

The Transactional View and Autopoietic Biology

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This essay concerns two remarkable scholarly partnerships. The first arose in the 1940s between the American philosopher John Dewey (1859-1952) and the American social scientist Arthur Bentley (1870-1957). Dewey and Bentley's collaboration culminated in their publication of *Knowing and the Known* (1949/1973). The framework presented in that book is herein referred to as the "transactional viewpoint." The transactional view stresses that person and environment always co-occur (within transactions), rejecting any conception of their independence (see Ryan, 2002; Khalil, 2003).

In the second partnership, Chilean biologists Humberto Maturana (1928-) and Francisco Varela (1946-2001) developed what is here referred to as the "autopoietic viewpoint." The autopoietic viewpoint is outlined in works such as *Autopoiesis and Cognition* (1980) and, written for a popular audience, *The Tree of Knowledge* (1992). Maturana and Varela invented the word "autopoiesis" (literally: "self-production") in an attempt to define living organisms as entities that continuously produce themselves.

Why care about the transactional and autopoietic viewpoints? Both viewpoints challenge prevailing theories of behavior, in which behavior is supposedly caused by inner motivations in organisms (what is called below, self-actional views), by organism-independent external environmental incentives (interactional views), or by both. Such views neglect the *context* of the co-occurrence of person and environment, which Dewey and Bentley called "transaction" (see Khalil, 2003).

Both partnerships sought clear, coherent, and scientifically sound frameworks for thinking about life, behavior, cognition, language, knowledge, and logic. More specifically, both partnerships were centrally concerned with the (recursive) application of knowing to itself—the problem of the knowledge of knowledge. Both viewpoints can be seen as a set of clarifi-

cations of the questions "What is it to know?" "How does the knower relate to the knowing?" and "How does the knowing relate to the known?" These questions have marred modern philosophy (Ryan, 2002).

For both partnerships, such questions usually are confused by the assumption of a pre-given and absolute separation between the knowing person and the known world (where *knowing* becomes an intervening bridge). As elaborated below, to solve (or better, dissolve) such confusions, both partnerships framed knower, knowing, and known as phases of a single natural process.

In what follows, the two viewpoints will be examined from the perspective of Dewey and Bentley's (1973, Chapter 4) differentiation between three levels of scientific inquiry: self-action, inter-action, and trans-action. While illustrated here with examples from physics, the differentiation is applicable to any domain of scientific inquiry, including inquiry into human behavior and knowledge.

Scientifically primitive *self-action*, where "things are viewed as acting under their own powers," was characteristic of Aristotle, for whom the stars moved according to their inherent internal essences. This contrasts with the intermediate level of *inter-action*, where "thing is balanced against thing in causal interconnection." Inter-action was heralded by Galileo and perfected by Newton with a billiard-table universe of interacting particles.

For Dewey and Bentley, the third and most advanced approach to inquiry is *trans-action*,¹ or "functional observation

of full system," where *phases* and *aspects* of action are described without "final attribution" to detached or independent elements, entities, or essences. Dewey and Bentley illustrated trans-action with Maxwell's theory of electromagnetic fields and Einstein's theory of relativity. Among other things, Einstein "brought space and time into the investigation as among the events investigated." Here Einstein exemplified what Dewey and Bentley stress as the heart of trans-action, namely "the right to see in union what it becomes important to see in union" (Dewey & Bentley, 1973, Chapter 4).

This essay argues that despite several similarities among the transactional and autopoietic viewpoints, the former makes trans-action basic, whereas the latter makes commitments to inter-action that impede its general inclination toward trans-action. The essay does so by contrasting the transactional and autopoietic approaches to four topics. In addition to establishing similarities and differences, the discussion of each topic is intended to give readers a preliminary feel for each viewpoint in its own right.

The Inseparability of Designation and Existence

The Oxford English Dictionary defines the word *designation* as "the action of marking or pointing out; indication of a particular person, place, or thing by gesture, words, or recognizable signs." If I ask you to consider the chair on which you are currently sitting, and if your command of English is sufficient to afford your compliance, then I have gotten you to designate the chair—I have gotten you to select it out from all the rest as a distinct object of attention—at least for a moment.

Interestingly, and importantly, designation always includes an act of designat-

¹ For clarity, the hyphenated word "trans-action" will always designate the third level of scientific inquiry, whereas "transactional" will designate Dewey and Bentley's specific approach (which is trans-actional in orientation).

ing *and* a thing designated. This point is critical to both the transactional and autopoietic approaches to knowing and the known.

Dewey and Bentley named the act of designating *designation* and the thing designated an *existence*. Do not be put off by their unconventional use of the word *existence*. All it means is a thing known to *exist*, in the etymologically accurate sense of *standing out* or *being perceptible*. Chairs, sentences, molecules, persons, tornadoes, etc. are all existences in this sense.

Dewey and Bentley took care to emphasize, again and again, that designation and existence occur only *together*. The reason they occur only together, wrote Dewey and Bentley, is that they are inseparable *phases* or *aspects* of a more inclusive activity incorporating them both. Dewey and Bentley named this more inclusive occurrence *fact*.

Etymologically, the word “fact” comes from “factum,” or “thing done.” “Thing done” incorporates both thing *and* doing. In precisely this sense, *fact* incorporates both existence *and* designation—like a coin with its two sides. Fact is at once designated-existence and existence-designated. Further, where an existence is directly a known, a designation is directly a knowing. A fact, therefore, is a knowing-known.

Consider atoms. In physics, the word “atom” is used to designate a complex of existences (including electrons whizzing around nuclei) that modern science has made known to us. The existences we know as atoms have changed over time, with, among other things, the identification of increasingly tiny constituents (including quarks). This change in the *existence* of atoms has proceeded hand-in-hand with development in the *designation* of atoms. To paraphrase Dewey and Bentley, the designation and the existence, or the knowing of atoms and the known atoms, have gone and will continue to go forward together. As facts, or knowing-knows, atoms are simultaneously being-better-known-by-us *and* making-them-better-known-to-us.

It is worth pausing to absorb the full weight of these assertions. Perhaps some readers will find themselves thinking “what nonsense!—of course chairs exist as chairs independently of designation!” Note, however, that to argue that “of course” a chair (or an atom or anything else) can exist outside and independently of designation is to forget that in order to make this point, one has to use the name “chair,” thereby invoking the very inseparability of designation and existence one is trying to deny! In other words, it is inconsistent to indicate something in order

to demonstrate that it can exist without being indicated. Chairs exist, but only alongside designation within fact.

The transactional formulation of designation and existence as inseparable phases is unconventional. To some, it will seem awkward—to others, idealistic. Later sections of this essay aim to dissipate such awkwardness and/or misinterpretation. For now, however, let us see how the autopoietic viewpoint sets up a similar framework in different words.

Maturana and Varela (1992) named the act of designation *distinction* and the thing designated a *unity*:

The act of indicating any being, object, thing, or unity involves making an *act of distinction* which distinguishes what has been indicated as separate from its background....

A *unity* (entity, object) is brought forth by an act of distinction. Conversely, each time we refer to a unity in our descriptions, we are implying the operation of distinction that defines it and makes it possible (p. 40).

Here again, as with Dewey and Bentley, it is emphasized that distinction and unity (or designation and existence) are mutual and reciprocal—each presupposing and making no sense without the other.

There is a difference, however. Whereas Dewey and Bentley offer *fact* as something within which designation and existence are rendered inseparable, Maturana and Varela have no equivalent word or notion. This relates to the earlier claim that the autopoietic viewpoint is less trans-actional—in this case Dewey and Bentley go further, with their *fact*, towards “seeing in union what it becomes important to see in union.”

Summing up, the transactional and autopoietic viewpoints mutually assert that there are literally no existences or unities (as knows) outside of designating or distinguishing (as knowings). Both viewpoints stress that knowing is a done thing and that a thing known is a thing done. With their notion of *fact*, however, Dewey and Bentley advance further a fully transactional account.

Organism, Environment, and the Circle of Life

Circularity permeates the transactional and autopoietic viewpoints. Here it is explored with respect to how each viewpoint conceptualizes the life-process. Not only will we see just what is meant by “autopoiesis,” but how Dewey-Bentley and Maturana-Varela differ in their views of relations among life, organism, and environment. Where the autopoietic view-

point seems to adopt self-action (with its notion of “self-production”) and in fact comes closer to inter-action, the transactional viewpoint begins with trans-action and consistently follows it through.

In the autopoietic viewpoint, the organism is distinguished from its surrounding environment (Emphasis 1), characterized by its autopoietic organization (Emphasis 2—elaborated below), and placed in a relation of necessary and continual *interaction* with its environment (Emphasis 3). These emphases are clear in the following statement:

As observers, we have distinguished the living system as a unity from its background and have characterized it as having a definite [i.e., autopoietic] organization. We have thus distinguished two structures that are going to be considered operationally independent of each other: living being and environment. Between them there is a necessary structural congruence (or the unit disappears) (Maturana & Varela, 1992, p. 95).

In their next sentence, Maturana and Varela explain that their “structural congruence” consists of “interactions between the living being and the environment” (p. 95). The important point here is that for Maturana and Varela, life is in and of an organism (“living being”), which *interacts* with an *outside* environment (which may or may not include other living organisms). The autopoietic view of life is sketched in Figure 1a.

The transactional alternative to the autopoietic view is sketched in Figure 1b (though keep in mind that it is extremely difficult to illustrate the dynamical inseparability of organism and environment in a two-dimensional static figure). Where Figure 1a shows two facts in interaction, Figure 1b shows one fact (i.e., one transaction).²

Let us now describe the autopoietic organization that for Maturana and Varela defines the living (see Emphasis 2 above). *Autopoiesis* literally means *self-production*, and is indicated by the arrowhead in the top right of Figure 1a. For Maturana and Varela, an organism is a *network of processes* which *produce components* which *continuously regenerate and realize the network of processes that produced them*. In other words, an autopoietic system is a continuous process of production with no distinction between producer and

² Figure 1b indicates only that for Dewey and Bentley organism and environment are inseparably intertwined phases of a life-transaction, and is not intended to imply anything beyond this.

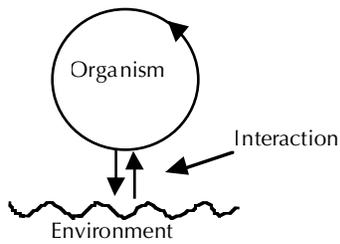


Figure 1a: The Autopoietic View of Life

produced. For Maturana and Varela, autopoietic systems “specify their own boundaries in the processes of self-production” (1980, p. 81).

Consider a unicellular organism. One of the many equally integral processes occurring in such an organism results in the production, monitoring, and maintenance of a membrane. This membrane, in turn, constrains the visible extent of the cell it is part of,³ enabling the cellular dynamics to continue producing the membrane along with other components necessary for the cell’s ongoing existence. Like the whole-part relation between the cell and any of these components, cell and membrane are circularly coordinated phases of a unitary process.

It is on the basis of such facts (read: designated-existences) that Maturana and Varela argue living systems are circularly constituted autopoietic systems. Existences designated and observed within cellular dynamics hang together in circular patterns of dependency. It is thus technically correct to state that the notion of autopoiesis is grounded in fact.

Aspects of this circular conception of life gel fluidly with the transactional viewpoint. Indeed, Dewey (1911) offered a similar definition of life sixty years earlier. Dewey defined a *function* as an arrangement of processes sufficiently complex to (a) serve some specific end in such a way as to (b) conserve itself. He gave the example of digestion. Digestion both transforms ingested nutrients into compounds amassed to renew bodily tissue *and* operates to “maintain the conditions of its own maintenance.” For Dewey,

The sum total of functions, in their reciprocal adjustment to one another, constitutes life, which accordingly, is defined in the same way as a function (p. 467).

If we collapse (a) and (b) above in making “self-maintenance” the “specific

³ Without preventing the cell’s sensory interaction with its environment at some distance beyond its membrane.



Figure 1b: The Transactional View of Life

end” served by the whole functional complex of minor-functions (digestion, respiration, excretion, etc.), we have a definition of life similar to autopoiesis.

In the same work, however, Dewey (1911) pinpointed a significant difference with the autopoietic view: “Life is a process which includes environment as well as organism within itself...” (p. 437, see also p. 467). Thirty-eight years later, Dewey reiterated this characteristically transactional assertion:

A life-activity is not anything going on *between* one thing, the organism, and another thing, the environment, but ... *as* life-activity, it is a simple event over and across that distinction (not to say separation). Anything that can be entitled to either of these names has first to be located and identified as it is incorporated, engrossed, in life-activity (in Dewey & Bentley, 1973, p. 203).

These claims differentiate the transactional and autopoietic views of life (despite certain similarities). We observed above that the autopoietic view attributes life to the (autopoietic) organism, where the organism is distinct from the environment, which is outside the organism, and with which the organism continuously interacts. This is consistent with aspects of the above-reviewed scientific stage of interaction, where “thing is balanced against thing in causal interconnection” (or what Maturana & Varela call “reciprocal perturbation”).

For Dewey and Bentley, by contrast, organism and environment are distinguishable only as inseparable phases *within* life-activity, which is equally and integrally of *both together* (see Figure 1b).

To sum up, by taking organism and environment as phases of a common life-transaction, the transactional viewpoint explicitly rejects the inter-actional convention of placing “living organism” in contradistinction to “external environment.” The autopoietic viewpoint, on the other hand, retains a commitment to the conventional view with an emphasis on

“interactions” *between* organism and environment.

Transdermality

In a recent *National Geographic* feature on the human epidermis, an introductory sentence read as follows: “Draped in place over our bodies, skin forms the barrier between what’s inside us and what’s outside” (Swerdlow, 2002, p. 39). It is interesting to reflect on the assumptions propping up this simple statement. One is that bodies, organisms, and selves share the skin as a common boundary. Another is that skin is primarily a *barrier* between insides and outsides. Both assumptions are routine, if implicit, in contemporary philosophy and psychology. Most psychology, for example, works from a tacit conception of the organism as a skin-bound body—a box like object with perceptual inputs (stimuli) coming in from, and behavioral outputs (responses) going out to, the “external environment.” Where behavioral psychologists have emphasized the so-called environmental outsides of the box, cognitive psychologists have emphasized hypothesized insides.

The explicit rejection of both assumptions underpins Dewey and Bentley’s transactional viewpoint. For Dewey and Bentley, organisms live “as much in processes across and ‘through’ skins as in processes ‘within’ skins” (1973, p. 139). To explain why, it is useful to consider the etymology of the word “organism.” “Organism” is a historical combination of “organize” and “-ism,” where the suffix “-ism” forms a simple noun of action from a verb (so, for example, “baptize” becomes “baptism”). “Organism” can accordingly be read as a noun designating the process, act, or result of *organizing* (where “organize” in turn combines “organ” in the sense of “tool,” “instrument,” or “functioning component of a greater whole” with “ize” in the sense of “to make into”). Now while the body can be treated as a static object, and bounded at the skin, Dewey and Bentley stress that the organism is a *dynamic organizational process*. When an organism is viewed in this way, it becomes natural *not* to bound it at the skin of its body (i.e., to treat “organism” and “body” as synonyms).

Consider a chimpanzee gathering termites with a stick. Here the stick is as much a part of the chimp’s organism (read: *organizational process*) as its eyes, mouth, and fingers. Just like the eyes and fingers, the stick is an organ or tool of what is getting done. If the reader feels inclined to exclude the stick from the chimp’s organism, how about a prosthetic arm from its human host? For that matter, how about

the hair and nails—are they outside the organism because they are outside the skin of her body? As such examples show, equating *organism* and *skin-bound body* leads to uncomfortable boundary issues. These issues are resolved when *organism* is instead equated with *dynamic organization*. When you pick up and drink a glass of water, the glass literally *is not* inside your skin-bound body, but literally *is* inside the organized and organizing activity without which you would not be alive. Indeed, during the process of drinking, the water passes your lips and becomes assimilated with your body, the whole process thereby extending straight across your skin. It is in light of such considerations that Dewey and Bentley emphasize that organisms are *transdermal*—occurring literally *through* and *across* skin. It is also worth reiterating that for Dewey and Bentley, organism occurs only via an environmental medium within the more inclusive (and equally transdermal) organic-environmental life-activity (as indicated in the previous section and Figure 1b).

When it comes to transdermality, the autopoietic viewpoint is ambiguous. We saw above that Maturana and Varela define an organism as a self-producing (autopoietic) network of processes in continuous interaction with an environment. They often imply that this network is bounded at the membrane or “sensory and effector surfaces” (i.e., the skin):

The organism ends at the boundary that its ... organization defines in the maintenance of its identity. At this boundary there are sensors (the sensory surfaces) ... and effectors (the effector surfaces) ... (in Maturana & Varela, 1980, p. 20).

In other places, however, they emphasize that inclusion in the autopoietic life-process depends on dynamic participation as opposed to spatial (i.e., skin-based) localization:

The boundaries of a living system are not fixed by the molecules that realize it but arise in the ... dynamics of participation in the autopoiesis of the organism (Maturana, 2001).

Such emphases suggest that the skin of the organism’s body *need not* correspond to the *actual extent* of the autopoietic network of processes. Maturana and Varela would do well to make this point more explicit, for as we have seen, they elsewhere can be read to imply that the organism *does* end at its skin. This ambiguity probably stems from an insufficiently trans-actional

conceptualization of organism and environment. If one adopts the framework of organism-environment *interaction*, convention dictates that skin is the line holding the two actors apart. If one adopts the frame of organism-environment *transaction*, however, the convention simply loses its force (as demonstrated in the previous section).

Summing up, the transactional viewpoint stresses the directly transdermal nature of organisms (as dynamic organizations). In contrast, the autopoietic viewpoint equivocates between taking (autopoietic) organisms as skin-bounded and taking them as transactionally transdermal.

Evaporating Subject-Object Dualism

The preceding three sections have laid the groundwork for discussing this final topic—evaporating subject-object dualism. Such evaporation is perhaps *the* core aim of both the transactional and autopoietic viewpoints.

First, what is subject-object dualism? Part of Descartes’ legacy (Ryan, 2002), subject-object dualism is the assumption or premise that the world comes to us sliced down the middle. On the one side is the knowing subject, on the other side is the known object. The dualism is central to Western intellectual culture, and comes to us in a thousand different wordings. Figure 2 shows some of the better-known varieties.

Subject	Object
Knowing	Known
Organism	Environment
Person	World
Inside	Outside
Observer	Observed
Epistemology	Ontology
Mental	Physical
Soul/Spirit/Mind	Matter
Rational	Empirical
Cognitive	Behavioral
Individual	Society

Figure 2: Varieties of Subject-Object Dualism

Notice that every component dualism of Figure 2 is completely reliant on a line. This line is all that partitions subject from object, knowing from known, organism from environment, person from world. I am *in here*, separated from what is *out there*, where the words “in” and “out” make no sense without a line at which one becomes the other.

Notice also that once you accept or unconsciously assume the existence of such a line, subsequent inquiry will be commit-

ted to solving the problem of how the two sides relate to one another. If the external world is forever separated from me, then how do ever I manage to acquire knowledge about it? If all I can really be sure of is my own internal thoughts, then how do I know that the external world even exists? The list of problems is self-multiplying and keeps philosophers very busy.

Attempted solutions to these problems take three forms. One form (what Dewey/Bentley call “self-actional”) asserts the primacy of the *inside* of the line and is called *idealism, subjectivism, solipsism, or rationalism*. Another form (what Dewey/Bentley call “interactional”) asserts the primacy of the *outside* of the line and is called *realism, objectivism, representationalism, or empiricism*. The third form tries to balance primacy between *both sides* of the line, which one may call “mutualism.” Mutualism should not be confused with the transactional view.

Consider the process of observing a bird. For the idealist, the bird is primarily an idea that the observer imposes on the world. For the realist, the bird exists independently of the observer, and its observation consists in making an internal copy or representation. For the mutualist, the bird and the observer both exist separately before they come together in the observation of the bird. These renderings are not stylized or fanciful. In contemporary scientific psychology, for example, while idealism is nowadays uncommon, realism and mutualism are the standard views.

As Dewey put it in a letter to Bentley dated February 1944, the quarrel among the idealist, the realist, and the mutualist “goes on and has to go on forever—until they give up their common premise.” That common premise, one more time, is a line of absolute separation between subject and object, person and world, organism and environment, and so on.

Having outlined subject-object dualism, we next consider the transactional alternative to this whole conceptualization, its related problems, and its ever-conflicting ‘solutions.’ To put it roughly, Dewey-Bentley’s cry is *get rid of the line*. More accurately, they suggest that the line, along with its two separated sides, is simply the wrong place to *start*. Instead of *starting* with *two facts*, separated by a line, they suggest *starting* with *one fact*, and realizing that any distinction of that one fact into two or more facts is necessarily *subsequent* to having the one fact to begin with.

We have seen this strategy at work in earlier sections. We saw that Dewey and Bentley *did not start* with existence as separate from designation, nor known as separate from knowing, and then try to bring the two together. Rather, they

started with *fact, only within which* existence and designation are distinguishable as inseparable phases. Likewise, we saw that Dewey-Bentley *did not start* with organism inside the skin-line and environment outside of it, and then try and bring the two together. Instead, they *started with transdermal life-activity, only within which* organism and environment are distinguishable as inseparable phases.

It is here that the word “transaction” really comes into its own. Dewey and Bentley use the word “transaction” to designate the *primary* process from which all the so-called dualisms are *secondarily* derived. Fact is a transaction. Life-activity is a transaction. You, the reading subject, and this, the read sentence, form together a transaction.

Turning to the autopoietic viewpoint, we find a similar critique of subject-object dualism and suggested means of its evaporation. At the same time, as we saw in each of the above sections, Maturana and Varela fall just short of fully realizing the trans-actional level of scientific inquiry. The autopoietic viewpoint suggests that the ‘problem’ of subject-object dualism evaporates with the realization that subject and object *co-arise* in a relation of *mutual specification*. In *The Embodied Mind*, Varela, Thompson, and Rosch (1991) explained as follows:

It is precisely this emphasis on mutual specification that enables us to negotiate a middle path between the Scylla of cognition as the recovery of a pre-given outer world (realism) and the Charybdis of cognition as the projection of a pre-given inner world (idealism) (p. 172).

While the autopoietic viewpoint stresses the *togetherness* of subject and object, it falls short of stressing their fully-fledged transactional *union*, despite many suggestive hints in this direction.⁴ In his afterword to *The Tree of Knowledge*, for example, Varela reiterated a “fundamental tenet” of the autopoietic viewpoint: “Animal and environment are two sides of the same coin, knower and known are mutually specified” (p. 253). Now what is this “same coin” affirming the necessarily mutual specification of designation and unity? of organism and environment? of subject and object? This essay has suggested that Dewey and Bentley’s *transaction* provides an answer more satisfactory than the inter-actionally

⁴ A particularly clear example is Maturana’s (2000) “the organism and the medium constitute together a larger ... system that arises as an ecological unity” (p. 464).

flavored autopoietic alternative. Transaction suggests a means by which the autopoietic viewpoint might shake off any inter-actional residue to partake with Dewey and Bentley in “functional observation of full system” (i.e., transaction).

To sum up, both the autopoietic and (more comprehensively) the transactional viewpoints dissolve the long-standing knowing-subject/known-object dualism as a mis-take. They also offer a compelling alternative: The only world is the world we know, and the world we know contains within itself both us, as knowing organisms, and that which we know, together, in indissoluble active union.⁵

Conclusion

This essay has reviewed and contrasted the scholarly collaborations of Dewey-Bentley and Maturana-Varela. It has done so from the perspective of self-action, inter-action, and trans-action as increasingly advanced levels of scientific inquiry. With respect to four topics, it was found that where Dewey and Bentley consistently adopt trans-action as their basic procedure, Maturana and Varela adopt aspects of the inter-actional, and yet regularly lean toward the trans-actional. This is consistent with Dewey and Bentley’s insistence that the three levels are not separated by any critical boundaries, and often appear in various mixtures.

This essay has only scratched the surface. Much of both viewpoints has not been touched upon. While this essay has established differences, it has at the same time established similarities. Relative to existing alternatives, the transactional and autopoietic viewpoints are close neighbors in a still lonely region of the contempo-

⁵ The phrase “indissoluble active union” comes from Dewey (in Dewey & Bentley, 1973, p. 189).

Editor’s Corner

3rd Annual Symposium on the Foundations of the Behavioral Sciences: **Dewey, Hayek and Embodied Cognition: Experience, Beliefs and Rules**, American Institute for Economic Research, Division Street, Great Barrington, Mass., July 18-20, 2003.

Behavioral Research Council, a division of American Institute for Economic Research, is organizing a conference on embodied cognition and cognitive economics. Embodied cognition is about the idea that the brain/mind is doubly embedded: embedded in the body on the one hand, and in the environment on the

other. Participants in this conference include philosophers of mind, economists, legal theorists, and neuroscientists.

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other. Participants in this conference include philosophers of mind, economists, legal theorists, and neuroscientists.

Keynote Speaker:

Gerald Edelman “Naturalizing Consciousness: From Hard Science to Human Science,” (1972 Nobel Prize for Physiology or Medicine) *Chairman*, Department of Neurobiology, The Scripps Research Institute; *Director*, The Neurosciences Institute

Participants in Plenary Sessions:

Antonio R. Damasio (TBA) *M.W. Van*

Allen Professor and Head of Neurology, University of Iowa Hospitals and Clinics

Jean-Pierre Dupuy "Embodied Social Cognition," *Professor*, Centre de Recherche en Épistémologie Appliquée, École Polytechnique, France; *Professor*, Departments of French/Italian and Political Science, Stanford University

Rodolfo Llinás (TBA) *Thomas and Suzanne Murphy Professor of Neuroscience and Chairman*, Department of Physiology and Neuroscience, New York University School of Medicine

Douglas C. North "Understanding the Process of Economic Change" (1993 Nobel Prize for Economics) *Spencer T. Olin Professor in Arts and Sciences*, Department of Economics, Washington University

Richard Posner "The Epistemological and Policy Views of Dewey and Hayek," *Judge*, US 7th Circuit Court of Appeals; *Senior Lecturer*, University of Chicago Law School

John R. Searle (TBA) *Mills Professor of the Philosophy of Mind and Language*, Department of Philosophy, University of California at Berkeley

Vernon Smith "Constructivist and Ecological Rationality in Economics" (2002 Nobel Prize for Economics) *Professor of Economics and Law and Research Scholar*, Interdisciplinary Center for Economic Science, George Mason University

Invited Participants:

Bruce Caldwell "The Place of *The Sensory Order* in F.A. Hayek's Thought," *Professor of Economics*, University of North Carolina at Greensboro

Thomas C. Dalton "Value, Belief and Inquiry: A Deweyan Perspective," *Special Assistant to the Provost and Senior Research Associate*, College of Liberal Arts, California Polytechnic State University

Kurt Dopfer* and Jason Potts** "Embodied Cognition in an Evolving Economic Environment: Genetic Invariants and Adoptable Rules," **Professor of International and Development Economics*, Department of Economics, University of St. Gallen, Switzerland; ***Lecturer*, School of Economics, University of Queensland, Australia

Edward Feser "Naturalism, Evolution and Hayek's Philosophy of Mind," *Visiting Assistant Professor*, Department of Philosophy, Loyola Marymount University

Geoffrey M. Hodgson "Instinct and Habit before Reason: Dewey, Hayek and Veblen," *Research Professor*, University of Hertfordshire, UK

J. Rogers Hollingsworth "Neuroscience and Socioeconomic Implications for Understanding Creativity,"

Professor of History, Sociology, and Industrial Relations, Department of History, University of Wisconsin, Madison

Mark Johnson "How the Embodied Mind Thinks Disembodied Thoughts," *Knight Professor of Liberal Arts and Sciences*, Department of Philosophy, University of Oregon

Elisabeth Krecké* and Carine Krecké** "Law and Experience," **Professor*, Faculty of Applied Economics, Université d'Aix-Marseille III, France; ***Lecturer*, Department of Art and Literature, Université d'Aix-Marseille I, France

Howard Margolis "Habits of Mind: Ideas as Possessions," *Professor*, Harris School of Public Policy Studies, University of Chicago

Bart Nooteboom "Routines, Relations and Radical Change: An Outline of a Cognitive Theory of the Firm," *Professor of Organizational Dynamics*, Rotterdam School of Management, Erasmus University Rotterdam, Netherlands

Mark Perlman "Competing and Complementary Authority Systems," *University Professor of Economics Emeritus*, University of Pittsburgh

John Pickering "Signs and Beliefs: Hayek's Inquiry and Biosemiotics," *Lecturer*, Department of Psychology, Warwick University, UK

Salvatore Rizzello "Knowledge as a Path-dependence Process: Micro-foundations and Economic Implications," *Professor of Economics*, Faculty of Law and *Coordinator*, Centre for Cognitive Economics, University of Eastern Piedmont, Italy

Frank X. Ryan "Neuroscience and Dewey's Critique of Behaviorism," *Associate Professor*, Department of Philosophy, Kent State University

Ulrich Witt "The Cognitive Underpinnings of the Generation of Novelty," *Director*, Evolutionary Economics Group, Max-Planck-Institute for Research into Economic Systems and *Professor*, Department of Economics, University of Jena, Germany

Contributed Papers:

Avner Ben-Ner* and Massoud Stephane** "The Saliency of Different Attributes of Identity: Experimental Evidence," **Director*, Industrial Relations Center, and *Chair*, Department of Human Resources and Industrial Relations, Carlson School of Management, University of Minnesota; ***Adjunct Assistant Professor*, the Department of Psychology, and *Assistant Professor of Psychiatry*, the Medical School at the

University of Minnesota

Harry Binswanger "Consciousness: An Objectivist Approach," *Visiting Professor*, University of Texas, Austin, and Objectivist Academic Center

Stephan Böhm "Computation, Markets and Central Planning: The View from Hayek and Searle," *Professor of Economics*, University of Graz, Austria

William N. Butos* and Thomas J. McQuade** "The Sensory Order & Other Natural Classifier Systems," **Professor of Economics*, Trinity College, Hartford; ***Visiting Assistant Professor of Economics*, New York University

Adam Gifford, Jr. "Rational and Irrational Behavior: A Cultural Biology Approach," *Professor and Chair*, Department of Economics, California State University

Nancy J. Holland (TBA) *Professor and Chair*, Department of Philosophy, Hamline University

Elias L. Khalil "Sensory Order and Spontaneous Order: A Transactional Critique of Hayek," *Director*, Behavioral Research Council, AIER

Gregory P. La Blanc "Embodied Cognition, Psychoneuroimmunology, and the Placebo Response," *Visiting Assistant Professor*, Department of Economics, University of Virginia

Richard N. Langlois "Embodied Cognition and the Economics of Organization," *Professor*, Department of Economics, University of Connecticut and *Senior Fellow*, Department of Management, The Wharton School, University of Pennsylvania

Julie A. Nelson "Freedom, Reason, and More: Feminist Economics and Human Development," *Senior Research Associate*, Global Development and Environment Institute, Tufts University

Stephen O'Sullivan (TBA) *Professor*, Department of Philosophy, Suffolk County Community College

Harold Wolozin "The Unconscious and Emotion in Economic Decision-making: Convergent Voices," *Professor of Economics*, University of Massachusetts, Boston

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