn, is related to the way communication is organised.

Is a balance in the allocation of resources for collective thinking needed? More specialised and more numerous public decisions call for an increase in the resources devoted by individuals (or groups of individuals) to political communication. Legislatures and governments control resources far larger than those of the community. This asymmetry of resources devoted to thinking may be used to lock-in the process of thinking in a position that is convenient for the delegated decision-maker. But at a deeper level there is the question of how scarce resources – always, however, a matter of allocation – may prevent dispersed knowledge from being used in the decision process.

IX. Conclusions

In the paper an extension of the categorial and theoretical frameworks that ought to be used to describe and explain public decisions has been proposed. Firstly, it has been suggested to draw a logical distinction between the collective brain and the collective mind – similarly to what the research programme of 'bounded rationality' has proposed in the study of individual agents' behaviour. Since this distinction implies that the brain causes the mental process, one is forced to concentrate on the 'physical' features of the brain. In the case of collective brains, which according to the proposed formal definition are 'specialised networks of agents', that means to put into focus the institutional foundation of collective thinking. Indeed, the structure that links the individuals making up the network is given by a matrix of norms, procedures, routines, practices which shape the interactions, mainly communication, within the units of the network. Since one may well expect that the 'institutional base' of the network will change in historical time, collective brains have to be seen as 'evolving systems'.

In a world of individuals (and agents) that are assumed to have 'bounded rationality', communication has a causal effect: it changes the structure of the population in terms of distribution of information, knowledge and values. Consequently, in the paper the hypothesis to conceptualise collective thinking as an evolutionary process has been suggested.

A further step in the analysis has been the observation that the collective brain is usually 'partitioned' – and the mental process segmented. Consequently, the flow of public decisions can be classified by reference to the classes of decision-makers and to the classes of decisions. This segmentation, that appears as soon as a class of decisions is delegated to a sub-group of the community, has been historically accompanied by a remarkable increase in the specialised production of knowledge functional to collective decision-making.

Collective brains become more differentiated as a result of the fact that they incorporate 'technical units' devoted to the production of knowledge. How these technical units perform deeply affects collective thinking. Moreover, the amount of resources that in society is formally or informally devoted to collective learning emerges as a key variable in explaining the range and rationality of collective decision-making.

A further consequence of having a segmented mental process is the intrinsic 'co-evolutionary nature' of collective thinking. Although to various degrees, each decision-maker is (or ought to be) a system which is open in terms of informational flow. If collective decision-makers want to be up to their moral canons they have to use the relevant knowledge that is dispersed in the environment in their decision process. Co-evolutionary collective thinking is both an observed phenomenon and a standard of collective behaviour.

As a final remark it may be worth stressing that the progress made in the last decades in the study of institutions and organizations may turn the pursuing of an *institutional theory* of collective decision-making into a rewarding enterprise.

Bibliographic references

- Ayres C.E., (1951), *Institutional Economics. The Co-ordinates of Institutionalism*, "American Economic Review, Papers and Proceedings", vol. 41, 1951.
- Bateson, G. (1979), *Mind and Nature: A Necessary Unit*, London: Wildwood House.
- Calafati A.G.(1996), *Mercati e gerarchie nel processo di apprendimento degli agenti collettivi*, in Montesano A. (a cura di), *Teoria economica dell'organizzazione*, Bologna: Il Mulino.
- Bandura A. (1977), *Social Learning Theory*, Englewoods Cliffs (New Jersey): Prentice Hall.
- Devlin K. (1991) *Logic and Information*, Cambridge: Cambridge University Press.
- Dopfer K. (1991), *Towards a Theory of Path Dependency*, in "Journal of Economic Issues" (2:535-550).
- Dopfer K. (1994), *How Economic Institutions Emerge: Institutional Entrepreneurs and Behavioural Seeds*, in Shionoya Y. and Perlman M. (eds.), *Innovation in Technology, Industries and Institutions*, Ann Arbor: The University of Michigan Press, 1994.
- Downs A. (1957) *An Economic Theory of Democracy*, New York: Harper and Row.
- Douglas M. (1987), *How Institutions Think*, London: Routledge and Kegan Paul.
- Dunleavy P. (1991), *Democracy, Bureaucracy & Public Choice*, New York: Harvester Wheatsheaf.
- Gilligan T.W. (1993), *Information and the Allocation of Legislative Authority*, in "Journal of Institutional and Theoretical Economics", pp.321-341
- Hamilton D. (1999²), *Evolutionary Economics. A Study of Change in Economic Thought*, 1970, London: Transaction Publisher.
- Hayek F.A. (1937), *Economics and Knowledge*, in "Economica" (February), pp. 33-54.
- Hayek F.A. (1945), *The Use of Knowledge in Society*, in "American Economic Review", Vol XXXV(4), September, pp. 519-530
- Hirschman, A.O. (1982) *Shifting Involvements. Private Interest and Public Action*, Princeton: Princeton University Press
- Lawson T. (1998), *Economics and Reality*, London, Routledge.
- Lewis D. (1986), *Casual Explanation*, in David Lewis, *Philosophical Papers*, Oxford: Oxford University Press.
- Lindblom C. (1963), *A Strategy of Decision*, New York: Free Press.
- Lindblom C. (1977), *Politics and Market*, New York: Basic Book.
- Luhmann N (1985), *Ökologische Kommunikation*, Opladen:Westdeutscher-Verlag.
- Lunghini G. (1981), *Scelte politiche e teorie economiche in Italia (1945-1978)*, Torino: Einaudi, 1981.
- Macey, J.R. (1992), *Organizational Design and the Political Control of Administrative Agencies*, in «Journal of Law, Economics & Organization», vol. VIII(1), pp.93-110.
- March, J.G. e Simon, H.A. (1958) *Organizations*, New York, John Wiley & Sons.
- Mitchell, W.C. (1967), *Types of Economic Theory*, New York, A.M.Kelley.
- Moe T.M (1990), *Political Institutions: The Neglected Side of the Story*, in «Journal of Law, Economics & Organization», vol. VI (Special issue), pp. 213-223.
- Moe T.M. (1991), *Politics and the Theory of Organisation*, in "Journal of Law, Economics and Organisation", Vol. VII (Special Issue).
- North D.C. (1990), *Institutions, Institutional Change and Economic Performances*. Cambridge University Press, Cambridge.

- Olson M. (1966), *The Logic of Collective Action*, Cambridge (Mass.): Harvard University Press
- Parsons & Shill E.A. (eds) (1959), *Towards a General Theory of Action*, Cambridge (Mass.), Harvard University Press.
- Schumpeter J.A. (1954) *Capitalism, Socialism and Democracy*, 1942¹, London: George Allen & Unwin.
- Sanford A. (1987), *The Mind of Man. Models of Human Understanding* Harvester Wheatsheaf, 1987.
- Searle J. (1984), *Minds, Brains and Science*, London: Penguin Books, 1991.
- Scheffer S. (1988), *Consequentialism and its Critics*, Oxford: Oxford University Press.
- Simon H. (1959), *Administrative Behaviour*, New York: MacMillan.
- Simon H. (1976), *From Substantive to Procedural Rationality*, in Latsis S. (a cura di), *Method and Appraisal in Economics*, Cambridge: Cambridge University Press.
- Simon H. (1983), *Reason in Human Affairs*, Stanford, Stanford University Press.
- Simon H. (1978), *Rationality as a Process and as a Product of Thought*, in "American Economic Review", vol. 68(2), pp.1-16.
- Stevens J.B. (1993), *The Economics of Collective Choice*, Boulder: Westview Press.
- Van den Doel H. and van Velthoven B. (1993), *Democracy and Welfare Economics*, Cambridge: Cambridge University Press.
- Van der Knaap P (1995), *Policy Evaluation and Learning Feedback, Enlightenment or Argumentation*, in "Evaluation", Vol 1(2), October, pp.189-216.
- Waddington C.H. (1977), *Tools for Thought*, New York: Basic Books.
- Weber M. (1980⁵), *Wirtschaft und Gesellschaft*, Tübingen: Mohr.
- Weingast B.R. and Marshall W. (1988) *The Institutional Organization of Congress*, in «Journal of Political Economy».
- Williamson O. E (1985) *The Economic Institutions of Capitalism*, New York, The Free Press
- Witt U. (1989), *The Evolution of Economic Institution as a Propagation Process*, in "Public Choice", , 62:152-72.
- Witt U. (1988), *Individualistische Grundlagen der Evolutorischen Ökonomie*, Tübingen: J.C.B. Mohr(Paul Siebeck).
- Ziman J. (1978), *Reliable Knowledge*, Cambridge: Cambridge University Press.
- Whitley R. (1984), *The Intellectual and Social Organisation of Science*, Oxford: Clarendon Press.