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The incomplete naturalist

Donald Willower on science and inquiry in educational administration

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Abstract *Considers Willower's theory of inquiry and his stance on science and epistemology which is derived from Dewey's pragmatist philosophy. Argues that Willower's naturalism, following Dewey's understanding, remains incomplete because Dewey did not have at his disposal the required causal neurobiological detail of human learning and cognition. Such detail has recently become available, and Dewey's biological metaphors are now being cashed out in relation to the causal mechanisms of inquiry, with interesting consequences for Willower's theory of inquiry. Concludes the article by exploring the notion of reflective inquiry in relation to human cognition, research methodology and organizational cognition.*

It is an honour and a privilege for us to contribute to this *Festschrift* in honour of Donald Willower's outstanding contribution to the field and profession of educational administration over so many years.

We have chosen to focus on an area of his work which was absolutely central in his thinking, as well as his lifelong intellectual passion: the importance of theory and science in educational administration and his conception of inquiry, derived from Dewey's pragmatism. It is a well-worn cliché to speak of "shiny beacons" but he was that to us in a field which, we felt, had not spent nearly enough serious intellectual effort in attempting to understand its own scientific roots, and the consequences for its practice and its values. It was most fortuitous for us that he cared deeply for many of the philosophical perspectives important to us, especially Deweyan philosophy and theory (a brief but excellent overview is Burnett, 1988). In our contribution we would like to celebrate his achievements and also point out where his Deweyan approach to inquiry might have taken him following very recent developments in naturalism. In particular, the first part of this article deals with the Deweyan concepts which underlie and characterize his work while the second addresses the extension and application of these concepts in a more systematic, naturalistic, theoretical context.

As ever, we align ourselves, not surprisingly, with Willower's stance on science, especially his naturalistic conception derived from the systematically developed pragmatist philosophy of John Dewey. As we have argued for almost two decades, with Willower's support, science continues to deliver results over its alternatives in all realms; for educational administration to deny itself a powerful source of knowledge that explains both its theory and its

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practice is counterproductive as well as short-sighted, a view Willower wholeheartedly endorsed (Willower, 1996; Willower and Uline, 2001).

In our view, it is in particular modern cognitive science that has expanded considerably our ability to understand human practice in its causal fine-grained detail. It is this kind of neurophysiological knowledge that can be considered a further naturalizing of the early account of human nature and conduct, so powerfully begun in Dewey's work with the theoretical and empirical means he then had at his disposal. "Filling out" these earlier conceptions of human conduct and nature, we suggest, is to update Dewey's project with modern scientific means, and thus coheres with his non-foundational and naturalistic beliefs. Whether Willower would agree with this is another matter, but undoubtedly he would continue supporting a view of science as ongoing, open-ended inquiry while possibly disagreeing with some of its details. It is in the spirit of ongoing inquiry and debate that this contribution is written. It is the best way we know to honour, and to continue, what was the life-long and deeply felt philosophical passion of his scholarly career.

Willower, the method of inquiry, and educational administration

From the early beginnings of his career, Willower upheld the importance and contribution of philosophy to educational administration's theory and practice. His position, expressed eloquently in an early paper, has remained current:

> . . .I think educational administration requires a philosophy that is open to a wide range of ideas and methods, that sees inquiry as a human enterprise that is full of weaknesses but is self-corrective, that is skeptical and strives for explication and public verification while attempting to confront varieties of experience in their own terms, and that pursues reflective methods in exploring values and the context of practice (Willower, 1984, p. 24).

Central to Willower's philosophy of educational administration is Dewey's conception of the theory or method of inquiry (e.g. Willower, 1994a), also described as instrumental or experimental logic (Dewey, 1938). Much has been written on this conception, and a comprehensive appraisal would require many more words than we have available in the present context (for classical introductions see Bernstein, 1967; Boydston, 1972; Rorty, 1982). A mere outline of its most salient points must suffice.

The theory of inquiry, or as Willower (1994a) prefers to call it, reflective inquiry, can only be understood on the background of Dewey's mature view of experience which expresses his thoroughgoing naturalism. The philosophical theory of experience is intimately linked with the processes and functions of life as explained by the biological sciences (Dewey, 1929). There are several implications which derive from this view and which set Dewey's conception radically apart from the early empiricists. Very important is his view that there is no mind/matter dualism, no radical split between the mental and the physical, and that experience is holistic rather than put together from discrete and disjointed parts. It is the constant interaction of a living organism with its

social and physical environment, "a matter of simultaneous doings and sufferings" (Hahn, 1972, p. 29).

It follows that there is no sharp divide between inner and outer realms of being, no dichotomy between objective external reality and subjective inner thought. Experience is a seamless and all-encompassing web. The active nature of experience is expressed in Dewey's rejection of the so-called doctrine of the "given" (see Sellars, 1968, Ch. 5) by emphasizing "what might be done to change what is given or taken, in furtherance of human purposes" (Hahn, 1972, p. 29). Experience is strongly connected with the future since anticipation determines an organism's ability to adapt, and to solve its problems. It is contextual, situational, and transactional (Hahn, 1972, p. 30).

On the background of such a dynamic and evolutionary view of experience, the world itself is considered a universe still in the making, following William James. The application of reflective inquiry or, simply, intelligence then naturally serves to help solve problems, settle conflicts, or clarify indeterminate situations. Inquiry is defined by Dewey (1938, p. 104) as "the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole". There are several ways in which reflective inquiry is brought to bear on human affairs.

Every inquiry process proceeds through several not necessarily sequentially prescribed stages and begins from a "felt difficulty", a vague feeling that something has gone wrong because a habitual response did not lead to the desired result. Such a perplexing or confusing situation requires considered reflection on what the problem causing it might be. The process of problem formulation is critical and involves much deliberation. It may continue for a while and the problem definition arrived at after deliberation provides the basis for the possible problem solution which might be further specified in the light of new arguments or evidence. Having settled on the proper problem definition, the various implications of a number of hypotheses are thought through with regard to their consequences. When all are weighed up and compared, one is selected for testing in action. This stage serves to verify or disconfirm the most promising hypothesis singled out through observation or experiment. If the hypothesis passes the tests, then the problematic or indeterminate situation will be transformed into a determinate and stable one. Knowledge, in Dewey's conception, is the objective of inquiry, gained by the careful application of the appropriate methods and norms of inquiry. In its abstract form knowledge means warranted assertibility, a conception to which we return later.

It is vital to the understanding of Dewey's work that the process of inquiry is applicable in all fields of human endeavour, from the everyday practical to the solving of personal problems, to conducting complex scientific inquiries. And equally importantly, working through to the problem solution as described, in addition to the problem solution itself, also provides some descriptive and explanatory statements about how we managed to solve it.

Conceived of as a general method of inquiry, this pattern applies to all problematic situations while its specific methods, procedures, and type of evidence vary with the nature of the situation and the problem under discussion. No inquiry can in principle be separated from the context of other inquiries because we derive our methods and procedures always from other earlier ones which both influence and modify the new inquiry process and its methodological and other ingredients. This process always takes place in a social or public context, and Dewey's conception of the community of inquirers, inspired by Pierce, is important here. It is the medium through which the conclusions and norms of inquiry are warranted. The final characterizing feature is that inquiry is a self-correcting and open-ended process. Together with the assertion of knowledge as warranted assertibility, Dewey's conception of inquiry radically departs from early empiricist approaches with their foundationalist assumptions of knowledge (see Evers and Lakomski, 1991, ch. 2 for detailed discussion of the various foundationalisms and their problems). As Bernstein (1967, p. 383) summarizes the difference:

> Inquiry and its objective, knowledge, are rational because inquiry is a self-correcting process by which we gradually become clearer about the epistemological status of both our starting points and conclusions. We must continually submit our knowledge claims to the public test of a community of inquirers in order to clarify, refine, and justify them.

When applied to the theory and practice of educational administration, that is, when considering the practical question of "how to make the work of school administration more reflective", Willower (1994a, p. 13) argues that we have to examine "the processes of internalization and institutionalization". By internalization he means Dewey's emphasis on human nature and conduct as based on habit and impulse, and that reflective inquiry must thus be "natural, virtually automatic and something that could engender commitment, emotion and even passion" (Willower, 1994a, p. 14), supported by appropriate social conditions. How to teach reflective methods remains, in Willower's view (1992, 1993a, b), a task yet to be solved in educational administration.

His major concern regarding internalization is, however, with the application of reflective methods to moral choice, and the importance of social science concepts and theories in grounding such choice. For Dewey, values are part and parcel of human existence and are integral to the situations in which humans find themselves. Moral choices and decisions necessarily arise in those situations since humans need to work out what they want most. The process of determining which value or values to adopt, with their attendant consequences for action, is called the process of valuation (Dewey, 1969). This process, in Willower's view, is ideally suited for making moral non-routine choices in educational administration when competing courses of action have to be decided in the context of fiscal restraint. It is not so much the values that are contested, he believes, but their implementation. Consideration of the consequences of adopting a certain course of action is most salutary for the business of administrative decision making (Willower, 1964) because it locates ethics in the concrete everyday situations of the decision maker. Since such

deliberation, in addition to factual knowledge, also requires ideas in the search for appropriate solutions, social science concepts and explanations can be most helpful. Indeed, if we want to realize certain values, such scientific knowledge of people and their organizations is critical. It does not solve our purposes well according to Willower (1994a, p. 15, 1994b), if we follow those "science bashers" who "wish to detach moral choices from the great facilitator of their actual attainment, namely their empirical grounding".

The idea of institutionalisation picks up Dewey's point about social context, which is always part of internalization, as he describes it. Translated into the administrative situation, it is important that individuals who engage in reflective methods do not do so in isolation since that, *inter alia*, could confirm and solidify favourite beliefs. Rather, engagement with outside groups or organizations is important to foster critical reflective methods more widely, and thus to examine set beliefs in the relevant community of inquirers. If this is made possible, then "Institutionalized reflective methods should lead to better and more ethical organizational decisions since the various sides of problems and the consequences of alternative solutions for different groups and individuals will be aired". In this way, we see "intelligence in action: a scientific attitude and open-mindedness along with a respect for evidence and experience" (Willower, 1994a, p. 16). Since such procedure is rare in organizational life, a major administrative task is the creation of conditions for critical and open discussion of problems so that they become a natural and routine way of problem-solution. None of this discussion implies that reflective methods are always successful or that they provide a foolproof way or recipe of getting to solutions. But they do allow for greater transparency of ethical decision-making and for the critical evaluation of the consequences of action.

In the context of the philosophical debate in educational administration, Dewey's reflective method stands out in that it provides a proper solution to the fact/value split that permeated discussions in the field, originating in empiricist conceptions of science that could not accommodate values (Willower, 1994c; Willower and Forsyth, 1999). Willower (e.g. 1996) argues that traditional positivism has not been a contender in philosophy for a while and that it has been built up as a straw man in recent controversies in educational administration. He singles out subjectivism, critical theory as well as neo-Marxist approaches that generally discuss values (in one form or other) but reject science by which, as he argues, they commonly understand some form of a defunct empiricism.

In the following we want to take a closer look at the theory of inquiry, seeking to augment its Deweyan formulation in three areas where advances in naturalism have interesting consequences for Willower's enterprise in educational administration. In particular, we propose to explore the notion of reflective inquiry as it relates to individual cognition, to research methodology, and to organizational cognition.

Naturalism and inquiry

Dewey's theory of inquiry was heavily influenced by his understanding of the findings of empirical psychology, notably James's biologically oriented psychology. For Dewey, it provided a powerful heuristic for reconstruing an holistic epistemological framework inherited from Hegel that was weak in explanatory detail. While epistemology, with its concern for what counts as justified knowledge, has long had a normative focus, it is important to realize that epistemology must also take a stand on the matter of how knowledge is acquired. A theory that reckons certain items of human knowledge to be justified needs to cohere with some account of learning that says these items can in fact be learned by humans. Plato's psychologically implausible theory of forms, for example, was precisely the result of having a theory of knowledge justification that outran the resources of the naturalistically possible. The idea of making the conditions of justification so strict that one could only know abstract objects, like goodness, justice, circularity, and the like, through a prior acquaintance of these by one's soul before birth, is to replace learning with recollection, thus shifting the learning problem back into another domain of being. And Dewey, as a psychologist, educator and philosopher, understood this matter perfectly well.

As is clear from Dewey's early attempts at formulating epistemologically interesting holistic conceptions of even basic human reflexes, the naturalising of learning as a major constraint on the construction of a viable epistemology was part of his philosophic enterprise. Our point, however, is that the biological metaphors that he adopted in formulating his theory of inquiry – talk of tension, resolution, and transformation – are, in the context of a thorough-going naturalism, precisely that: metaphors. What is required here is a detailed causal story to sustain the epistemology. Dewey was certainly happy to theorize learning and even concept formation in terms of the hypothesized activity and dispositions of nervous systems. Unfortunately, the contribution that biology could make towards supplying the required causal detail, at the time of his writing, was minimal. Our own claim is that recent advances in cognitive neurobiology, made only over the last 15 years or so, have begun to supply the resources for cashing out these Deweyan metaphors into real epistemological mechanisms that promise to be useful in giving accounts of the nature of inquiry.

Reflective inquiry for individuals

Naturalistic theories of individual cognition deal with accounts of how the brain processes information. A naturalistic epistemology would therefore deal with both learning and also the normative question of why that learning was epistemically progressive. Willower maintained an active interest in such research.

> An especially complex phenomenon of special interest to students of educational administration is the thought processes that come into play in decision making. Students of cognition have begun to examine mental processes using frameworks that deal more

> adequately than in the past with complexity. Sometimes reductively called brain research, this work is beginning to bear fruit (Willower, 1998, p. 93).

What Willower was referring to was a set of mathematical models of neural information processing and their general principles of operation that held the promise of explaining an important puzzle in administrator decision making. For on the one hand, he was anxious to recommend to administrators an active engagement with the processes of reflection in their daily work life, but on the other hand he was puzzled over the apparent lack of administrator deliberation in decision making, remarking that "it is clear that most administrators just do not devote a lot of time and energy to reflective analysis" (Willower, 1994c, p. 39).

The resolution of this paradox, he thought, could lie in appeal to the notion of reflective analysis as an implicit process. For example, "what appear to be snap judgments in administration are actually grounded in a process of pattern recognition" (Willower, 1994c, p. 40). Two broad clusters of models of neural processes – artificial neural networks, or ANNs – hold the promise of instantiating an explication of reflection as an implicit process (see Evers, 2000a, for details.) The first is especially interesting because it models pattern processing in a clear and transparent way. For Willower, following Dewey, inquiry is initiated by the recognition of the problematic (Willower, 1994a, p. 6). This is rather too general a formulation for the purposes of accommodation with our simple modelling exercise, and so certain restructurings are required. For example, let us assume that agents commence with some body of knowledge that creates expectations about the consequences of events, including their own actions, in the world. Let us then define problem recognition, in this context, as a mismatch between expectation and experience. The problem can then be construed as the task of how the agent's body of knowledge might be adjusted so that it correctly anticipates the future course of its experience. Assuming that such experience is not random, that is, assuming that it is patterned, we can conceive of the problem in terms of training an artificial neural network to learn the patterns obtaining in experience, or (more realistically), in particular aspects of experience.

Equipped with this reconstrual, we can now formulate a simple version of inquiry and reflection that can be modelled with all the numerical precision available in the model. For an ANN that receives inputs representing experience, processes them according to its dynamics operating on a stored representation of knowledge, and produces outputs that represent expected experiences, stored knowledge is contained in the geometry and connections among layers of artificial neurons (see Evers, 1998; Evers and Lakomski, 2000, for details and applications). From the perspective of normative epistemology, we want to understand how this knowledge can be changed in an epistemically progressive way so that the ANN makes fewer mistakes in its expectations. Improving knowledge under pressure of feedback is a form of supervised learning, with the source of feedback functioning as a teacher. Learning occurs by making iterated small adjustments to the numerical values of the network's connections among neurons subject to the constraint that these adjustments

gradually minimize the difference between output and expected output. Inquiry/reflection is thus occurring as the network's representation of knowledge settles into a solution that minimizes this difference (Churchland, 1989, 1995). In real brains, there is no requirement that any of this processing be conscious. Indeed, it is most likely that none of it is. Nevertheless, we think that this kind of modelling is one way of attempting to gain legitimate insights into the dynamics of reflection.

One objection that might be raised against this kind of purported elaboration of Dewey, is that it is so far removed from anything in his conceptual framework that there is nothing present that can be elaborated in this way. There is some merit in this objection if it is supposed that Dewey was committed to a particular mechanism for explaining the nature and acquisition of knowledge. However, as Willower has constantly reminded us, Dewey's epistemological stance was both fallibilist and experimental and because this was meant to be understood recursively, it applies to the theory of knowledge itself. It was more a framework than a mechanism, although in our view it placed interesting constraints on what could count as a mechanism. For example, it required epistemology to cohere with the findings of natural science, particularly biology and psychology. And it favoured holism as opposed to foundationalist forms of empiricism, for Dewey was perfectly well aware of the myth of the empirical "given", and that all observation is "theory-laden". These are good reasons for allowing Dewey's epistemology to be informed and extended by developments in cognitive science, and we think Willower would have agreed, while typically asking for more pay-offs in terms of useful insights into individual decision making and other acts of administrator cognition.

Research methodology

In addition to providing the basis for a theory of individual reasoning and reflection, epistemologies, suitably specified, can function as research methodologies. As we have seen in Willower's work, following Dewey, this proved to be the case. Our own efforts at specification once again contain the basic Deweyan elements of fallibilism, experimentalism, holism, and the "problems/solutions" process that figures so centrally in his account of inquiry. However, in our view, combining these elements to yield a normative epistemology, one that in Dewey's terms allows knowledge to be judged for its warranted assertibility, requires a shift towards coherentism. The reason for this is that arguments for holism in epistemology serve as powerful criticisms of varieties of empirical foundationalism, the broad idea that knowledge is entirely justified by appeal to some set of sensory experiences, or observation reports.

Willower is familiar with anti-foundationalist arguments, stating "my view is that inquiry or science needs no foundation outside of its own self-rectifying processes" (Willower, 1993b, p. 154). And he acknowledges the tension that emerges over the precise nature of "self-rectifying", where he elaborates: "The

Deweyan notion that ideas should be judged by their consequences is crucial in science where, of course, those consequences are commonly empirical" (Willower, 1993b, p. 154). But, because of his worries about coherentism, he never addressed squarely the puzzle of how to fit together the empirical evidence for self-correction with the anti-foundationalist arguments for holism to give a theory that is normatively warranted.

Once again, a more thorough-going naturalism could have taken explication forward, at least tentatively, into proposals for mechanisms. One mechanism that has been used to explain a wide variety of epistemically progressive theory changes in natural science has been an artificial neural network that uses unsupervised learning to model coherence (see Thagard, 1992, 2000).

Consider, as a starting point, the problem of interpreting ambiguous data. In Figure 1, known as a Necker cube, the perceptual data admits two major interpretations of perspective, namely that either face ABCD or face EFGH is at the front.

This ambiguity gives two sets of incompatible but consistent hypotheses. So we can say hypothesis "A is at the front", Af, coheres with hypothesis "B is at the front", Bf, and also Cf and Df, and hypothesis "E is at the back", Eb. Similarly, we can say that Ab coheres with hypotheses Ef, Db, Cb, and Bb. We can also say that Af incoheres with Ef. Now these hypotheses, and the relations of coherence or incoherence that exist among them, can be modelled in an ANN with true hypotheses having an activation value of 1 and false hypotheses having an activation value of 0. And where the connection strength between hypotheses is high (1 rather than 0) we can say that they cohere, and where low, we say that they incohere.

Choosing the best interpretation is therefore a matter of maximizing global coherence among all the hypotheses, which will mean that some will be turned on (have high activation values) and large connection strengths between them, and others will be turned off. Global coherence in such a model in just the total sum of the product of activation values of adjacent hypotheses and the weights between them (see Evers, 2000a, p. 219). With the Necker cube, two

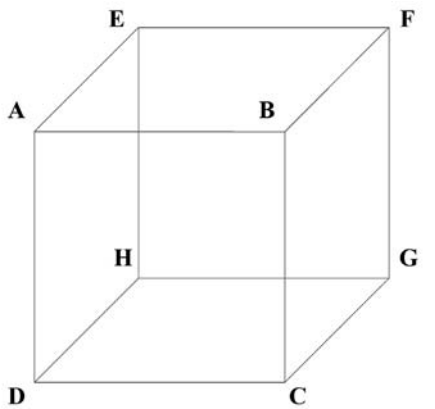

Figure 1.
The Necker cube

interpretations would equally maximize global coherence, and so an interpreter would oscillate between perceptions. But this is rarely the case in real theory choice situations. In most situations one theory, or interpretation, will maximise global coherence. The role of empirical evidence in such an ANN is modelled by having evidence expressing hypotheses set with particular activation values, say high values for the "empirical consequences" driving self-correction. This still leaves open the possibility that the most coherent interpretation can require us to discount certain items of empirical evidence (akin to selective perception) in favour of other items.

These epistemological models are a recent development arising out of naturalism's extension into accounts of mind, in particular the causal machinery of human cognition. They are limited and speculative, barely capturing the complexity of real neural networks. Nevertheless, they throw light on matters concerning the nature of inquiry and warranted assertibility that would not be possible within the framework of suggestive metaphor that characterises much of the discussion of inquiry and reflection today.

Organizational cognition

Dewey, Willower, and a host of others have emphasized the social nature of inquiry. For example, quoting Dewey, Willower makes the point that "...there is an affinity between science and democracy since 'freedom of inquiry, toleration of diverse views, freedom of communication, the distribution of what is found out to every individual as the ultimate intellectual consumer, are involved in the democratic as in the scientific method'" (Willower, 1994a, p. 11). Again, most of the explication of inquiry at this level of analysis is rather abstract and general. And again, recent advances that draw on the naturalist's agenda of taking the findings of science seriously have some insights to offer. Studies of cognition need to deal with relations among clusters of neuronal ensembles, which can be modelled as an ANN comprising of a group of smaller ANNs linked together in a pattern of communication. Recent work by Hutchins (1995) takes advantage of these conceptual tools in order to model social phenomena. One particular example of this is his modelling of simple organizational learning, in a small artificial organization. As organizational learning is an instance of social inquiry, the model is instructive for what it can reveal about the possible constraints on successful organized inquiry.

Hutchins (1995, pp. 250-61) in his simulation, treated small ANNs as individuals, linked together in a pattern of communication as given by Figure 2.

The issue under analysis was what pattern of communication and organization would most facilitate learning by the whole organization. Summarizing the details, since their implications for educational administration are discussed more fully elsewhere (Evers, 2000b), learning was defined in terms of the model as absence of confirmation bias. Confirmation bias refers to the net's capacity to get locked into a particular theory or interpretation. In this simple organization, individuals are capable of adopting one of two theories or interpretations: those represented by sets of numbered hypotheses (*H*) connected by heavy lines (indicating coherence

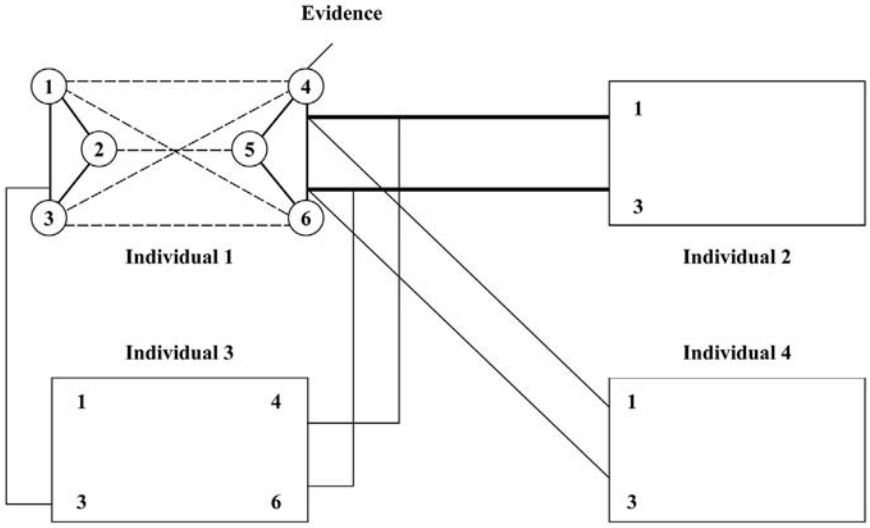

Figure 2.
Modelling an organization of individuals. Each individual is able to choose among two interpretation, theories, or sets of hypotheses. Not all nodes are shown for each individual (adapted from Hutchins, 1995, p. 251)

relations). Thus, one theory, for individual 1, is given by *H1*, *H2*, and *H3*, while the other theory is given by *H4*, *H5*, and *H6*. Let us say that the organization adopts a theory, or interpretation, when most individuals share that theory. Now leadership in this artificial organization is modelled by making one of the individuals more persuasive that the others. That is, the pattern of connectivity is such that the leader's choice of a theory causes others to adopt the same theory.

The fundamental result to emerge from this kind of simple modelling exercise was that leadership enhanced the organization's decision making capacity, in the sense that the organization was able more readily to settle into an agreed interpretation in the light of simulated experiential inputs. However, this capacity was purchased at the expense of increased conformation bias. On the other hand, organizations with weak leadership, while having less capacity for decision making, also learned more rapidly.

This result is appealing to those of a Deweyan persuasion in social philosophy, because it yields exactly the outcome that Dewey would have expected: democracy enhances social inquiry. But by engaging in this sort of modest and limited modelling exercise, inspired by the naturalist's agenda, we gain deeper insights into processes that were previously only accessible through metaphor and looser reasoning.

Conclusion

Willower's philosophy of administration was, as we have seen, thoroughly Deweyan. However, in two respects Dewey's philosophy, and particularly his epistemology, could be fruitfully extended in ways that would have enhanced

its value for the theory and practice of educational administration. The first involves more comprehensive efforts to extend naturalism to the explanation of mental phenomena, particularly cognition. The second involves using naturalistic extensions to cognition to develop Dewey's holistic epistemology into a more powerful tool for determining warranted assertibility. It is a tribute to Willower's remarkable breadth of scholarship that he maintained a deep interest and critical perspective on these matters.

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