Interpretation as Action : The Risk of Inquiry

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"We hope you will find these thoughts of ours both interesting and useful." These are words spoken to express an intention, a bearing in the mind of a person toward an object which is yet to be achieved. The readiest moment of human life involves the interplay of signs, ideas, and objects — more explicitly, the interrelation of signifying expressions, states and dispositions of the mind or person, and objects or objectives either actual or potential. Our work designing instruments to enhance the play of inquiry has attuned us to the themes of interpretation and intentionality which every inquiry seems to involve. We hear what sounds like familiar strains reaching us from the hermeneutic quarter. The purpose of this essay is to trace to their sources a few of these potentially common themes, to draw out one line of their historical development, and to gather what consequences they inspire for educational practice and continued inquiry.

Introduction

In order to study the nature of signification and communication the theory of signs must involve itself with questions of interpretation and intention. The theory of inquiry studies the common pattern of all determination, all proceeding toward the settlement of unsettled situations. There is a key relationship between signs and inquiry. We will follow this relationship through three points of reference. Aristotle's *Peri Hermeneias* or *On Interpretation* introduces the relationship of signs, impressions in the mind, and objects. C.S. Peirce fully explores the triadic relation of signs, interpretants, and objects in its bearing upon his three-stage process of inquiry. John Dewey elaborates these ideas in his view of the lived experience as the "existential matrix" of inquiry. Three major questions will be explored:

How does the sign relation that underlies the nature of signification and communication compare within these works?

We discuss the role of the interpreter in the activity of interpretation. Aristotle assumes that objects and impressions in the mind are constant across all interpreters. Confronting this assumption with the needs of hermeneutic and educational practice, we argue that a comparative and developmental understanding of interpreters is required. This in turn demands the more complete theory of signs envisioned by Peirce and Dewey, which continues to be developed in the semiotic and pragmatic traditions.

What is inquiry and how is it related to the theory of signs?

We examine the structure of inquiry as articulated by Peirce and Dewey. In this model inquiry begins with a surprising phenomenon or problematic situation. Whether felt as pleasant wonderment or painful bewilderment, we feel driven to some activity that will return us to our prior equilibrium. This may issue in a search for explanation that reduces the surprise or for a plan of action that resolves the problem. The ensuing activities share a common form, the differentiation of a pattern. In our consternation we recognize a variety of features, some of which can be varied as part of our capacity for free choice. The problem or surprise is present because of its difference from something. As a surprise, what happens is different from what we

habitually expect. As a problem, what happens is different from what we hopefully intend. To change the systematic expectation against which background a surprising phenomenon originally figured, we must discover some freedom to change what generated that expectation, and so to modify our personal model of the world.

What do these ideas suggest for the practice of education?

A variety of implications will be explored. In this view the teacher acts as a catalyst of inquiry, serving as a mediator to quicken the actualization of something already present in the potential of the student. Emphasis is placed on developing tools that extend the learner's capacity for inquiry. The authors' goal is to design computer software that will enhance the capacity for exploring complex, qualitative information and will support inquiry by serving as a bridge between teaching and research. By engaging in their own explorations and making assumptions explicit, learners will be invited to "think reflectively" about their interpretations.

The Theory of Signs and the Role of the Interpreter

We accept the tenet of pragmatism that all thought takes place in signs. Our interest in the enterprise of "training thought" (Dewey 1991) demands that we examine the role of the interpreter in all the activities that make use of or take place in signs.

Aristotle On Interpretation

Our first point of reference is Aristotle's introduction of the sign relation in his treatise *On Interpretation.*

> Words spoken are symbols or signs (*symbola*) of affections or impressions (*pathemata*) of the soul (*psyche*); written words are the signs of words spoken. As writing, so also is speech not the same for all races of men. But the mental affections themselves, of which these words are primarily signs (*semeia*), are the same for the whole of mankind, as are also the objects (*pragmata*) of which those affections are representations or likenesses, images, copies (*homoiomata*). (Aristotle, *De Interp.* i. 16^a4).

This early text recognizes the three roles within the sign relation: signs, ideas, and objects. It also characterizes the relationships between these three roles. For Aristotle, the relation between signs (words) and ideas (affections and impressions) is that of a symbol to what it symbolizes. In origin, a symbol was a split coin used as a token of recognition. In concrete terms the symbol is a particular kind of sign. As a fragment, it refers both to its other half and to the whole that they originally formed. The relation between ideas and objects is that of an impression to what it is a likeness of. Although Aristotle leaves it implicit, we can see that there is a relationship between signs and objects that is a compound of the first two relations. It is the indirect relation, a fragment of a likeness. There is irony here, that the sign relation is rooted in a type of iconoclasm.

Figure 1 illustrates the sign relation as described by Aristotle. The arrows are drawn to indicate the direction of increasing symbolization, proceeding around the faces of the sign relation in an opposite sense from the process of adducing meaning which it is the job of interpretation to reconstruct. The interpreter, as agent and embodiment of all the various sign

processes, does not have a particular role in the sign relation but is in a sense identified with the whole of it.

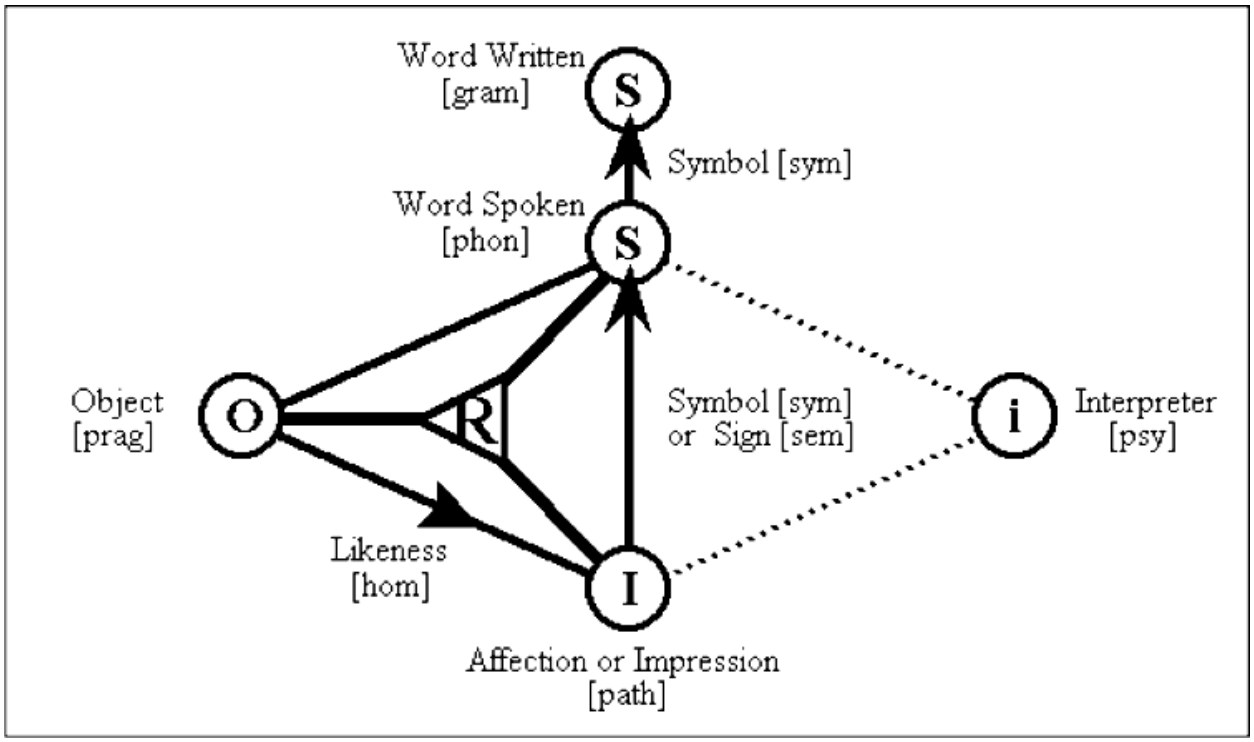

Figure 1. The Sign Relation in Aristotle

Aristotle's description contains two claims of constancy, that ideas and objects are the same for all interpreters. This view does not allow for the plurality and mutability of interpreters, two features that we must be concerned with in hermeneutics and education. John Dewey expresses this point well:

> Thinking is specific, in that different things suggest their own appropriate meanings, tell their own unique stories, and in that they do this in very different ways with different persons. (Dewey 1991, 39).

However, this account of Aristotle's may be considered in part a reasonable approximation and in part a suggestive metaphor, suitable as a first approach to a complex subject.

Some other features of this text will figure in our later discussions. *Pragmata*, the Greek word used for "objects", has shades of meaning ranging from physical objects to purposeful objectives to problematic objections. Derivatives of it can refer to troubles and treatises, all very much the business of inquiry. These objects became the "going concerns" of pragmatism. However, the attempt of pragmatists to convey these varied meanings in practice was often misconstrued as a reduction of intentions to physical operations. One last point of interest, the text suggests that Aristotle appreciated the tension between cultural and natural signs by employing words with both connotations (*symbola vs. semeia*).

The Sign Relation According to Peirce

In moving from Aristotle's account of the sign relation to Peirce's it helps to identify some links between them. Words spoken or written are classed together as *Signs.* Ideas, affections and impressions, correspond to what Peirce calls *Interpretants.* For all practical purposes interpretants are just another class of signs. They may even be just another role the same class of signs can play. If any distinction is intended between them, it is only that interpretants are more intimately involved in the mind or person of the *Interpreter.*

Peirce gave the following definition of a sign in his 1902 Application to the Carnegie Institution:

> Logic is *formal semiotic.* A sign is something, *A,* which brings something, *B,* its *interpretant* sign, determined or created by it, into the same sort of correspondence (or a lower implied sort) with something, *C,* its *object,* as that in which itself stands to *C.* This definition no more involves any reference to human thought than does the definition of a line as the place within which a particle lies during a lapse of time. (Peirce, NE 4, 54).

There are two important features to note in this portrayal of the role of signs in logic. First, Peirce's goal is to differentiate the formal and the material aspects of thought and inquiry. This attempt is motivated by his interest in a certain question: "What is the relation of matter and form in the actuality of the mind (*entelechy*) and is their synthesis a *third something* or not?" This helps us understand how Peirce can be concerned with developing a formal characterization of signs and sign processes without being just another "formalist". His interest is partly due to the influence of Aristotle, whose dictum that "soul is form" is given in the following text:

> So the soul (*psyche*) must be substance (*ousia*) in the sense of being the form (*eidos*) of a natural body (*soma*), which potentially (*dynamei*) has life. And substance in this sense is actuality (*entelecheia*). (Aristotle, *De Anima* II.i. $412^{a}20$).

Second, Peirce's claim that his definition of a sign involves no reference to human thought means no *necessary* reference. The adjective "non-psychological" that he often attaches to this conception of signs and logic is not intended to be exclusive of human thought but to expand the scope of the concepts beyond it (Peirce, NE 4, 21). The prefix "non" is better read as an acronym for "not of necessity", and is commonly used in mathematical discourse in just this way. It extends the use of a concept into wider domains than the paradigm cases upon which our original intuitions were formed.

A definition of signs and their processes which is not limited by prior restriction to human psychology can be used to investigate human thought as a species of natural process. There is considerable power in this naturalistic viewpoint. It allows us to put human thought in a context of other sign processes, to ask what might be the specific differences that distinguish it, and to consider its evolution through different orders of complexity.

Two other features of the sign relation, as portrayed by Peirce, are especially crucial. First, the designations *sign, interpretant,* and *object* are pragmatic roles and not attributes of real essence or permanent nature. Second, a sign relation in the generic case can be *irreducibly triadic,* and as such cannot be wholly understood from any compound of its dyadic fractions.

Pragmatic Roles *vs.* Exclusive Attributes

The assignments of entities to the roles of sign, interpretant, and object do not mark any distinctions of essence or substantial differences among these entities. The same entity may function in any role. For example, Queen Elizabeth may be a symbol of her realm to her subjects; but as a person, she is an interpreter of the English language. Of course, some things may be found more suitable than others for a given role, but this is a pragmatic factor and discovered after the fact. These attributions are exactly that, roles attributed to an entity from a certain point of view, and correctly attributed only in relation to its moment by moment functioning in a currently relevant sign process.

Sign Relations are Irreducibly Triadic

What does it mean that a sign relation is irreducibly triadic? In simplest terms it means that there are facts about a sign relation which cannot be pieced together from separate investigations of the pairwise relations. Thus, studies which limit themselves to *syntax* (relations internal to the sign domain) or *semantics* (relations between signs and objects) or *semiotics* (relations between signs and interpretants), all necessary to the topic, are not sufficient to capture the full dimensionality of the subject. *Pragmatics* is the name we use for the full theory of signs, one that provides for the consideration of plurality and progress in the analysis of interpreters.

Why is it important that a sign relation is irreducibly triadic? In our general effort to understand complex phenomena using the simpler things we already understand as guides, the irreducibly triadic nature of signs brings both good news and bad news. The bad news we have already seen. There is no hope of fully understanding the sign relation in terms of anything simpler. The good news is this. If we do become accustomed to things as complex as the sign relation, then many other interesting phenomena can be clarified by using it. Indeed, it is our impression that at least some of the tensions in the issue of intentionality can be resolved by relating them to similar tensions in the sign relation.

Signs and Inquiry, Information and Doubt

When we call attention to the fact that signs and expressions are human artifacts, it forces us to recognize that signs are objects in their own right, with all the contingency and facticity that this entails. It is only natural that in pointing out the status of a sign *as* sign, we are reminded of its fallibility, the chance that it can fail to mean anything either present or forthcoming, the risk that it may lead or mislead by degrees in its aim. The sign may be broken in numerous ways, failing to connect by not denoting or not connoting, losing its relation to objects in the world or ideas in the mind. All the ways that it can succeed are ways that it can fail to signify.

> What is frequently appreciated in many so-called symbols is exactly their vagueness, their openness, their fruitful ineffectiveness in expressing a “final” meaning, so that with symbols and by symbols one indicates what is always *beyond* one’s reach. (Eco 1986, 153).

The fallibility of signs is shared with the human activities of interpretation and inquiry, and bears a relation to the situated character of all dynamic processes of determination.

> If doubt and indeterminateness were wholly within the mind — whatever that may signify — purely mental processes ought to get rid of them. But experimental procedure signifies that actual alteration of an external situation is necessary to effect the conversion. A *situation* undergoes, through operations directed by thought, transition from problematic to settled, from internal discontinuity to coherency and organization. (Dewey 1988, 185).

Signs are enabled to have significance only within a proper setting. A whole system of signs is required to constitute what we variously call a medium, a channel, a formal or natural language. In such a context, information becomes a property that we attribute to signs. A sign given in this kind of situation has the ability to reduce the uncertainty that an interpreter has with regard to an object domain. It is in virtue of this ability that a sign is said to possess and convey information.

This power of reducing uncertainty, of mediating between the less and the more determinate situation, is just the virtue that inquiry seeks to have. Our established systems of signs are the typical results of well-completed inquiries, while inquiries in the present tense have no guarantee of yielding such stable and reusable products.

The Pattern and Stages of Inquiry

Up until now we proceeded synthetically, attempting to reconstruct the nature of inquiry from the shape and flow of its chief constituents, signs in action. We now move inquiry into the foreground, examining the functions and stages which support it. In doing this it is natural to reverse the order of presentation, and to work from our current perspective on signs toward the functional and historical precursors which round out our view of inquiry.

To illustrate the place of the sign relation in inquiry we begin with Dewey's elegant and simple example of reflective thinking in everyday life:

> A man is walking on a warm day. The sky was clear the last time he observed it; but presently he notes, while occupied primarily with other things, that the air is cooler. It occurs to him that it is probably going to rain; looking up, he sees a dark cloud between him and the sun, and he then quickens his steps. What, if anything, in such a situation can be called thought? Neither the act of walking nor the noting of the cold is a thought. Walking is one direction of activity; looking and noting are other modes of activity. The likelihood that it will rain is, however, something *suggested.* The pedestrian *feels* the cold; he *thinks of* clouds and a coming shower. (Dewey 1991, 6-7).

In this narrative we can identify the characters of the sign relation as follows: *coolness* is a Sign of the Object *rain,* and the Interpretant is *the thought of the rain's likelihood.* In his 1910 description of reflective thinking Dewey distinguishes two phases, "a state of perplexity, hesitation, doubt" and "an act of search or investigation" (Dewey 1991, 9), comprehensive stages which are further refined in his later model of inquiry. In this example reflection is the act of the interpreter which establishes a fund of connections between the sensory shock of coolness and the objective danger of rain, by way of his impression that rain is likely. But reflection is more than irresponsible speculation. In reflection the interpreter acts to charge or defuse the thought of rain (the probability of rain in thought) by seeking other signs which this thought implies and evaluating the thought according to the results of this search.

Figure 2 illustrates Dewey's "Rain" example, tracing the structure and function of the sign relation as it informs the activity of inquiry, including both the movements of surprise

explanation and intentional action. The dyadic faces of the sign relation are labeled with just a few of the loosest terms that apply, indicating the "significance" of signs for eventual occurrences and the "correspondence" of ideas with external orientations. Nothing essential is meant by these dyadic role distinctions, since it is only in special or degenerate cases that their shadowy projections can maintain enough information to determine the original sign relation.

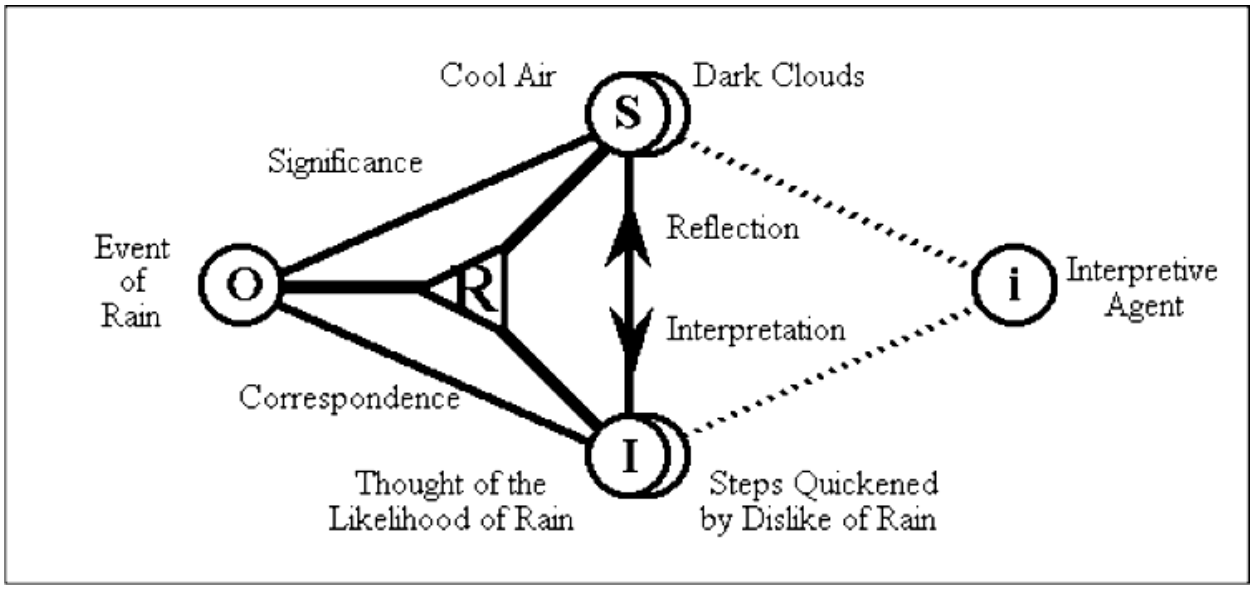

Figure 2. Signs and Inquiry in Dewey

If we follow this example far enough to consider the import of thought for action, we realize that the subsequent conduct of the interpreter, progressing up through the natural conclusion of the episode — the quickening steps, seeking shelter in time to escape the rain — all of these acts form a series of further interpretants, contingent on the active causes of the individual, for the originally recognized signs of rain and for the first impressions of the actual case. Just as critical reflection develops the associated and alternative signs which gather about an idea, pragmatic interpretation explores the consequential and contrasting actions which give effective and testable meaning to a person's belief in it.

Dewey's Definition of Inquiry

By 1938 Dewey had developed a definition of inquiry which summarized his mature views:

> Inquiry is 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. (Dewey 1986, 108).

In view of the apparently inextricable relationship our previous discussions have detected between interpretation and inquiry, it would seem natural that a definition of inquiry should have some bearing on interpretation. Given Dewey's definition of inquiry, this forces the question: Can both interpretation and inquiry be seen as special types of determination?

Prior to our discussion of the sign relation, an affirmative answer to this question might have seemed surprising, because these two things seem so different. Interpretation and inquiry are not

usually identified with each other in everyday thought. Interpretation gives meanings to signs. Inquiry seeks to end perplexity. Interpretation of everyday speech is not reflected upon as problematic, whereas inquiry is the very model of problem-solving activity.

But now the idea that interpretation is every bit as risky as inquiry should be familiar. There is no infallible reflex which gives meanings to signs, expressions, and texts. Conversely, inquiry, "thinking" in its best sense, "is a term denoting the various ways in which things acquire significance" (Dewey 1991, 38). So there is no longer an obstacle to viewing these two processes as forms of determination.

Architecture of Inquiry

Peirce and Dewey gave similar accounts of the architecture of inquiry, its typical pattern and generic stages. Both Peirce and Dewey agree that inquiry is "a response by human beings to some break or interruption in their previously untroubled behavior." In Dewey's later thought, the stages of inquiry involve: (1) "the problem implicit in such an interruption is located, formulated, and developed"; (2) "hypotheses (or suggestions) for solving the problem are introduced and are examined, with a view to determining by reasoning just what is implied by them"; (3) "a hypothesis is *tested* by appropriate experiments which either verify or disconfirm such logical consequences of the hypothesis"; and (4) "a judgment as to whether a proposed hypothesis does (or does not) resolve the problem that initiated the inquiry." (All quotes in this paragraph are from Nagel, in Dewey 1986, xv-xvi).

Peirce's most elegant and detailed account of inquiry is given in the context of his 1908 article "A Neglected Argument for the Reality of God" (CP 6.468-476). According to Peirce, inquiry begins with "some surprising phenomenon, some experience which either disappoints an expectation, or breaks in upon some habit of expectation of the *inquisiturus*".

The first functional stage of inquiry is *abduction,* which involves "pondering these phenomena in all their aspects", allowing a conjecture to arise "that furnishes a possible Explanation", regarding the conjecture with "favor" and holding it to be "Plausible". Abduction is the "whole series of of mental performances between the notice of the wonderful phenomenon and the acceptance of the hypothesis." It is:

> the dark laboring, the bursting out of the startling conjecture, the remarking of its smooth fitting to the anomaly, as it is turned back and forth like a key in a lock, and the final estimation of its Plausibility, … Its characteristic formula of reasoning I term Retroduction [abduction], *i.e.* reasoning from consequent to antecedent. (Peirce, CP 6.469).

Peirce's second stage of inquiry, *deduction,* is the testing of the hypothesis.

> This testing, to be logically valid, must honestly start, not as Retroduction starts, with scrutiny of the phenomena, but with examination of the hypothesis, and a muster of all sorts of conditional experiential consequences which would follow from its truth. (Peirce, CP 6.470).

Finally, in the third stage, *induction,* the inquirer ascertains "how far those consequents accord with Experience, and of judging accordingly whether the hypothesis is sensibly correct". (Peirce, CP 6.472).

Peirce divides the stages of inquiry at different points than Dewey, relating them to three modes of inference that he calls *abductive, deductive,* and *inductive* reasoning. (Abduction suffers a flight of fanciful names from *hypothesis*, through *presumption* and *suggestion,* to *retroduction.*) These forms of inference were drawn from Aristotle's three figures of syllogism and passed through a series of metamorphoses in Peirce's refractory. Though they follow one another in the typical progress of inquiry, these elements of inference may also be combined in other ways, for example, to yield mixed forms of reasoning such as analogy (Peirce 1982, 180).

Implications for Educational Practice

According to John Dewey, it is because of the human quest for perfect certainty that philosophy has inherited three problematic viewpoints:

> the first, that certainty, security, can be found only in the fixed and unchanging;
> the second, that knowledge is the only road to that which is intrinsically stable and certain;
> the third, that practical activity is an inferior sort of thing, necessary simply because of man's animal nature and the necessity for winning subsistence from the environment. (Dewey, 1988, 41).

These predispositions of philosophy toward antecedent, fixed universals have led to what Peirce and Dewey call a spectator theory of knowledge which "excludes any element of practical activity that enters into the construction of the object known" (Dewey 1988, xi). Still it is not the uncertainty itself for which Dewey believes we lack tolerance but the risk that it entails. In contrast with invariants the results of action, even action painstakingly planned and conceived, can never be certain. Its outcomes are only probable. What then can inquiry offer that the spectator theory of knowledge cannot? Instead of the pursuit of invariant objects as the foundation of certainty, inquiry affords a feeling of control based on discovering the "relations among changes in place of definition of objects immutable beyond the possibility of alteration" (Dewey 1988, 82). No longer are we passive receptacles of facts but actively involved explorers, constantly interpreting our experiences.

Teacher as Catalyst

In this view the teacher acts as a catalyst of student inquiry, serving as a mediator or sign to quicken the actualization of something already present in the potential of the student. The student's impulse is the 'moving spring' of inquiry, but impulse does not direct intelligent inquiry. It is purpose that shapes reflective inquiry — "A purpose differs from an original impulse and desire through its translation into a plan and method of action based upon foresight of the consequences of acting under given observed conditions in a certain way" (Dewey 1963, 69). Such purposes are formed through observation, experience (both first hand and as information obtained from those who have wider experience), and judgment which puts observation and experience together to determine what is "signified" (Dewey 1963, 69). To nurture this process teachers can create environments where blind action (impulse) is not an end in itself but where experiences build the habits of reflective inquiry. Reflective thinking, "active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of

the grounds that support it, and the further conclusions to which it tends" (Dewey 1991, 6) is indeed the process of inquiry.

Suspending Conclusions and Questioning Assumptions

The inquiry process demands that we suspend our conclusions and tolerate the lack of mental ease created by uncertainty until alternatives have been examined. We must overcome the tendency to jump at the first suggestion that presents itself. Gadamer has said that it is not entirely our judgments but also our prejudices that determine our being since they are "the conditions whereby we experience something — whereby what we encounter says something to us" (Bernstein 1971, 97). Reflective thinking is then also critical thinking, "calling into question the assumptions underlying our customary, habitual ways of thinking and acting and then being ready to think and act differently on the basis of this critical questioning" (Brookfield 1991, 1).

This reflective operation as we've seen can be triggered by a surprise or a perplexity that we seek to bring to a more settled state. Today, there is no shortage of such events. "As people try to make sense of these externally imposed changes, they are frequently at teachable moments as far as the process of becoming critical thinkers is concerned" (Brookfield 1991, 10). Teachers who desire to develop the habits of inquiry in their students might do well to consider the characteristics of critical teachers described by Freire which include competence in communicating the possibility of alternative interpretations, the courage to challenge assumptions, willingness to risk being fully engaged in the educational exchange, humility, and the political clarity to recognize distorting perspectives (Brookfield 1991, 82). However, it must also be noted that teachers, as human beings, have values and prejudices of their own. Recognition of these assumptions and beliefs to ourselves and to our students is an important part of teaching reflective thinking. It involves the willingness to examine our biases in the light of student perspectives.

Building Tools for Inquiry

However, such attitudes are not enough. Emphasis is further placed on developing tools that extend the learner's capacity for inquiry and reflective thinking. "The important thing in the history of modern knowing is the reinforcement of these active doings by means of instruments … devised for the purposes of disclosing relations not otherwise apparent" (Dewey 1988, 70). Thinking reflectively about our own practice, the education of children and adults and the development and use of computer technology, has led the authors to a belief in the value of guided inquiry as educational method and to the use of the computer as a tool for active learning.

Because of its capacities for interaction, modeling, and feedback the computer has the potential to open new educational horizons. The authors' goal is to develop computer software that will enhance the ability of learners to experience and explore their own worlds — to form more settled interpretations of the relationships observed, and to examine and reinterpret the assumptions forming their world models. Because the complexity of qualitative information often makes the process of observation overwhelming, such new tools are needed to explore the depths of qualitative information, to recognize its patterns, and to interpret its significance. The second goal of this software is to reduce the gap between teaching and research by empowering learners to work more directly on information gathered for research. Finally, the third goal is to

model the flow of each learner's inquiry and to highlight the individual student's implicit assumptions. By engaging in personal explorations and making assumptions explicit, individual learners will be invited to "think reflectively" about their distinctive and shared interpretations.

References

Aristotle, (1983). Prior analytics. In G.P Goold (Ed.) & H. Tredennick (Trans.), *Aristotle (Vol. 1).* Cambridge, MA: Harvard University Press.

_____. (1986). On the soul. In G.P Goold (Ed.) & W.S. Hett (Trans.), *Aristotle (Vol. 8).* Cambridge, MA: Harvard University Press.

Bernstein, R.J. (1971). *Praxis and action: Contemporary philosophies of human activity.* Philadelphia, PA: University of Pennsylvania Press.

_____. (1986). *Philosophical profiles.* Philadelphia, PA: University of Pennsylvania Press.

Brookfield, S.D. (1991). *Developing critical thinkers: Challenging adults to explore alternative ways of thinking and acting.* San Francisco, CA: Jossey-Bass Publishers.

Dewey, J. (1963). *Experience and education.* New York, NY: Macmillan Publishing Company. Originally published 1938.

_____. (1986). Logic: The theory of inquiry. In J.A. Boydston (Ed.), *John Dewey: The later works, 1925−1953. (Vol 12: 1938).* Carbondale, IL: Southern Illinois University Press.

_____. (1988). The quest for certainty. In J.A. Boydston (Ed.), *John Dewey: The later works, 1925−1953. (Vol 4: 1929).* Carbondale, IL: Southern Illinois University Press.

_____. (1991). *How we think.* Buffalo, NY: Prometheus Books. Originally published 1910.

Eco, U. (1986). On symbols. In J. Deely, B. Williams, & F.E. Kruse (Eds.), *Frontiers in semiotics.* Bloomington, IN: Indiana University Press.

Peirce, C.S. (1960). A neglected argument for the reality of God. In C. Hartshorne & P. Weiss (Eds.), *Collected papers of Charles Sanders Peirce, (Vol. 6: Scientific metaphysics).* Cambridge, MA: Harvard University Press. Originally published 1908.

_____. (1976). Parts of Carnegie application. In C. Eisele (Ed.), *The new elements of mathematics (Vol. 4).* The Hague, Mouton Publishers. Original letter dated 1902.

_____. (1982). On the logic of science. In Peirce Edition Project (Eds.), *Writings of Charles S. Peirce: A chronological edition. (Vol. 1: 1857−1866).* Bloomington, IN: Indiana University Press. Original lecture dated 1865.

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