RATIONALITY, DEMOCRACY, AND LEAKY BOUNDARIES:
VERTICAL vs. HORIZONTAL MODULARITY

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Abstract:

Are boundary issues raised by processes of globalization exogenous or endogenous to the theory of democracy? In response to this question, an analogy is suggested between political theory and cognitive science. A distinction between vertical and horizontal modularity in cognitive science is introduced. Horizontal modularity, and the way it may seem to threaten rationality, is illustrated by reference to imitation. Possible evolutionary functions of imitation are considered, and it is explained how rationality can be rethought so as to reconcile it with horizontal modularity. An analogous distinction between vertical and horizontal modularity in political theory is considered. In a similar way, democracy may seem to be threatened and need to be rethought in the face of increasing globalization. The simulation of evolution might aid imagination in normative political theory and help to rethink democracy in an increasingly horizontally modular world.

1. Are boundary issues raised by processes of globalization exogenous or endogenous to the theory of democracy?

Can democracy be adequately understood in terms of majoritarian procedures? Majoritarian procedures depend on certain parameters to be well defined: in particular, on specifications of boundaries and of units. For a given issue, we can ask: should majoritarian procedures be applied within local or state boundaries, or internationally? And should the units represented equally by such procedures be individuals, or other units such as families, regions in a federal system, or states? These critical parameters are obviously not fixed by nature. No one boundary or set of units is simply given. Nor is there necessarily any one correct specification of them for all political purposes. Especially if we take a global view, various familiar boundaries and units display complexity of structure and relativity to purpose: they overlap and layer and nest and cut across one another.

How should boundaries and units be specified, an agenda of issues be divided up, and particular types of issue be assigned to particular decision-making domains, identified in part by the choice of boundary and unit? As Robert Dahl (1982) and others have pointed out, we cannot appeal simply to majoritarianism to resolve such jurisdictional questions: a majority of what units, and within which boundaries? So the question arises: are the values that guide these jurisdiction-setting tasks properly seen as exogenous or endogenous to democracy?

The exogenous view would be as follows. Various forces and powers operate to set boundaries and units and to assign issues to domains. We are not necessarily in control of

this process, and the values that guide it, to the extent it is guided at all, are independent of the values of democracy. We should not confuse democracy with other values. Democracy must presuppose these parameters, so it cannot determine them and hence cannot determine that some are more democratic than others. In a classic expression of an exogenous view, Dahl writes: "The fact is that one cannot decide from within democratic theory what constitutes the proper unit for the democratic process" (1983, pp. 103ff).

Here is a contrasting, endogenous view. (In developing this contrast, I will put the endogenous view more forcefully, since the exogenous view has been made familiar and has been forcefully expressed by others.) Democracy does bear on jurisdictional questions; democracy is more than majoritarianism with presupposed parameters. Gerrymandering can have anti-democratic or pro-democratic effects. Distinctively democratic values, such as values of self-determination, autonomy, respect for rights, equality, and contestability, are already at stake in the choice of boundaries and units and the assignments of issues to domains so defined: for example, in the relationships of political boundaries to ethnic groupings, in the treatment of refugees, in the assignment of certain issues to referenda, to individuals for private decision, to judicial review, to a body of representatives of regions, and so on. Some choices of boundaries and units and assignments of jurisdiction might tend to repress and others to foster the autonomy of individuals, respect for their rights, and their deliberative and rational capacities. Some choices of boundaries and units and assignments of jurisdiction might involve built-in tendencies toward bias or cooperative failure that hinder self-determination, while others might avoid them. The values that illuminate these issues and guide heterarchical institutional design cannot plausibly be segregated from the values of democracy (Hurley 1989, ch. 15; Hurley, forthcoming 1999). Rather, they should be integral to our best understanding of democracy itself. Otherwise, democracy will be handicapped in its ability to provide a coherent ideal in the face of global complexity. It will be only a fragment of a political ideal.

On the endogenous view, heterarchical complexity per se is not undemocratic. It is not undemocratic per se to fix a boundary for majoritarian procedures to operate within. Some boundaries may be more democratic, others less. It is no more undemocratic per se to assign jurisdiction over issues in a complex, overlapping, layered, nested way, with different units and boundaries for different types of issue. Of course, there is scope for disagreement about jurisdictional issues, whether their structure is simple or complex. And whether simple or complex, such issues can be resolved in more or less democratic ways. We cannot, however, understand how one assignment of jurisdiction or choice of boundary is more democratic than another in terms simply of majoritarianism. If we try to do so, we face a regress: this move embeds the very questions about jurisdiction, boundaries and units, we are trying to answer.

The issue between the exogenous and endogenous views arises, inter alia, in the course of considering how the theory of democracy should deal with the undermining of traditional state boundaries by processes of globalization.[1]

Globalization makes it increasingly the case not only that people beyond state boundaries can be profoundly affected by internal decisions, but also that external factors can wrench power and control away from internal decision procedures. Functional power networks specific to various particular domains of activity--economic, political,

environmental, informational, technological, legal, etc.--increasingly cut across traditional state boundaries (see and cf. Held, forthcoming 1999[2] and Held 1996, ch. 10; Altvater, forthcoming 1999[3] Dahl, forthcoming 1999[4]). If the theory of democracy traditionally presupposes the type of state boundaries that globalization undermines, what could or should take their place?

On the exogenous view, we cannot appeal to the values of democracy to answer this question. But what can we appeal to? Perhaps a maximally expanded boundary, in effect that of a world state, could reinstate majoritarian democratic theory at the global level. But why presuppose this state boundary? On reflection, it is no more given by nature than any other. The domain-specific power networks that tend to undermine state boundaries may well not support a world state either. So globalization plus the exogenous view tend to support a kind of scepticism about democracy. On the exogenous view, globalization presents an empirical threat to democracy: it means that the essential procedural presuppositions of democracy may no longer hold, as an empirical matter. If this is the case, then the demands of democracy are indeterminate. Perhaps some ways of responding to the boundary-undermining effects of globalization are better than others, but they are not more democratic. We should not confuse democracy with other values.

By contrast, the endogenous view can in principle respond to the consequences of globalization in terms of democratic values. A world state, even a majoritarian one, may be unattractive on many grounds, some internal to the values of democracy itself. Some ways of arranging higher-order power relationships among domain-specific power networks may be more democratic than others. While the endogenous view sees the possibility of genuinely democratic values surviving the empirical demise of the traditional presuppositions of democracy, the exogenous view sees ersatz democracy.

The way the exogenous/endogenous issue arises in the context of globalization suggests that the contrast may be too sharp. The concept of democracy may not be static, but may itself demand dynamic adaptability. As we rethink democracy in the global context, perhaps what we need is something more like an idea of continuity in the evolution of democratic values, where the normative relationships of procedural and substantive component values have an essentially dynamic aspect.[5]

Recall at this point the still-fruitful classical idea that there may be analogies between social and political structure, on the one hand, and the structure of the mind, on the other.[6] Boundary issues have become a recent focus of attention in cognitive science as well as in political theory. Some interdisciplinary lateral thinking may aid the search for the legitimate descendants of democratic values and procedures in the global context. To this end, consider an analogy between rationality and democracy: between the way rationality is conceived in cognitive science and the way democracy is conceived in political theory. Questions familiar from recent philosophy of mind are these: Is it essential to rationality, cognition, and thought that the internal causal processes underwriting them have a certain structure? In the absence of that causal structure, are true rationality and thought eliminated? (See for example Stich 1996.) Consider the parallels with our questions about democracy: Is it essential to democracy that internal political procedures have a certain structure? In the absence of that procedural structure, is true democracy eliminated?

2. Vertical vs. Horizontal Modularity in Cognitive Science: Rethinking Rationality[7]

Traditional cognitive science conceives the mind as dependent on underlying processes whose overall structure is vertically modular. Each vertical module performs a broad function and then passes the representations that result on to the next. In the perceptual module, information about location, color, motion, etc., is extracted from inputs by different streams of domain-specific perceptual processing. The representations produced by the different input processing streams converge and are combined by perception. The unified result proceeds to cognition, the central module that interfaces between perception and action. This is where the processes occur that rational thought and deliberation depend on. Rationality is conceived to depend on internal procedures, such as the manipulation of internal symbols or representations, including those passed on by perception. On the basis of current and stored input and cognitive processing, a motor plan is arrived at, which is passed on to motor programming processes to be executed. Processing occurs in a linear sequence of separate stages, from perception to cognition to action. There can be parallel processing within a given stage, for example, prior to the point at which information about color and about motion are combined within perception. However, the overall functional structure is vertically modular.

We should avoid confusing claims about the mental states of persons with claims about the underlying subpersonal processes on which those personal-level mental states causally depend. The vertical modularity conception is a conception of the functional structure of subpersonal causal processes. However, we can understand why the vertically modular view has seemed natural. At the personal level, we distinguish between a person's perceptions, her reasoning, her intentions. Vertical modularity finds similar distinctions at the level of subpersonal functions and causal processes. It may be natural to assume such an isomorphism between one level of description and another.

Nevertheless, this vertically modular conception of subpersonal causal processes is coming under a certain amount of pressure in recent cognitive science and philosophy of mind, from neural network and dynamical systems approaches (Thelen and Smith, 1994, pp. 174, 220, etc.; Elman et al, 1996, Kelso, 1995, Plunkett and Elman 1997, Port and van Gelder 1995; Brooks 1991; Clark 1997, p. 13ff, 58; Kelso 1995; Hutchins 1995, pp. 292, 316, 364ff; Milner and Goodale 1995, pp. 10-13, 26, 41-46, 65, 163, 170, 179, 200; Hurley, 1998b, etc.). This body of work is beginning to extend beyond the territories it is usually associated with (perception, motor control, etc.) and to develop cognitive ambitions. It suggests a contrasting conception of the mind as depending on distributed subpersonal processes that are functionally horizontally modular in structure.[8] One way we can think of these is in terms of layer upon layer of content-specific networks. Each layer or horizontal module is dynamic, extending from input through output and back to input in various feedback loops. Layers are dedicated to particular kinds of task. One network, for example, may govern spatial perception and the orientation of action (the so-called 'where' system). Another may govern food recognition and acquisition-type behavior (part of the so-called 'what' system). Another may govern predator recognition and fleeing-type behavior (another part of the 'what' system). Another may govern some of the variety of imitative responses to the observed behavior of others, and so on. Evolution and/or development can be seen as selecting for each layer. Each subpersonal layer is a complete input-output-input loop,

essentially continuous and dynamic, involving external as well as internal feedback. Thus, not only are sensory and motor processes coupled, but the neural network is directly coupled to the creature's environment; horizontal modules are essentially 'situated'. Each dynamic layer is a system distributed across the perceiving and acting organism plus the relevant parts of its environment (perhaps including other organisms: see Hutchins 1995 on socially distributed natural cognition). However, a given environmental object or feature that can be presented in personal-level content in different ways can also feature in more than one subpersonal horizontal layer or module or system of relations.

What happens to vertical boundaries on a horizontally modular view? Vertical boundaries, such as those around sensory or motor processes, or around central cognitive processes, or indeed around the organism as a whole, are relatively transparent and permeable. The mind is "leaky", as Andy Clark puts it (1997). It does not follow that vertical boundaries disappear entirely. But they share functional significance with horizontal boundaries, and the tendency of the recent work mentioned is to emphasize the latter at the expense of the former, on both empirical and theoretical grounds.

No attempt is made here to argue for a horizontally modular view, which is unorthodox and controversial within cognitive science. Rather, we will pursue some hypothetical questions about the relationship of horizontal modularity to rationality. Eventually these questions will be related to the issues we began with about democracy.

In particular, can a horizontally modular view accommodate cognition and rationality? If our minds are dependent on horizontal layers dedicated to particular tasks, does it follow that our rationality is an illusion? Is the new view inhospitable to the very concept of rationality? Does it eliminate genuine rationality?[9]

Though our first reaction may be that it does, recent work (also unorthodox and controversial) has argued that properties of cognition and rationality can emerge from what are in effect horizontally modular systems. But on this view these properties need to be rethought, so that they are not conceived as depending on a linear sequence of separate stages or on procedures internal to a central interface between input and output. Instead, rationality might emerge from a complex system of decentralized, higher-order relations of inhibition, facilitation, and coordination among different horizontal layers, each of which is dynamic and environmentally situated. Just as evolution and development can select a network at each layer than can do the job wanted, they can also operate on relations between the layers in favor of rationally flexible responses to problems that the environment sets the organism.

However, rationality conceived in this way is substantively related to the world. It does not depend only on internal procedures that mediate between input and output, either for the organism as a whole or for a vertically bounded central cognitive module. Rather, it depends on complex relationships between dedicated, world-involving layers that monitor and respond to specific aspects of the natural and social environment and of the neural network, and register feedback from responses (see Hurley 1998b on the idea of an organism-centered *dynamic singularity*). Among the aspects of the environment included in these feedback loops may be events that amount to the actions of others and, for language-using creatures, to uses of natural language by others (see Hurley 1998a). Very crudely, some layers get turned on and others turned off, in a totality of ways that count as rational

overall in the circumstances. On this view, rationality is a higher-order property of complex patterns of response, which emerges from the layers of direct dynamic couplings between organisms and their structured environments.

3. Imitation, rationality, and evolutionary search.

It may be helpful to consider a more specific illustration of how horizontal modularity might seem to threaten rationality and how the threat can be responded to. We can consider, as an example of a horizontal layer, the imitation system.[10]

In 1977 Meltzoff and Moore published the first of a series of papers about the imitative tendencies of newborn human infants.They claimed that newborns can imitate both facial and manual gestures. For example, infants stick out their tongues reliably when they see someone sticking out his or her tongue. Meltzoff and Moore argued that this behavior cannot be explained in terms of either conditioning or innate releasing mechanisms, and that it implies that neonates can equate their own unseen behaviors with gestures they see others perform (Meltzoff 1995; Meltzoff and Moore, 1977, 1983a, 1983b, 1985, 1995). More recently, Meltzoff has shown that in the process of imitation infants "perfect" actions that were
unsuccessfully executed by adult models.

In 1986 Lhermitte and his colleagues in Paris published intriguing clinical studies of patients with certain kinds of frontal brain damage. Such frontal patients can be affected by an imitation-behavior syndrome. Imitation syndrome patients persistently imitate gestures the experimenter makes, even though they have not been asked to do so and even when the imitative behavior is socially unacceptable or odd (such as putting on glasses when already wearing glasses). When these patients are asked why they imitate, given that they have not been asked to imitate, their answers display a measure of cognitive entrapment: they say they feel they have to, that it is their duty, that the gestures they see somehow include an order to imitate them, that their response is a natural reaction. They do not disown their behavior and may attempt to justify it. Although their behavior reflects a loss of autonomy and rationality, it has been considered to be voluntary, not merely reflexive. For example, a patient with the frontal imitation syndrome might refuse to imitate hair combing because he wore a wig that would come off. So his imitative behavior is not simply reflexive, and is subject to some voluntary control. But there is still a loss of rationality: in this example, since there is no reason to imitate to begin with, there is no need to have a reason for refusing. (Lhermitte contrasts frontal imitation syndrome with echo-reaction apraxia, which results from a different kind of brain damage. Echo reaction apraxia patients have immediate, automatic, reflexive imitative reactions; the patient himself may criticize or disown these reactions but cannot control them.) It is suggested that these frontal patients have damage to an area that normally functions to inhibit the activity of a system that makes particular connections between perceptions and actions. On this view, damage to the inhibitory area can release imitative patterns of behavior, among others (Lhermitte, Pillon and Serdaru 1986; Lhermitte 1986; Stengel, Vienna and Edin 1947).

However, the tendency to imitate is not confined to the young and the brain-damaged, but extends to normal adults. Normal experimental subjects who were instructed

to point to their noses when they heard 'nose!' or to a lamp when they heard 'lamp' performed correctly while watching the experimenter perform correctly. But they were unable to avoid mistakes when they observed the experimenter doing the wrong thing. There was a tendency to imitate what they saw rather than to follow the instruction heard, even though they had been clearly instructed to follow the verbal command and were trying to obey the command rather than to copy the example (Eidelberg 1929; Prinz 1990). This suggests that although the underlying tendency to imitate is inhibited in normal adults under many conditions, it is still there, and can be revealed under experimental conditions. It may operate under a range of natural conditions as well; dysfunction can reveal aspects of normal function.[11]

It is controversial whether genuine imitation is found in nonhuman animals—in part because the essential features of imitation are contested.[12] However, the clearest evidence there is for imitation in nonhuman animals relates to intelligent mammals such as apes and cetaceans. In one case, a human observer stood at the glass wall of an acquarium, smoking while watching a mother and infant bottlenose dolphin. The infant dolphin swam up to the glass near where the person was standing and watched as the person blew a cloud of cigarette smoke at the glass. Immediately, the infant dolphin swam off to her mother, took a mouthful of milk, returned to the person at the glass, and released the mouthful of milk, which formed a cloud that engulfed the infant dolphin's head, producing an effect similar to that of the cigarette smoke (Byrne 1995, pp. 73-74; Taylor and Saayman 1973).

A tendency to imitation, to the extent it can entrap cognitive processes, involves a certain threat to rationality. (If imitation were merely reflexive, it would not threaten rationality.) This potential to threaten rationality is typical of a horizontal module, considered in isolation from others (for other examples and discussion, see Hurley, 1998b, essays 9, 10). The connections a horizontal module makes between perception and action are too rigid and may not be rationally mediated by someone's desires or intentions, as in the imitation syndrome patients. In many circumstances, imitation would be counterproductive or an irrelevant distraction from the task at hand. Moreover, the holism of practical rationality requires that intentional action depend on the rational interaction of perceptions and intentions, beliefs and desires. But the tight mapping between external stimuli and responses involved in imitation threatens such holism with respect to imitative responses.

Closely related points are often made in criticizing behaviorism. No given perception by itself can determine what someone should do, since different purposes rationally lead to different intentional actions, and purposes are not determined by perception. Behaviorism tries to take a short cut through the rational interaction of perception and intention, belief and desire. It makes too tight a connection between the content of a perceptual experience and its manifestations in action, one which fails to respect a rational agent's degrees of freedom. The type of behavior that is rational in a given environment is relative to a purpose, but purposes are not fixed by perception. These points seem to threaten the rational status of unmediated imitative transitions from perception to behavior.

Nevertheless, a tendency to imitate may have important and beneficial functions. Why might evolution favor neural or subpersonal structures that give rise to imitative tendencies? This is not hard to see. Variations in the inherited behavioral traits of adults may slightly favor some members of a given generation over others, so that some reproduce and others do not. Offspring may benefit if they can acquire the behavioral traits of their

successful parents through imitation as well as through inheritance. A young creature that has an innate tendency to act the way it observes others act will, through observing its parents, tend to pick up the behavior of creatures that have survived long enough to reproduce. A tendency to imitate would permit adaptation within as well as between lifetimes (see also and cf. Boyd and Richerson 1985). In the human case, in particular, imitation may play an important role in the acquisition of language.[13]

So, we should consider how minds are made up as well as how we make up our minds. The tendency to imitate may be among the developmental means by which sensorimotor systems are calibrated and by which people acquire a basic vocabulary of intentional actions, both linguistic and nonlinguistic, and become the kinds of mature agents to whom the principles of rationality and autonomy generally apply.

How can we have it both ways? How can the beneficial functions of imitation be secured without creating a general threat to practical rationality? The basic shape of the answer is of course that horizontal modules with their specific sensory / motor links should not be considered for these purposes in isolation from one other. In particular, imitation needs to be inhibited and facilitated appropriately in relation to other systems, if the subject / agent is to achieve rationality, at least under a range of normal conditions. There could be motivational or other mechanisms to override or inhibit the imitative tendency, while releasing it in certain circumstances or developmental periods. In addition to a variety of dedicated horizontal layers, we need higher-order structures that connect these layers, facilitating or inhibiting their functions when they are related to one another in certain ways, or under various environmental conditions.

Now the higher-order structures that connect the horizontal imitation system with other horizontal layers can also have beneficial functions, and so can also be the objects of evolutionary search. Evolution can search the space of higher-order structural possibilities for sets of relationships between horizontal modules that inhibit and facilitate their operation in appropriate environmental contexts and at appropriate developmental stages, in ways that increase overall fitness. One (oversimple) supposition might be that the beneficial functions of imitation are concentrated in early development. Thereafter, the imitative tendency may be inhibited and overlaid in a wide range of normal circumstances (though not necessarily all). Even so, its underlying influence could still be revealed under nonnormal conditions and by brain damage. However, in certain kinds of environment, imitation may be a good way to economize on the cost of individual learning: in a situation of uncertainty, the number of others who perform a certain act may correlate with the likely value of the act, so that imitation may be a useful rule of thumb or heuristic (Hedstrom 1998). Another hypothesis is that it may be evolutionarily advantageous to mimic certain behaviors in certain circumstances in order to obtain the benefits of cooperation without incurring its costs. For example, the imitation system might be switched on to mimic the behavioral appearances or signals used by cooperators to identify one another, in order to receive cooperation, then switched off by the cheater just before it comes to the point of reciprocation. [14]

Rationality can be conceived in general terms as an emergent property of such a complex system, distributed across organisms and their structured environments. Despite the potential conflicts between imitation and rationality, rationality may build on and

develop out of the imitative tendency, among others. Rationality may emerge from complex relationships between horizontally modular subpersonal systems which, considered in isolation, generate behavior that is less than rational.[15] More would of course need to be done to provide a positive account of rationality in these general terms. The aim here is not to do that. Rather, it is to suggest how the threat that horizontal modularity may seem to pose to rationality can in principle be disarmed.

The moral of our consideration of imitation is: we can rethink rationality. Rationality need not be conceived to depend on procedures internal to vertical boundaries. It is not eliminated by and can even depend on horizontal modularity.

4. Vertical vs. Horizontal Modularity in Political Theory: Rethinking Democracy.

I hope this is all sounding a bit familiar, and that the analogy between these boundary issues about rationality and the issues about democracy we began with is beginning to make itself apparent. To be explicit: On the one hand, there is a vertically modular view of the subpersonal causal structures on which minds depend. Rationality is seen as depending on procedures internal to certain of such vertically modular structures. On the other hand, there is a vertically modular conception of the power structures on which governance depends. Democracy is seen as depending on procedures internal to certain of such vertically modular structures. The exogenous view we began with presumes that the political world is divided into individuals and states, along vertically modular lines, and defines majoritarian procedures by reference to these units and boundaries. This presupposition of vertical modularity is threatened by globalization. [16]

The analogy is not perfect, and should not be pressed too far. But it is suggestive, and may help us to see how democracy too can be rethought in the face of boundary problems. What happens if the world turns out not to to be structured along vertically modular lines, in either case? That is, what would happen to rationality if it turned out that the best empirical account of the causal processes that underwrite the mind was not vertically modular? And what happens to democracy if the modern world does not satisfy presuppositions of vertical modularity? [17] If rationality is conceived in essentially vertically modular terms but the world turns out to be horizontally modular in the relevant respects, then rationality is empirically threatened. Similarly, if democracy is conceived in essentially vertically modular terms but the world turns out to be horizontally modular in the relevant respects, then democracy is empirically threatened.

One response is to reconceive rationality and democracy, respectively, in terms more hospitable to horizontal modularity. In each case, the question arises whether such reconceptualization would constitute an abandonment of the genuine concepts for ersatz versions. Would such revision in effect concede that genuine rationality, or democracy, had been eliminated? Or would it rather amount to an improvement in our understanding of the nature of rationality, or democracy--or at least a challenge to traditional views about their nature? Arguments about elimination in cognitive science are complex and I don't pretend to do justice to them, or resolve them, here. The point is rather to suggest the analogy (see Figure 1).

As we've seen, vertical modularity is under pressure in political theory, as a result of

increasing globalization. This in turn puts pressure on the applicability of a conception of democracy in terms of internal procedures that presuppose units whose vertical boundaries are fixed exogenously to democratic theory. Globalization creates structures and complex dynamic processes that distribute power across state boundaries. When we view the world in this way, state boundaries go transparent and permeable--leaky--, even though they do not disappear entirely.

[Figure 1 about here]

While the functional power networks thrown up by processes of globalization do not necessarily respect traditional vertical distinctions between nations, they often do reflect horizontal distinctions between specific domains. Like the horizontal layers in a dynamic systems conception of the subpersonal processes on which mind depends, global processes are often dedicated or domain-specific. Consider the global organizations and processes that deal with banking, trade, information technology, human rights, environmental issues, and so on.

Now what is the place of democracy in this view of a horizontally layered world, where vertical boundaries are shifting and increasingly permeable? Is the concept of democracy still applicable? If we presuppose an internal, procedural conception of democracy our first response may be "no". But consider the possibility that the correct answer might be "yes", as for the parallel question about rationality. On this view, democracy also needs to be rethought. It can no longer be understood strictly in terms of internal procedures, can no longer be conceived to presuppose fixed units and vertical boundaries. But democracy no more requires vertically modular power structures than rationality requires vertically modular subpersonal structures. We need to understand how the various horizontal layers of activity, which can themselves be more or less democratic, can also be related to one another more or less democratically. Democracy might be an emergent property of the higher-order system of relations between various functional power networks, global institutions and processes, which may or may not be democratic considered in isolation. The operation of 'external' forces can be democratized, appropriately inhibited and facilitated, not just by 'internal' control, but also, or instead, by being embedded in a larger system with a complex structure and dynamics.[18]

For example: what kinds of relationships between the international networks concerned with human rights law, information technology, ecological issues, trade and finance and industry, etc., would generate more or less democracy? To answer such a question, we need a way of evaluating resulting states of affairs as more or less democratic. But we also need to know what states of affairs are possible: what the consequences over time of various arrangements would be. Evolution cannot search the space of possibilities for us here. We only have one world, and cannot afford to expend it in evolution. Moreover, deliberate design of a global system of institutions to serve certain goals may well be frustrated by the characteristic and fundamental unpredictability of complex dynamic systems: the only way to find out how they will behave is to let them run and see. How can the space of possible relations among various international processes be searched effectively, with the aim of finding complex relationships from which more rather than less democracy emerges?

5. Ways the world might be: simulation and imagination in normative political theory.

Different sets of relations among global institutions played out over time may give rise to different tendencies (again, cf. Hutchins 1995). Some oversimplified examples may convey the gist. Suppose that the ratio of certain international economic variables is correlated with some measure of the rate of environmental damage. Suppose, then, that if that ratio is used in a certain role as a parameter in the lending policy of the IMF, and we let the system run, over time it develops so that the economic autonomy of certain impoverished and dependent areas of the world is increased while the rate of environmental damage is reduced. On the other hand, if this ratio is used in a different parametric role, the opposite tendencies are produced. How can these different tendencies be predicted in advance? Or consider a choice between information technology policies: should nations that censor information about human rights and refuse to cooperate with international human rights organizations have full access to the internet? What would be the effect, for example, of granting tax subsidies or other favors to commercial internet users that voluntarily refrain from doing business via the internet with organizations in censoring nations? The effects on respect for human rights and on individual autonomy are hard to predict. These illustrations are, in fact, vastly too simple; the complexity of the real world does not lend itself to easy examples.

It is well known that complex dynamic systems, as modelled using neural network techniques among others, can display striking forms of emergent self-organization despite the lack of a central controlling module (Elman et al 1996, Kelso 1995, Thelen and Smith 1994, etc.). Given the nonlinear complexity involved, these patterns of self-organization may be opaque to an unaided design perspective, and may best be discovered by computationally simulating evolution. Emergent order may be unpredictable by any means other than simulation, even in a fully deterministic system. We can harness the power of evolution as a mechanism of search without running the risks of extinction by simulating evolution. Computational evolution can search the space of possible complex systems using genetic algorithms, under selective pressure that we provide. Evolutionary techniques are being applied to design robots (for a summary, see Clark 1997, ch. 5). Could they not also be applied to global institutional design?

Some of the ways a horizontally modular world might be arranged are substantively different in normative respects from other ways it might be arranged. For example, to invoke a republican conception of democratic citizenship, suppose that some institutional arrangements are better than others at fostering autonomy, deliberative capacities, public-spiritedness, and other civic virtues in citizens, at encouraging thoughtful and widespread participation in public life and decision-making within a variety of fora, at facilitating fair contestability, and at avoiding concentrations of power in biased hands. Suppose that some such differences count as ways in which the world might be more substantively democratic. Of course, other values may also be relevant. The supposition is that among the various applicable values are distinctively democratic values. If this premise is granted, then we may be able to use simulation techniques to work backward from such substantive judgments to an understanding of what structures and procedures count as democratic in a horizontally modular world. On such a view, norms of substance and of procedure would be dynamically and adaptively related within the concept of democracy, in application to a

changing world. The short essentialist argument from lack of certain traditionally presupposed vertical structures and procedures to the elimination of democracy is too short. We can do better.

We might model various institutions, organizations, and processes that constitute the horizontal layers of the global system, in ways that benefit from experience at network modelling in cognitive science. We could first build various subnets, and then build a supernet out of them.[19]

Suppose first that various horizontal layers were modelled separately, each one by a neural network trained to simulate dynamic empirical data about the given area: a subnet. One such subnet might model international banking processes, another might model processes in the international legal system, and so on. We would try out various subnet structures or 'architectures' for each horizontal domain, and attempt to train up a subnet (algorithmically adjust the connections between its units) until its performance simulates the specific horizontal layer we are modelling. Subnet training could be guided by detailed specifications of the empirical data to be simulated.[20] An adequate subnet itself could be very complex. 'Context units' of subnets might reflect important remaining aspects of vertical modularity, such as the distribution of population and GNP across nations, so that vertical modularity does not disappear entirely. But vertical modules could be treated as the context within which horizontal modules operate, rather than vice versa.

Second, consider how these different horizontal subnet layers interact when we connect them up in various ways into a big supernetwork and let the supernet run. Even holding the subnets' internal structure and connections fixed and varying only the connections between subnets, we may find that some of the resulting tendencies may be more desirable in terms of democratic values than others. At this stage our modelling goes heavily normative. We are not simply trying to model the world as it is, but to use simulation to help us to imagine, understand, and evaluate ways the world might be. So we cannot rely on empirical data to supply detailed specifications of our aims, and simply adjust the supernet algorithmically until it simulates the detailed empirical data.

We can of course also evaluate the subnets separately with respect to how democratic they are, and perhaps find ways to improve them. We could then enter the stage of supernet modelling with normatively improved subnets. Arguably it matters how democratic certain horizontal layers are internally, and not just how democratic the overall system is in its tendencies. That is compatible with recognizing that the overall system might also have democratic tendencies resulting from interaction of subnets that may not themselves all be especially democratic (see again note 15).

Again, we can benefit from experience within cognitive science: of applying genetic algorithms and fitness functions to evolve complex nets with desired properties. A genetic algorithm would throw up a variety of supernets by random variations on relations between subnets. We could let the supernet simulations run, see what they do, and choose the ones we like to apply the next round of mutation to. By this means we might succeed in evolving an ultra-complex supernet with attractive emergent properties but which we would have been hard put to design deliberately.[21]

In order to simulate evolution, however, we need to provide a fitness function. Rationality may emerge under evolutionary pressure, but democracy needs guidance from us to emerge at the global level. A fitness function expresses our selection among the supernet possibilities the genetic algorithm throws up. It can reflect substantive values continuous with those of democracy as traditionally conceived, even if these cannot be understood in the internal, procedural terms that presupposed a vertically modular world. That is, the same substantive values of self-determination, autonomy, respect for rights, equality, contestability, etc., that motivate internal democratic procedures can also bear on processes that are not internal but that relate people across different nations. The fitness function would be devised so as to search for emergent patterns and processes that tend to satisfy such values.

In order to decide what relations between international networks would count as more or less democratic, we need both a way of evaluating resulting states of affairs for their democratic character and a way of knowing what the resulting states of affairs would be. It is natural to suppose that we need first to develop our conception of democratic values and then to figure out how best to serve them in a global context: to specify the end or goal, and then determine the means. The first problem may seem to be the normative problem, the second merely technical. It may seem that simulation techniques borrowed from cognitive science can contribute only to solving the technical problem, not to solving the normative problem. That would be worthwhile in itself. But I suspect that simulation might have a contribution to make in solving both problems, and that they are not so sharply separable.[22] The complexity of our subject matter, and the need to adapt norms of democracy to the global context, may make it better to think about norms and techniques more interactively. The concept of imagination seems particularly appropriate here: simulation may aid our normative imagination, our abilities to envisage and evaluate alternatives in a complex world. Learning what is possible, what properties emerge from various ways of connecting up international networks, may help us to develop our conception of democracy, to specify more sensitively the emergent properties that count as democratic in a global context. Evolving a complex system to satisfy one specification of a democratic norm and comparing the way it works with alternative systems thrown up en route may alter our conception of the norm.

The difficulties of coding and interpretation in such a simulation project would be significant, but perhaps not insuperable. It is worth investigating further the feasibility of such a new approach to the design of cosmopolitan democracy. There may also be other areas of potential cross-fertilization of modelling and simulation techniques between the cognitive and social sciences.

I've exploited the analogy between boundary issues in cognitive science and in political theory in order to suggest how democracy could be rethought as an emergent property of a complex globally distributed dynamic system or supernetwork. Like rationality, it need not be conceived in internal and procedural terms. It is not wedded to vertical modularity. Democracy is not eliminated by, and can even depend on, horizontal modularity.

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NOTES

[1] As Ian Shapiro has pointed out (personal communication), localism also undermines traditional national boundaries. It need not do so just by creating new less inclusive boundaries (as in seccession), but may also do so in a piecemeal domain-relative way, and so increase the net permeability of boundaries.

[2] Held is sceptical about the uncritically appropriated concept of the territorial political community at the centre of dominant theoretical approaches to democracy. Given increasing globalization, the traditional conception of democracy in terms of a circumscribed self-determining community of citizens begins to appear strained. Held's view, like the view taken here, is that globalization does not so much defeat democracy as force us to rethink it in less boundary-presupposing terms than are traditional. He also indicates what is here called the 'horizontally modular' character of the global scenario, though he also agrees in effect that vertical modularity does not disappear: that the "rhetoric of hyperglobalization" is sometimes overdone and that nation states continue to be immensely powerful. Held's own conception of cosmopolitan democracy strips the idea of sovereignty away from the idea of fixed borders and territories, and recognizes the multiple citizenships of people.

[3] Altvater writes: "More important for the question of the procedural rationality of democracy is the difference between national political borders and the principal boundlessness of economic processes. ...democracy requires coordinates in space and time to secure "governability".... Borders are necessary to secure the formal democratic working of the procedures. ...the perforation of national borders is shaping the democracy's space and time, and thus the meaning of sovereignty is changing." He emphasises the effects of economic and ecological factors on political boundaries and processes.

[4] In his forthcoming sceptical view, Dahl writes: " In sum: if it is difficult enough for ordinary citizens to exercise much influence over decisions about foreign affairs in their own countries, should we not conclude that the obstacles will be far greater in international organization? Just as many important policy decisions in democratic countries are in effect delegated by citizens to the political elites, will not the citizens of countries engaged in an international association delegate effective control to the international policy elites? And won't the extent of delegation in international organizations go well beyond any acceptable threshold of democracy?"

[5] This suggestion is broadly in harmony with Held's views on cosmopolitan democracy and the boundary problem (forthcoming).

[6] This idea was revived in the contemporary context by Hurley 1989. So the suggestions made here can be seen as an extension of that project. For a precursor of the horizontal/vertical distinction developed here, see especially ch. 15.

[7] Some material in this section is adapted with modification from various passages in Consciousness in Action, essay 10, by S. L. Hurley, copyright 1998 by the President and Fellows of Harvard College, with permission of Harvard University Press.

[8] A horizontally modular view of the mind is not argued for or defended here, merely reflected on. It is an emerging and controversial idea that challenges various more orthodox views; see Hurley 1998b, especially essays 5, 10, for further discussion.

A technical clarification: The vertical / horizontal contrast drawn in this section should not be confused with the vertical / horizontal contrast drawn by Fodor (1983), part 1. It is closer to but not identical with the vertical / horizontal contrast drawn by Clark (1997), p. 12-14 and elsewhere, and to that implied by Goodale and Milner (1992) when they suggest that functional modularity extends from input right through to output (this would count as horizontal modularity, in present terms); see also Milner and Goodale (1995). It is closer still to some of the contrasts developed by Brooks (1991) between the horizontal domain-specific layering of his subsumption architectures and the traditional Artificial Intelligence approach. Note that in present terms, Fodor's view counts as vertically modular: he functionally distinguishes transducers, input systems, central processors, motor systems, and supposes the flow of information becomes available to these systems in about that order; input systems mediate between transducer output and central cognition by producing mental representations on which central cognition then operates; input systems are 'informationally encapsulated', while the central system is not (1983, pp. 41-42). However, in present terms, horizontal modules are domain-specific. We do not give up domain-specificity by moving from vertical to horizontal modularity. See and cf. Thelen and Smith (1994), pp. 174, 220; Elman et al (1996), pp. 37, 40-41, 100, 108, 158, etc.; Hurle y (1989), ch. 15.

[9] What is the relationship of these questions to questions about whether the truth of connectionism and lack of internal classical structure would eliminate thought or merely alter our views of what thought is? (For a recent discussion and references see Stich 1996; see also Hurley 1998a and Hurley 1998b.) The threat to rationality from horizontal modularity is in the first instance a local threat to the holism of practical reason, in the way explained in the text. Holism is seen as necessary for rationality on a wide variety of views, so the threat to holism needs to be disarmed. By contrast, the threat to thought from connectionism supposedly derives from lack of classical causal systematicity, of syntactical subpersonal structure isomorphic with the conceptual structure of thought. The view that such isomorphism between the personal and subpersonal levels is necessary for thought is more controversial than the view that holism is necessary for rationality. In this sense the need to

disarm a threat to holism is more urgent, even though the threat is more local. This threat is more fundamental than the threat posed by connectionism to an internal language of thought. Notice that these points are put in terms of a need to defeat a threat to a necessary condition for rationality. It is not suggested that holism is sufficient for rationality.

[10] For present purposes nothing turns on whether 'the' imitation system is unitary or not. A variety of distinguisable behavioral phenomenon are commonly called 'imitation' (see especially Byrne 1995, Heyes and Galef 1996), and it may well be that a variety of interacting horizontal neural systems underwrite them. What is to the point here is the horiztonal orientation of whatever system or systems underwrite imitation of various kinds. I speak of 'the' imitation system for convenience of expression. However, for what it's worth, I suspect that response facilitation and mirror neurons are basic building blocks in relation to imitation. I am indebted to Dick Byrne and Giacomo Rizzolatti for discussion of these issues.

[11] Imitation appears to involve an immensely complex mapping from visual inputs to motor outputs. It is tempting to speculate about how the observed tendency to imitate might be achieved by the nervous system. There are various possibilities involving stronger or weaker forms of shared neural coding for perception and for action (Prinz 1990, Hurley 1998b). Mirror neurons have been discovered in monkeys (di Pellegrino et al 1992; Jeannerod 1997), in an area corresponding to one of the language areas, Broca's area, in the human brain. Mirror neurons, like many other neurons, have both perceptual and motor fields: that is, their firing correlates with certain perceptions as well as with certain motor intentions. But mirror neurons also have the feature that their perceptual and motor fields match: they fire when the agent perceives someone acting in a certain way or when she does the same thing herself (or both). They are not a strange curiosity, but are plentiful. They can be very specifically tuned. For example, certain cells might fire when the monkey sees the experimenter bring food to the experimenter's own mouth with his hand or when the monkey does the same (but not when when the experimenter brings food to his mouth using a tool).

It is also tempting to speculate about why the nervous system should be wired in such a way as to facilitate imitation. To address this question we can invoke a distinction between the architecture, or general structural features, of neural networks, and the variable degree and direction of fine-grained synaptic connectivities within a network of a given fixed architecture (argued for in Elman et al 1996). In nature, evolution can operate on types of architectural starting points, despite a degree of plasticity of architecture with development and experience. So perhaps it can select for structures that have general or default phenotypic tendencies, such as the presence of potential mirror neurons. However, empirical evidence suggests that fine-grained synaptic connectivities are not innate (Elman et al, p. 315, etc.). Rather, they are a function of development and experience, within the interactive constraints set by neural, bodily, and environmental structures. For example, the co-firing of connected neurons, which may have an environmental source, may increase their positive degree

of connectivity, so that the firing of one facilitates the firing of the other. Physical growth may change co-firing patterns, resulting in developmental changes in connectivity (Thelen and Smith 1994). Suppose, for reasons considered in the text, evolution favors architectures that have default imitative tendencies, even if these are slight. For example, suppose 'weak' mirror neurons are selected by evolution: these create a slight tendency to favor imitation in certain contexts. With experience, this tendency could be reinforced as connectivities alter to facilitate the co-firing of connected neurons.

I emphasize that these possibilities are purely speculative, but they may make the complex mappings that imitation involves seem slightly less inexplicable.

[12] Evidence of genuine imitation must distinguish it from other forms of social learning. An early and simple definition of imitation was: learning to do an act by seeing it done. But this fails to address various complexities about what is required for true imitation. For example, is the behavior that looks imitative merely independently produced in response to the same or similar stimuli? Perhaps the model's behavior simply draws attention to the relevant stimulus. Some behavior, like yawning and laughing, seems contagious. But is contagious behavior genuine imitation, if it is not cognitively complex or intentional? Or if it involves only the facilitation of responses that are instinctive or are already in an animal's repetoire rather than the acquisition of novel behavior? If imitation is required to involve novel behavior, how exactly is behavioral novelty to be assessed: does novel behavior result from new combinations of existing elements? Or again, is the animal that seems to be imitating merely trying to duplicate the results of the model's behavior, by trial and error, rather than imitating the behavior itself? Must genuine imitation already involve some understanding of the model's intentions, or does imitation provide one foundation for inferences from first to third person experience? For discussion, see Heyes and Galef 1996.

[13] Development and evolution may work together. A weak innate imitative tendency might be strengthened as a result of imitative experience, if connections between sensory and motor neurons that fire together are strengthened. As a result, neural connections would be calibrated on meaningful and functional gestures and behaviors, which would facilitate the emergence of more complex intentions and compound behaviors. Recall that the area of the monkey brain in which mirror neurons have been found corresponds to Broca's area in the human brain, one of the areas on which linguistic abilities depend(di Pelligrino et al 1992).

[14] Thanks to Diego Gambetta for discussion of these points; on “greenbeard” genes and their vulnerability to imitative cheater mutants, see, e.g., Dawkins (1982), pp. 144-145.

[15] As Hutchins (1995, ch. 5) has emphasized in his work on network simulations of socially distributed cognition, the rationality of the whole cognitive system does not require the rationality of the components of the system. Overall rationality may be an emergent property of the whole system. For example, confirmation bias is a propensity for a cognitive system to affirm prior views and to discount, ignore, or reinterpret evidence that runs counter to an already-formed view. However, even given confirmation bias in individuals, certain structural conditions on communication within the group may enhance the cognitive performance of the overall system so that it does not display confirmation bias as a whole. Confirmation bias in individuals with different starting points and limited intercommunication produces a diversity of views. The trick then is to find a way of airing these diverse views in a way that facilitates finding and settling on the correct resolution.

Reflection on Hutchin's fascinating study of navigation as socially distributed cognition suggests various other possibilities. For example, could the legal system be understood as socially distributed cognition; could something like what Hutchins does for navigation be done for law?

[16] The exogenous view as described in section 1 presupposes vertical modularity, but should not be equated with it. One could think that democracy depends on procedures internal to vertically modular structures, because one thinks the world is in fact vertically modular in structure, while also holding that the boundaries of such structures can be determined more or less democractically, that is, endogenously to the theory of democracy. The threat globalization poses to vertical modularity is especially problematic given the exogenous view. This is because the latter regards vertical boundaries as essential parameters fixed exogenously to the theory of democracy, and so has no way of dealing with their undermining within the theory of democracy. By contrast, if boundaries issues are endogenous to the theory of democracy, movement in the direction of horizontal modularity resulting from globalization is less problematic. Holders of the endogenous view can switch to a horizontally modular view of the world if and when that becomes more realistic, and revise their views of the implications of democracy for boundary issues to embrace the new boundary issues.

[17] The antecedent may or may not be satisfied in the case of the mind, and the question is posed hypothetically, for the sake of argument. It may be less controversial that the antecedent is satisfied in the case of the globalizing world; but globalization has its skeptics too.

[18] As well as being in harmony with Held's position on cosmopolitan democracy and boundaries, there is a sense in which this view can also be regarded as a radical extension of Dahl's (1982) notion of democratic polyarchy, in which there is "a complex system with several or more layers of democratic government, each operating with a somewhat different agenda"; but compare his sceptical view (forthcoming 1999). It also constitutes a variation on Hutchin's (1995) point that the cognitive properties of a group depend not just on the cognitive properties of

individuals, but also on the way they are related.

[19] "If one thinks of the brain as a network of networks, global architectural constraints concern the manner in which these networks are interconnected" (Elman et al 1996, p. 29).

[20] Using, for example, standard backpropogation techniques. See also and cf. Casti 1997.

[21] No suggestion is intended that precisely the same network structures and weights that do some piece of cognitive work would also do normative political work. I am indebted to Bernard Williams for revealing this possible misunderstanding to me.

[22] I am grateful to Ronald Dworkin for comments that prompted this clarification.