Article

Inner Speech and the Linguistic Sign: Toward a Quantum Semiology

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Abstract

A neuroquantological account of inner speech and the linguistic sign is proposed. Inner speech, meaning, and thought are defined and located in the theoretical structure of dual mode quantum thermofield brain dynamics. Other-action (sensory input from the environment and the body) and self-action (self-tuning signals generated by the brain itself) are distinguished. Being (presencing) is disclosed in the "between-two" of dual thermofield modes making a match. The link between the signifier aspect and the signified aspect of the semiological sign is that of superposition. In communication the signifier is used to evoke its entangled signified. The extent to which communication is successful depends on similar self-actions and attunements within linguistic communities. The discussion supports the extension of neuroquantology to semiology.

Key Words: neuroquantology; quantum brain theory; Saussur; Vygotsky; semiology; inner speech; inner voice; linguistic sign; signifier; signified; thermofield brain dynamics

NeuroQuantology 2011; 2: 243-254

Introduction

Inner speech is a pervasive feature of human existence (Martinez-Manrique and Vicente, 2010; Vygotsky, 1986; Wiley, 2006) and despite Vygotsky's ground-breaking efforts far less discussed than its prominence in quotidian experience deserves. The internal monologue runs on throughout our waking life, and so accustomed are we to its companionship that we barely take note of it. Inner speech seems pale compared to perceptions, emotions and urges, yet is equally persistent. Meditators well know the powerful resistence of inner speech to true silence. We may tell the inner voice to "shut up" but it always escapes in the very telling!

The use of linguistic signs also profoundly characterizes our existence and is at the foundation of human advance. In contrast to inner speech there is an enormous and complex literature available on semiology and semiotics, founded in Saussure (1966) and Peirce (1982; 1998) respectively. The focus here will be on Saussure's conception of "signifier," "signified," and the "bond" between them. The discussion of inner speech and the linguistic sign will be confined to the classical approaches of Saussure and Vygotsky, in order to make clear the engagement with *neuroquantology*. The endeavor is only to open up the interface rather than systematically investigate it in the contemporary framework of linguistics.

The present discussion aims at development of a neuroquantological theory of inner speech and the linguistic sign. What makes this topic especially difficult is specifying what we mean by "thought," "meaning," "presence," "Being," indeed "consciousness." While *neuroquantology* takes great pains in discussing quantum brain functioning, such terms are mainly left to squabbling philosophers to figure out.

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Received Jan 28, 2011. Revised March 4, 2011.
Accepted March 10, 2011.

Such an unreflective stance does not take advantage of possible benefits of a "hermeneutic circle" in which the scientific and the philosophical solicit each other, so that the evolving discussion "bootstraps" a self-consistent mutual advance. The specification of these terms makes for perhaps laborious reading, in that we usually fuzzily skim over them but are asked here to keep specific meanings in mind.

A phenomenological style of inquiry is conducted below, which is not customarily found in scientific journals. By "phenomenological" I do not mean the strict procedures of Husserl (Smith and McIntyre, 1982) or strategies introduced by Heidegger (1982) and Merleau-Ponty (1962), but simply observations of one's own experience, self-observation that any interested party might make. Some phenomenology is indeed tacit in any discussion of "consciousness" and we are always unofficially checking out the plausibility of claims about consciousness against our own experience. The unabashed phenomenological observations reported below are properly understood as invitations to coreflect.

The phenomenology of inner speech

Unlike external speech, inner speech lacks pitch and loudness. We say that our inner voice is "located in our minds," and minds lack extension, so the inner voice must lack extension too. The inner voice is nowhere, strictly speaking not even located where one is. Yet it is recognizeably configured. Inner speech carries differences. It is after all distinctly "saying" this and not that. *The differences of inner speech are nonextensive yet present.* So "presence" and *res extensa* are not synonomous. Conflating them will bar all progress.

I emphasize again that inner speech is *present* and underline that such presence does not require extension. As predominantly visual creatures making our way about the *res extensa* we naturally identify presence with extension, but presence—Being—and extension can be independent. Inner speech is not unique in this.

The term 'Being' is especially problematic and causes no ends of difficulties, yet cannot be avoided (at least in English and German). 'Being' will be capitalized here to distinguish it from a being (an entity). Heidegger (1962; 1982; 1999) had deep insights with regard to Being but Heidegger is notoriously opaque and his terminology inconsistent. 'Being' will be used here in the sense of presence, existing, appearing, "thereness," and not in the sense of an entity or an essence. In my usage 'Being' has the same meaning as dis-closure, which is a less encumbered term. Dis-closure emphasizes that closure, which is distinctionless and abyssal, is ontologically primary. To get free of closure that Being might appear, an action is required (dis-). The act re-veals (un-veils, clears, lights) beings (entities) in their Being (presence). The *entity* whose act dis-closes is called by Heidegger "the Dasein." The "there" (*Da*) of the Da-sein is disclosedness.

For example, the primitive chemical sense of smell may be pleasantly or repugnantly present, but itself lack any extension. When we say that the sweet smell of orange blossoms extends throughout the Ojai valley, the scent as such has no extension; it just smells the unmistakable way it smells. We *attribute* extension to the odor, but this is not our experience of it. Possibly the lady standing next to us is wearing orange blossom perfume but if we step away from her, the smell does not disappear, so it must be everywhere. We are thus able to locate smells by sampling behavior but the olfactory receptors themselves can't distinguish the lady from the orchards.

So extensionless presence is not unique to inner speech. The present discussion seeks to comprehend this phenomenon of presencing inner speech in a particular neuroquantological framework. After the excursus into quantum brain theory, the discussion will return to inner speech and later extend to the linguistic sign.

Thermofield Brain Dynamics

Since thermofield brain dynamics (TBD) has been described numerous times (Globus, 2009a; Jibu and Yasue, 1995; Vitiello, 1995; 2001), including in these pages (Globus, 2005; Vitiello, 2003), only a highly schematic interpretation will be provided here, sufficient for an elucidation of inner

speech. The core idea of thermofield dynamics is that there are dual ontological modes of the universe which share the ground (or "vacuum") state. One mode is labeled *our* mode; it is time-forward, entropy-increasing. The other mode is the time-reversed *alter* mode, negentropy increasing. In the thermodynamical frame our mode is considered the system and the alter mode is considered its heat bath environment. Our mode may be dissipative in some regions, able to temporarily increase negentropy, which the alter mode must correspondingly balance by increasing in entropy (or vice versa). Dual modes permit second quantization a true thermodynamical degree of freedom (rather than a statistical approximation).

What is ontologically exceptional about these dual modes is that they are not two different substances or processes, or different aspects of the same neutral substance, or one a fundamental process from which the other process secondarily emerges. These dual modes are at parity, mathematically described by complex and complex conjugate numbers respectively; they are imaginary modes. The irreal dual quantum modes of thermofield dynamics are not autonomous in their own right but "exist" *only* in their relationship. That is, the between-two has ontological priority, which brings something new and subtle to ontology.[2]

The between-two offers a current state that shifts over time. The unique state of the between-two is the matching of dual modes. The dual modes "belong-together" in the between-two as complex conjugates, such that the belonging-together is real. ($a+bi \times a-bi = a^2 + b^2$, since the cross terms cancel and $i^2 = -1$.) This reality with its irreal dual modes *is* only in virtue of dual mode belonging-together. But the "is" in this sense is not something there which might be manifested to us if we strolled by, but a Kantianesque *is-in-itself*. In the case of the brain as quantum macroscopic object, the between-two comes under exquisite control, and its matchings through the changing is-in-itself are rich and varied. The between-two of a brain-sized rock is boringly the same over time; it just is.[3] The between-two of a living dissipative human brain is no less than our ever-changing existence!

It bears emphasis that states of the between-two are not transformed to succeeding states. This is no logical computation. Each state is consecutively generated *de novo* from the whole in virtue of belonging-together. This reminds of Bohmian dynamics in which the whole is primary, consisting in mutually implicated orders, and explicate order (Being) is successively unfolded from the whole (Bohm, 1980). Thus Hiley states,

> In the general context of Bohm's ideas the vacuum state should not be regarded as absolute and self-contained. Rather each vacuum state provides the basis for what we called an explicate order so that a set of inequivalent vacuum states could be thought of as providing an array of explicate orders, all embedded in the overall implicate order in which all movement is assumed to take place (Hiley, 2001; p. 32).[4]

The movement between inequivalent representations, between inequivalent vacuum states, is then regarded as a movement from one explicate order to another. It was the implicate order that *enabled* this transformation to take place as an unfolding of moments (Hiley, 2001, p. 33, italics added).

Explicate order on the present interpretation is an achievement of the ground state between-two

[2] It is noteworthy that dual mode thermofield dynamics embodies Spencer-Brown's (1969) "first distinction" between self and other. The first distinction is ontological, as Spencer-Brown proposed, but his mark that cleaves the undifferentiated and distinguishes inside from outside requires a metaphysical subject to make the mark (not unlike the metaphysical subject that briefly appears in Gödel's theorem to make a metamathematical statement (Globus, 2004)). In thermofield dynamics the duality is already included in that the system requires a heat bath with which to exchange energy. In principle, for any system (or system *cum* environment) its heat bath is the rest of the universe. Thermofield dynamics extends this principle, conceiving our entire universe as system and an alter universe as its heat bath.

[3] This is where the issue of panpsychism comes in. The rock indeed *is*, in itself, in the ground state match, but no more than that. The brain in contrast richly *exists* (ex-ists), variably discloses in the between-two. There is a lower bound to is-ness, however, the coherence length, below which there are insufficient numbers of quanta for condensation to take place. So mind is not an aspect of all matter, contra Vimal (2009). (See Globus (2009b) on "halting the descent into panpsychism.")

[4] Page numbers of quotes from Hiley are taken from www.bbk.ac.uk/tpru/BasilHiley/14MomentsANPA2001W.pdf

The quantum brain theory just outlined gives a new meaning to "duality." This is not the substance duality of Descartes, nor the dual aspects of a neutral substance found in Spinoza, nor the duality of phenomenon and impotent epiphenomenon which Huxley (1898) proposed, nor the emergentism of Sperry (1969) where the duality is between interacting parts and a supervenient whole. The new duality is the two of *between-two*. The resources of the between-two are ontologically enriched in that when the duals *belong-together* (in the sense of being complex conjugates of the form a+bi and a-bi), then the between-two is real. The dual modes are irreal but the between-two in the case of match is real. Being is not a given or aspect or derivative but a continuing *de novo* achievement of the duals. Phenomenal reality is dis-closed between-two. (Some monadological implications of this position are discussed at length in Globus (2003; 2009a; 2010).)

The dissipative brain is considered by thermofield dynamics to be a type of quantum macroscopic object that is richly capable of recording traces of incoming orders in the form of Nambu-Goldstone boson condensates. The brain has a *total memory* in the sense that new traces are continually added to all previous traces in an inclusive superposition (Jibu and Yasue, 1995). With quantum tunneling over time the traces tend to dissolve and the brain forgets (Jibu and Yasue, 2004).

When a sensory input first comes in, dissipates its energy and falls into the ground state, its dual mode memory trace is of the form particle-hole. This is because a consequence under Goldstone's theorem of the abundant rain of sensory input falling into the ground state is that quanta in the form of Nambu-Goldstone boson condensates are created in our mode, preserving the ground state symmetry broken by the input. At the same time, under Umezawa's tilde-conjugation rules, quanta must be equivalently annihilated from the alter mode. As a consequence the dual mode trace of the novel sensory input involves particle-hole pairs.

When a sensory input is repeated, a dual mode *re-trace* (recognition trace) is created of the form hole-particle (since quanta are annihilated from our mode by the repetition signal and accordingly must be created in the alter mode under the tilde-conjugation rules). When sensory input, dissipating its energy and falling into the ground, and retraces are complex conjugates, then their belonging-together is real and the disclosure of Being results. The model cashes out world in the between-two of the dissipative brain. The rest at all scales from microscopic through macroscopic to cosmological comes under quantum description. (On quantum macroscopic objects with sharp boundary structures, see Umezawa (1993, Chapter 6).)

A crucial feature of symmetry in this account: In rich systems there are *emergent symmetries*. Different brain regions would have different emergent symmetries and accordingly different types of broken symmetry. The between-two in different regions would accordingly be distinct. Emergent symmetry is the correlate of qualia. The visual quale is incorrigibly distinct from the auditory quale because different symmetries emerge in different brain regions. Emergent symmetries explain the problematic of differing qualia (Globus, 2009b).

Wave Cybernetics in Quantum Brain Dynamics

The early formulations of Umezawa and coworkers[5] were rather static formulations which Jibu and Yasue (1995; 2004, Jibu, Yasue and Pribram (1991)) moved forward by developing quantum brain dynamics (QBD). QBD was influenced by Bohm's (1980) physics and Pribram's (1971) formulation of holographic brain theory (for which classical physics suffices). Jibu and Yasue (1995, sect. 40) formulated a "wave cybernetics of the brain." "Holonomy" or the "law of the whole" is fundamental to quantum brain dynamics.

The control function in QBD is a Schrödinger-like wave function, a phase wave that guides the state variable. (This idea is modeled on de Broglie's pilot waves and Bohm's quantum potential.) This phase wave is tuned moment to moment so that control is fluidly exercised.

[5] See Umezawa (1995) for the history of this work.

> Each state variable evolves due to local interaction with the globally tuned phase wave (Jibu and Yasue, 1995; p. 130). [T]he nonlocal, cooperative phenomenon of wave cybernetics taking place in the dendritic network influences or modulates the macroscopic cybernetics of the neural network (Jibu and Yasue, 1995; p.132).

Vitiello's (1995) innovation was to bring in dissipation and make the state variable between-two. The brain's superlative ability to control its states (and not be at the mercy of sensory input and memories of it) is to constrain the match in the between-two. I term this cybernetic ability "self-action."[6]

Participants in the Matching Process

Three participants in the matching process of the between-two have been distinguished above. Total memory (subject to decay by quantum tunneling) is one participant. A second participant is "other-action" which is initiated at sensory receptors (including receptors within the body). A third participant is "self-action" initiated by brain subsystems; functionally it *tunes* the between-two moment-to-moment by constraining what might belong-together in the match.

What complicates this picture is that some other-action is actually self-initiated. There is after all sensory feedback from self-initiated motor acts. Further, sensory receptors are primed to pick up orders expected on account of those behaviors. The receptor priming signals are termed "corollary discharge." Thus a significant component of other-action is *self-initiated other-action as a consequence of motor acts and corollary discharge*.[7] We shall see below the relevance for inner speech.

Cotemporal self-action and other-action are superposed in the ground state, coherently interpenetrated, so that either alone can call up the entangled other. Memory traces are entangled too by cotemporality and common invariances. Entanglement offers a mechanism for association.

Such a thermofield brain has cybernetic properties, in that self-action steers what might match in the between-two. Disclosure is constrained by self-action, other-action and total memory. All participate in a process in which "conscious states"—better, disclosures of Being—result. Instead of a world reality being autonomously there, which we each perceive a version of, the only *world* there is—indeed, the only *worlds* there are—must be between-two: disclosures in virtue of belonging-together by the dual modes of thermofield brains in parallel.

On this formulation of thermofield brain dynamics (which differs somewhat in ontological interpretation from that of Vitiello (2001)) macroscopic reality, too, comes entirely under quantum description and macroscopic phenomenal world is between-two.[8] Macroscopic quantum objects, which are well known in quantum field theory (Umezawa 1993), have no Being. Macroscopic quantum objects are unpresent, unlike macroscopic phenomenal world. *Being is not autonomous and fundamental but achieved between-two.* With this schema of thermofield brain dynamics the discussion returns to the problem of inner speech.

Internal speech, external speech, thought and meaning

One can of course say out loud one's inner speech. The inner voice making caustic observations about someone at a social gathering might be spoken aloud but the connection to actually saying it is unfacilitated. It is not that when we do speak out, inner speech goes blank; inner speech faithfully echoes "in the mind" whenever we speak out.[9]

[6] Self-action might be called 'intentionality' but that philosophical term carries too much baggage to be used here.

[7] Corollary other-action is crucial to the formulation of Baysean cognition (Chater and Oaksford, 2008), in which the brain's real time model of the world is continually probabilistically updated by feedback from errors in the model's predictions of behavioral consequences.

[8] There is no transcendent world which the phenomenal world re-presents. World is always immanent, phenomenal worlds in parallel across "observers," monadological (Globus 2003; 2009a; 2010).

[9] This point can be grasped. Through a simple phenomenological experiment of counting numbers outloud and to oneself. Alternate: 1, 2 (out loud), 3, 4 (inner speech), 5, 6 (out loud), 7, 8 (inner speech), etc. It can be observed that the inner count continues on whether or not there is an external count. Ordinarily outer speech "drowns out" inner speech but the latter remains in continuity. Inner speech and outer speech are not alternatives; the same inner speech is present during outer speech, in listening to speech, and in reading. It can be noted that the inner voice during reading is the

In understanding someone's speech, the meaning is not *in* the sound configuration but something we correlatively *have*. This point is brought out in listening to an unintelligible foreign language, which will have no meaning; the unknown tongue is experienced only as configurations of sound. When we understand the language, we have the meanings too. The sense of "having" the meaning needs to be elucidated.

What is it that presences in "having" a meaning, that is dis-closed? It is the *expression* of meaning in inner speech that presences, not meaning as such. Meaning is the "subtext" of expression, as Vygotsky points out. It is extensionless inner speech that presences rather than a presencing of meaning. Meaning as such has no Being but is a tendency, an attunement. Language is misleading—reflecting a metaphysical bias that pervades English—in saying that we "have" meanings, since what we actually have is an inner voice. "Holding" meanings is a much more felicitous expression for self-tuning, since "holding" implys a posture, a manner, a situatedness.

Vygotsky (1986) observed in *Thought and language* that inner speech unaccompanied by external speech becomes somewhat of a shorthand, a "peculiar syntax" which develops in the progression of childhood. When the overt speech act goes in concert with the inner version, there is no such streamlining, but when there is only inner speech, it tends to be disconnected and incomplete compared to external speech. A related feature of inner speech pointed out by Vygotsky is that the unnecessary subjective terms fall away. One does not have to specify "I" when one speaks to oneself.

The action of speaking out loud is of course far more than emitting sounds from a voice box. Highly complicated movements of the mouth, tongue, respiratory apparatus, face, abdomen, indeed the entire body posture are involved. It takes years of practice for the child to learn coordination of these complex actions. When we speak out loud there is sensory feedback not only from the sounds produced but from the bodily regions just mentioned. Furthermore, through the corollary discharge, the action of speaking also primes auditory receptors to detect what is being spoken and there is sensory feedback from this expectation too. In "silent speech"—when we merely "mouth the words"—the action of pushing air through the larynx is inhibited; all the rest just described goes on covertly. Inner speech is but a less intense and streamlined version of such silent speech, characterized by short cuts and individual peculiarities (Wiley, 2006).

So in inner speech all the sensory consequences of the behavior of actually speaking outloud still comes into the brain (though having less intensity) with this exception: the auditory information of location, amplitude and frequency is missing. In inner speech there is still sub rosa action of the larynx, the tongue, etc. which have sensory consequences, though no sound is actually produced. In the match of these sensory residuals with retraces the inner voice presences. Spoken speech and inner speech are both between-two; the latter lacks participation of auditory information in the match and so its disclosure lacks location, loudness and pitch but is otherwise the same.

With this account of inner speech the discussion turns to "thought." Vygotsky uses a striking image to distinguish thought from speech: thought is reflected in the word like the sun is reflected in a droplet of water. The fault in this image is that the sun is an object, not a context. Vygotsky understands thought as a comprehensive contextual whole which rains words. And words in turn provoke thought as contextual whole.

> The relation between thought and word is a living process; thought is born through words. A word devoid of thought is a dead thing, and a thought unembodied in words remains a shadow. (Vygotsky, 1987; p. 255).
>
> Thought is not expressed but completed in the word ... . Any thought has movement. It unfolds ... . This flow of thought is realized as an internal movement through several planes (Vygotsky, 1987; p.249-50).

Thought is whole, a context, and thinking—specifically meaning this or meaning that—is a global operator, whereas words are concrete, unfolded in the dynamics.

same inner voice as during thinking and speaking. It is always "my" inner voice—the voice of subjectivity—across different acts.

> A thought may be compared to a cloud shedding a shower of words. Precisely because thought does not have its automatic counterpart in words, the transition from thought to word leads through meaning. In our speech, there is always the hidden thought, the subtext. Because a direct transition from thought to word is impossible, there have always been laments about the inexpressibility of thought (Vygotsky, 1987; p. 251).

Thinking is an act that means. Thinking as self-action is to be distinguished from thought which provides an inescapable "subtext" (or context, here "attunement") to whatever we might speak. This subtext is not some kind of transformable string but a global operator on the dynamical process of speech disclosure, out of which Vygotsky's "shower of words" unfolds to explicate presence.[10]

Subtextual thought is itself a stratified context of different planes according to Vygotsky.

> This enrichment of words by the sense they gain from the context is the fundamental law of the dynamics of word meanings. A word in a context means both more and less than the same word in isolation: more, because it acquires new content; less, because its meaning is limited and narrowed by the context. The sense of a word, says Paulhan, is a complex, mobile, protean phenomenon; it changes in different minds and situations and is almost unlimited. A word derives its sense from the sentence, which in turn gets its sense from the paragraph, the paragraph from the book, the book from all the works of the author (Vygotsky, 1987; p. 245).

A similar notion is found in Husserl, where the "horizon" is "sedimented" (Smith & McIntyre, 1982), and again found in Heidegger as sedimented "situatedness" (Dreyfus, 1991), and in Searle (1983) as sedimented "background." *The deeper the plane of sedimentation, the less open to self-action.* That is, attunement crystallizes at deeper levels. This fixation of attunement begins early in development. At the extreme is Tinbergen's "imprinting" in which the duckling quickly becomes attuned to follow a large moving object (in natural conditions, the mother duck). As psychotherapists well know, the character and personality set in childhood are most difficult to retune. To borrow Wittgenstein's illustration, we see a photograph of a man walking on a hill. We see him in that frozen moment as walking forward up the hill rather than walking backward down the hill, because our deep sedimentation is attuned in this way.

In terms of the quantum neurophilosophy developed above, self-action tunes linguistic systems. There are many participants in the tuning process, such as drive, affect and mood; the present focus is on cognitive self-tuning of linguistic systems. To self-tune is to mean and the meaning is the attunedness.The self-tuning inputs fall into the ground state and participate with falling sensory flows and with retraces in the process of belonging-together. Vygotsky makes the acute observation that whereas the Bible says in the beginning was the word Goethe's Faust insists that in the beginning was the deed. *Action precedes Being*, is prerequisite to Being. This is to say that action is ontologically primordial (which breaks sharply from Descartes' fundamental substances). Self-tuning action is prerequisite to meaning, inner speech, outer speech and indeed is crucial to the disclosure of Being.

To review, the Vygotky model of inner speech entails: (1) a self-action that tunes the linguistic system. (2) meaning, which is the resulting sedimented attunement. (3) a distinguishing of inner speech from external speech. Inner and outer speech both presence in the belonging-together of the between-two, but the former contains no extensive information. Along these lines inner speech can be accommodated to the quantum thermofield model.

Quantum Semiology

It is striking that in the fourteen chapters of *The Cambridge Companion to Vygotsky* (Daniels, Cole and Wertsch, 2007) there is not a single reference to Saussure and in the fifteen chapters of *The Cambridge Companion to Saussure* (Sanders 2005), there is no reference to Vygotsky either. Vygotsky focuses on inner processes,

[10] The "implicate" and "explicate" terms I have been utilizing are of course Bohm's (1980).

whereas Saussure focuses on the semiological sign, but a smooth segue can be found between these two original thinkers, despite the cleavages promoted by academicians involved in their narrow specialities. Vygotsky was a psychologist before the full (albeit temporary) triumph of operationalistic behaviorism and was comfortable with talking about thought and meaning as well as behavior, whereas Saussure's focus was on the objective system of linguistics. Since Saussure by no means neglected thought and meaning, there is no true disjunction with Vygotsky.

> The characteristic role of language with respect to thought is ... to serve as a link between thought and sound ... . (Saussure, 1966; p. 112)
>
> A linguistic system is a series of differences of sound combined with a series of differences of ideas ... . (Saussure, 1966; p. 120)

Indeed Saussure's considerations of thought are in some respects deeper than Vygotsky's. Thought for Vygotsky is a cloud-like undifferentiated whole, whereas as will be discussed, Saussure conceives difference as *already* integral to the whole.

Saussure's narrowly focused concept of the linguistic sign features a "bond" between a *sensory image*, which is called the "signifier," and a "meaning" or "concept" termed the "signified." Vygotsky's inner speech does not strictly qualify as a sign in the Saussurean frame because it does not have sensory characteristics. Primarily interested in language, Saussure does not care about inner speech which serves no communicative function. But on the phenomenological analysis conducted above, Saussure's definition of the sign might be relaxed. For inner speech the signifier is present yet not extensive. As cannot be over-emphasized (since our very language remains pervaded by old metaphysical assumptions), Being is not confined to the external world. Inner speech "is" too. We are perfectly justified in saying that we "hear" our inner voice and that we "listen" to it: the presence of the inner voice is not a mere presence but retains linguistic characteristics, while lacking the extensive variables of loudness, pitch and location. Inner signs can be thus distinguished from outer signs but the bond between some sort of a presence and a meaning is found in both.

An examination of what Saussure (1966) means by the "bond" between signifier and signified illuminates semiology. Saussure italicizes that "*the linguistic sign is arbitrary*" (67) and has two aspects.

> ... the linguistic unit is a double entity, one formed by the *associating* of two terms (p. 65, italics added)
>
> The linguistic sign *unites*, not a thing and a name, but a concept and a sound image. (p. 66, italics added)

Furthermore, the two aspects have an intimate relationship.

> The linguistic sign is then a *two-sided* psychological entity ... . The two elements are intimately *united*, and each recalls the other. (p. 66, italics added)

So there is a unity with two facets. The unity is provided by a single entity which possesses two aspects. But the aspects are not merely passive, like the faces of presidents carved on Mt. Rushmore; they are actively bonded, each "recalling" the other.

Such a bond can be conceived as quantum superposition. Signifier and signified become interpenetrated in virtue of *co-temporal* other-action, as a consequence of some sensory impingement, and self-action which the brain generates on its own. This superposition between signifier and signified is entirely contingent, which is why the linguistic sign is arbitrary. Either one can then call up the entangled other in the ground state, and both participate in belonging-together with the reservoir of retraces. So the unity of the linguistic sign consists in the mechanism of superposition.

Saussure has this great insight: Signifier and signified are each within their own facet purely differences.

> As Saussure conceives it, each signifier and signified consists of nothing but *difference* from every other signifier and signified in the system. ... 'Whether we take the signified or the signifier, the language contains neither ideas nor sounds that pre-exist the linguistic system, but only conceptual difference and phonic differences issuing from this system' (Joseph, 2004; p. 60, quoting Saussure).

Saussure's insight translates easily to quantum terms: Saussure is describing companion *plena of symmetry* that might be generated: signifier symmetry and signified symmetry. Symmetry-breaking is a condition for the possibility of particular signifiers and signifieds. Unfolded presence is the fruit of that potential. This theory is completely unlike one in which everything is built up from component particulars.

The "symmetry" of a plenum means its indifference to transformation, that the plenum is indifferent to certain operations on it. Those operations to which the plenum is indifferent comprise the symmetry group. Thus a circle is indifferent to any degree of rotation—it remains the same circle—and a square is indifferent to rotations of 90 degrees no matter how many times. More cogent for present considerations, the electric dipole field of water molecules at higher energy has rotational symmetry in that the dipole field is indifferent to rotation of the water molecules. The dipole moment field vectors point every which-way, and after rotation still point every which way. However in the zero-energy ground state the dipole moment vectors are correlated, all pointing in the same direction. Rotate them and they point in a new direction which "breaks" the rotational symmetry. So the symmetry of the ground state in this instance is not indifferent to the operation. "Not indifferent" to an operation is the meaning of symmetry-breaking.

In the symmetry formulation, then, difference is the breaking of symmetry. But the lost symmetry is preserved. In accordance with Goldstone's celebrated theorem, boson condensates form over macroscopic regions (on the order of 50 microns for water molecules), preserving the lost symmetry and thereby offering the possibility of memory. Symmetry conservation provides a trace of symmetry-breaking order in the form of Nambu-Goldstone boson condensates. This fact of quantum physics is what first attracted Umezawa (1994) and coworkers to develop a quantum brain theory of memory, which Jibu and Yasue (1995; 2004) expanded to a quantum theory of consciousness. Vitiello (1995; 2001) extended the model to the brain as a dissipative system having the dual quantum modes of thermofield dynamics. *Saussurean difference as symmetry-breaking establishes a bridge between semiology and neuroquantology*.

So each of the two facets of Saussure's ground is a kind of plenum which can differentiate.[11] Each facet is an emergent symmetry which might be broken and preserved by boson condensates. The two symmetries are broken as particular signifiers and particular signifieds. The bond is the contingent superposition of different condensates that conserve the symmetry broken by other-action and the symmetry broken by self-action.

The linguistic sign, then, can be formulated in terms of two symmetries of indifference. Symmetry-breaking and cotemporal superposition bring bonded differences out of unbonded indifferences. Each calls up the other in their contingent entanglement: a particular signifier presented will elicit a particular signified, and a particular signified will elicit a particular signifier. The immense versatility of the linguistic sign stems from both the two plena of symmetry available and the arbitrariness of their contingent bonds. Given the sensory consequences of covert motor actions related to self-tuning signals, then only an unextended state presences in the match with retraces—which is the inner voice.

The formulation just given offers a basis for an appreciation of the linguistic sign. When arbitrary linguistic input matchs retraces of that input, a signifier is disclosed, comes into being, like any other worldly configuration. And the same is true for the sensory consequences of a self-tuning action on speech systems, which in matching a retrace of that input discloses a signified in the guise of inner speech. In virtue of this role for retraces (traces of recognitions), and antithetical to the way we usually think, *memory is doubly prior to Being* rather than Being prior to some memory of it. The pump needs to be primed so to speak, traces first laid down that Being might then appear in the surprising light of belonging-together. Belonging-together creates clearings

[11] Saussure himself emphasizes the differences and that there are plena entailed is left tacit.

"amidst"[12] the quantum beyond-darkness, in virtue of the match. Memory comes first and then Being might be freed from the closure of indifference, which is to *be*, to be dis-closed as difference. Like any other worldly Being, the signifier is between-two. Extensive signifier and inextensive signified in the guise of inner speech both presence between-two in virtue of belonging-together on the part of dual thermofield modes.

The semiological sign has been interpreted here in terms of dissipative thermofield quantum brain dynamics. The presencing signifier is a ground state disclosure between-two in the belonging-together of other-action (sensory input) and memory traces. The presencing signified is a ground state disclosure between-two which relies on the sensory consequences of covert motor activation and corollary discharge associated with self-action (self-tuning input). These sensory consequences belong-to memory traces and signifieds are disclosed. The bond between signifier and signified is an entanglement, not an external linkage.

Discussion

A neuroquantological interpretation of Vygotsky's inner speech and Saussure's linguistic sign has been attempted, making use of phenomenological observations. It was argued that it is a grievous mistake to restrict presence or Being to *res extensa* and that inner speech is a bona fide albeit extensionless presence. To mean was formulated as an act of self-tuning the brain's linguistic systems, and meaning is the resulting global attunement of those systems. It would be misleading to say that meaning presences, that we "have" meanings; what we "have" is extensionless inner speech and what we "hold" is a stance of situating meanings. Thought is understood here as a background which is a sedimented whole, a subtext to presencing inner speech. Thought functions as a global operator on quantum brain dynamics. So *meanings are not presences; what presences is inner speech*.

The focus on inner speech calls to attention that inner speech is a presence, too, but a presence without extensive information (comparable to an odor, but not so tied to the limbic system). Saussure's sign should accordingly be amended such that inner speech is considered as a presencing signifier too. Inner and outer speeches are both presencing signifiers, but the former has no extensive information. (Being is not restricted to *res extensa*.) Signifieds are categorically distinct from both inner and outer speech: signifieds are attunements resulting from self-action.

Linguistic self-action might be labeled with 'subjectivity' were that term not so laden with metaphysical residue. Self-action rains influence on the between-two, "tunes" the between-two, in addition to the hard reign of the "stimulus",[13] i.e., other-action. Both self-action and other-action constrain what might be dis-closed (in the language of metaphysics, "what might appear in consciousness"). Co-temporal self-action and other-action on linguistic systems become superposed, and in their entanglement are associative. Each alone will call up the other.

Vygotsky (1996) intimated that thought is a movement of the whole. Combined with the formulations of Saussure (1966), thought is a movement of the utterly indifferent whole which in virtue of symmetry-breaking finds expression as differently configured parts (i.e. symbol strings and their syntactical arrangements). In turn the parts can provoke the whole (i.e. meaningful thought). Either aspect of the Saussurian sign calls out its other aspect, which permits communication of global meanings between different brains and self-communication for one brain system. In communication, the whole in one (Vygotsky's "cloud") rains syntactical parts which evoke the (more or less) same whole in the other. It is the great advantage of neuroquantological systems to underwrite whole-part and part-whole transformations with relative consistency across systems (of

[12] The quotation marks remind that this is a borrowed metaphysical term that is strictly speaking impermissible in quantum theory. Abground has no inner structure, like Bohm's holomovement, so "amidst" does not truly apply. An indirect way of pointing to Abground is *Neti. Neti.*, not this, not that, not the other thing, ad infinitum. But such a manner of pointing retains objectuality in the thing negated, whereas Abground in its true sense is pre-objectual.

[13] A "stimulus" is etymologically a goad. External stimuli goad our experience and action. Self-action is a governor on those mechanics.

course the tighter the linguistic community and social consensus, the closer the attunement and the more the consistency across between-twos). If a version of quantum brain theory might offer a plausible quantum semiology, as attempted above, this would lend support to the broad endeavor of revolutionary neuroquantology.

Comment

The nascent field of neuroquantology may be hobbled if too narrowly revolutionary. Since the mainstream has considered neuroquantology "flaky" (Globus, 2010), it is tempting to appear ultrascientifically rigorous in methodology, but too much objectivity may throw out the baby with the bath. The limitations of contemporary brain science, despite its truly spectacular advance, are most apparent when we consider our own consciousness—or better, consider our own existence. Technology is the defining paradigm of our times and the wondrous capabilities of computers for objectivity serve to embarrass our personal resources. Even neuroquantologists typically assume the brain is computing, with computation enhanced by quantum degrees of freedom. When we thematize the *freedom* of our own moment-to-moment flowing existence, however, with its inner speech, linguistic competence and capability for "deontic powers" such as rights, duties and obligations based in social institutions (Searle, 2010), computation, no matter how powerful, will not get the job done. Phenomenological approaches such as attempted above may better mesh with the field of neuroquantology.

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