What Counts as Knowing?  
Is Knowing Free of Culture and Context?

Immaculate Namukasa  
University of Alberta  
Edmonton, Alberta

In the comedy movie *The Gods Must Be Crazy I* (1980) a Bushman in the Kalahari Desert sets out to return to the gods the evil thing that fell from the sky, after it has caused upheaval in his once peaceful clan. Seeking to restore peace in his community, Xi (N!xau) the head of the family, embarks on a journey to the end of the world to dispose of the evil object. He does not know that a pilot had tossed the soft drink bottle from an airplane.

The movie is a story of the adventures of a white teacher, Kate Thompson who, fed up with city life, takes a teaching job in rural Botswana, where she meets and falls in love with a zoologist, Andrew Stein. Stuck with their Land Rover in the Kalahari, Andrew and Kate meet Xi on his way to and from the end of the world.

The African producer, Jamie Uys, has been critiqued for exaggerations in depicting the world of the Bushmen and for racial insensitivity in the movie, but that is another matter. What is of interest for us is the question, “What counts as knowing?” Is there some knowing—that is genuinely shared among the Bushmen, shared with the white teacher, the zoologist and other characters including the agro-pastoralist tribes as well as with the guerilla forces who are retreating from the war front? Is there a way of knowing that is free of the locale and day-to-day activities of the knower? Did the characters’ immediate tools, materials and interactions, and what they do—other than being constraints of time and space—add significance to their basic cognition?

Biologically, humans have bodies that have similar basic functions; as a species their bodies embody an evolutionary history. Increasingly, cognitive researchers are emphasizing the role of our bodies in cognition. But does my body, for instance, as an African female, add something of significance to my cognition? And when and how do objects, propositions or concepts of my knowing happen to be known the way I do know them? How and where does a transparent, hollow object that falls from the sky happen to be perceived as many things but a soft drink bottle?

Using the movie, I would like to point to similes and analogies to what counts as basic knowing in educational settings. Historically, the child, the uncivilized other and the less developed state have been viewed in somewhat similar ways, thus the use of analogies from the Bushman for the education of children is not far-fetched. The particular choice of *The Gods Must Be Crazy I* movie is not without reason: the movie attempts to offer a glimpse into the interface between two people who appear to know (or not to know) in radically different manners—the Bushman clan leader and the white teacher. In the framework I am using, the ecological-complexity theory, both individuals are seen as learned (competent) in their respective livelihoods. The movie alternates between depicting each knowing as not knowing depending on whose setting is presented—the Bushman’s world or the urban-western world. By so doing, it brings a western viewer closer to viewing Kate with the impression one usually gets when reading or viewing
descriptions of non-western cultures. Thus the movie offers a space for interrogating the view that only the civilized, the school-educated (usually white male person) knows, which the oral and land-based tribes as well as children do not (yet) know. Such a view, unfortunately, appears to motivate many curriculum developments: It motivates the urge to hastily educate the uncivilized and the children into literate and civilized ways of knowing. Yet literate and formal ways of knowing are, according to Abram (1996) and other postmodern scholars, one among many possible ways of knowing.

I specifically re-read Maturana and Varela’s biological theory of knowing along side the movie to explore what counts as basic, operational knowing, given the possibility of myriad ways of knowing. I also attempt to relate symbolic and ethical knowing to basic knowing. Particularly I explore four notions of embedded-embodied knowing including:

1. Basic knowing as operational knowing—all knowing including the more symbolic, abstract knowing as grounded in operational knowing.
2. Objects, entities, propositions or concepts of knowing as brought forth rather than necessarily pre-existing and independent of human activity; the notion that objects of knowing arise as humans coordinate actions with the people that they live together with—inter-objectivity.
3. Ignorance as an indicator of differing ways of knowing and differing domains, systems of reality or communities of observers, what Maturana refers to as a domain of inter-objects.

It appears a situated and embodied view of knowing that is increasingly explored in the non-traditional views of learning furthers the discussion of what counts as knowing by foregrounding our bodies, the bodies that we interact with, and the eras and space (the locales) that we bring forth. Our situatedness and embodiment are the primary conditions of as well as (liberating) constraints for knowing.

Basic Knowing as Operational Knowing in Domains of Reality

On the situatedness of knowing, Varela asserts:

Proper units of knowledge are primarily concrete, embodied, incorporated, lived; that knowledge is about situatedness; and that the uniqueness of knowledge, its historicity and context, is not a “noise” concealing an abstract configuration in its true essence. The concrete is not a step toward something else: It is both where we are and how we get to where we will be. (Varela, 1999, p. 7)

One wonders whether Varela’s assertion applies to all knowing. Isn’t there a way of knowing, really basic and universal, that all bodies or members of the human species, irrespective of their situatedness, share? Or is it that even the most primitive or biological knowing is somewhat tainted by our inherited as well as lived histories? On the other hand, is the more reflective, abstract (imaginative, cultural) or symbolic knowing not, in any way, grounded in our immediate and concrete experiences?

We might talk about tacit knowledge including instinctive, intuitive and, possibly, habitual knowing—the wisdom of the body as that basic knowing which all people seem to be capable of. Part of this knowing—as a mechanism for survival or pleasure—might even be existent in animals of a particular species, as well as at a lower scale of simpler organisms and body systems or organs. The immune system’s actions and interactions, for example, could be seen as knowing and learning acts, of which the traditionally fore-grounded defensive mechanism is just a part. At a bodily level, when I itch I scratch without reflecting on the order of the muscles and the order in which I should scratch, says Maturana to illustrate body knowing as an example of operational knowing. Maturana (1988a&b) and Varela (1999) refer to such behaviors as operational knowing that arise as the organism continuously interacts with its environment.

With operational knowing we may just do what we do, even, without need for conscious awareness of it, without necessarily attending to the doing itself; just like functioning organisms or systems interacting with their environments, we do not ask: the “why” and the “how” of such actions. To know in this sense is to act adequately (or knowing to stay alive) in one’s immediate world. To live, then, is to know, and to know is to continue in the praxis of living. Immediate
and operational knowing is at times contrasted with second order, linguistic and symbolic knowing in which humans are able to reflect on their actions and imagine environments. With second order knowing humans ask about the why of their doings so as to symbolically make commentaries on their own or others’ knowing acts. However, as we shall see with the Bushmen, even abstract and symbolic knowing is ground in operational knowing.

After the Bushmen find the bottle, they immediately act and interact with it. They discover uses for it. They begin with considering the foreign object as one of the strangest and most beautiful things, a gift from the gods. Then, with time, as a labour saving device—carrying water, making patterns on clothing, and, later, they learn it could make music when blown into. Yet even as the single bottle becomes so useful to them, they soon discover that it evokes among them emotions of anger, dissension and violence when someone else is using it, emotions that until then, Uys the movie producer claims, had not yet been experienced in this hunting and gathering community. Xi, a clan leader, then immediately recognizes the bottle as an evil thing to be disposed of. In a simplistic manner, we may refer to the utilitarian and immediate interactions with the bottle (such as using it as a vessel) as basic knowing. The perception of the bottle as an evil thing, we may refer to, as linguistic, reflective or symbolic knowing. Symbolic knowing of the bottle results from recursive interactions with it. Both the Bushmen’s basic and symbolic knowing appear to be enabled as well as constrained by their domain of experiences.

Xi and his tribesmen, in the depth of the harsh Kalahari Desert, have not yet participated in the drinking of Coke or in ownership of non-replicable, centrally produced and patented objects. They do not even make pottery. Unlike other characters, they have no grounds, no history to distinguish the object even as a man-made object. Dependent on the Bushmen’s livelihood as antelope hunters and fruits, nuts and root gathers, their particular actions and interactions, Maturana would say, are chosen at a deeper level of coherences of experiences. Dependent on what the Bushmen are, dependent on what they do for a living and for pleasure, they are compelled on an operational basis to bring forth a ‘surplus’ (although to an external—non Bushman—observer it appears as a deficit) significance with the bottle in ways that are adequate at every moment.

The Bushmen, at every instant, bring forth a compelling world (compelling from the stand point of Bushmen) with the Coke bottle, a world so different from what I could have brought forth had I seen a bottle drop from the sky. They had no grounds, no history to distinguish the bottle, even, as a discarded container dropped by a stranger. To the Bushmen the bottle could be many things but a soft drink container dropped by a traveler from another civilization. For peoples who ‘wander’ in the large expanse of sub-tropical land for generations living in temporary homes, the operational preferences with this strange object that was received from the sky are to perceive it as a gift from the gods and, later, to reflectively know it as an evil thing, a demon. Each of the operational preferences, although seemingly contradictory to each other, is possible and situatedly adequate at every instant.

The contrast between Xi’s and Kate’s domain of reality (hence domain of knowing) is so pronounced, however, it is akin to, albeit at a less elaborate scale, to what we experience in daily life communication and interaction, especially in educational settings, even among people of the same culture and locality. Interactions between people with compelling worlds that are subtly different could benefit from the recognition that one’s world, one’s understanding, one’s view of the world is necessarily unique. Even though an individual’s or a community’s domain of reality might have a lot of family resemblances (to use Wittgenstein’s vocabulary) with the individuals or communities that they share backgrounds, experiences, histories, etc with, it is to a larger extent unique.

The Bushmen’s immediate knowing is not only embedded in their way of living and in their immediate surrounding but it also seems to change from moment to moment. What is a gift from the gods soon becomes a demon to be discarded. Varela (1999) refers to these changing worlds as micro-worlds or micro-identities that shift with our actions and interaction. Indeed our actions and interactions change the world for us. Herein lies our agency or intentionality—our actions and interactions including the vast non-consciously deliberated upon actions on a moment-to-moment basis shift our worlds, which in turn nuance our knowing. In a word, knowing is fluid. At every moment the Bushmen find themselves in a somewhat different way with the bottle. In the praxis of living, Maturana and Varela would say, the Bushmen continually bring forth,
sometimes subtly and other times totally different worlds, each world requiring different actions and interactions, each world conducive for enacting different knowledge. The Bushmen’s bodies, their immediate tools, materials and interactions, add significance to their conception of the Coke bottle. In a recursive manner, our perceptions (which are inseparable from our conceptions) of, say, the Coke bottle guide our actions with it, and our actions with it in turn further guide our later perceptions of it. Thus in teaching, it might be crucial to attend to the possible and changing worlds of children and how their actions guide their perceptions.

In the foregoing discussion, an educational question would be: What would be required for Xi to see the Coke bottle the way Kate (a teacher on a run away from the busy and crammed city life) sees it? Or would he ever? Better still, why would an educator desire that the Bushman views the Coke bottle the way the teacher—who has participated in the drinking of bottled soft drinks—does?

Traditionally, educators have unquestionably privileged a single perspective usually stipulated in curriculum documents. Maturana refers to the vision of single perspective as a universa—a single and a static reality. A universa guided education system demands obedience from the child. Rather than inviting the child to participate in the drinking of bottled drinks, and by doing so, to bring forth a world in which a container with a narrow opening is commonly, mainly and usefully perceived as a bottle, we have unfortunately required the child or the tribal people to repeat after us that it “is a Coke bottle.” The point is, a child’s ongoing interactions and actions, his/her situatedness is not mainly a limitation to knowing; rather as Varela puts it, the concrete and lived is “where we are and how we get to where we will be.” Our situatedness is the ground as well as the horizon of our knowing. Our biological structures, our bodies embody our lived and inherited experiences and histories. Therefore what we know as well as what we will ever know is constrained by our structures.

The moral for education is, every organ, every child and every human being acts adequately, albeit in his or her own domain of reality, a domain that might be subtly or drastically different from other organs’, other children’s or other peoples’ worlds. To educate then has more to do with inviting others into common domains of reality that we as educators or policy makers think are, for some reason, better fitting than those domains of reality that children or adult students are participating in at a particular moment in a particular place. Educating may have to do with attending to children’s domains of reality as well as structuring children’s interactions and ecologies in ways that are generative of worlds that, we think, are more useful. For education to be focused on the explicit instead of focusing on the richer experiences of participation, living and bringing forth relevant worlds is problematic in many ways, such as in considering every different view to be inferior to the view stipulated by the curriculum.

**Error or Ignorance as Indicators of Differences in Signification Spheres**

While the Bushman in the movie and I (the presumably more civilized other) share the physiology of the body, there is a lot we do not have in common, both in terms of the environment, history, experiences, language, etc. We participate in different activities and interact with different people and within different ecologies. Thus what knowing is including symbolic knowing to the Bushmen, from an embodied and embedded view of knowing, is inevitably distinct from what knowing is for me (except if I participated in a considerably similar domain of reality as the Bushmen’s, which may amount to being a Bushman). In the bushman’s and in my domain of reality what counts as knowing is acting coherently in our own realities, realities in which each of us arises. Knowing is adequate doing in a particular body and particular world. And that is the common principle to what counts as knowing, Maturana and Varela would maintain.

Xi’s action of seeking to dispose of the bottle that is disrupting his community at the end of the world is an act of knowing. It is only to us, observers from a different world, or perhaps even to Xi at a later time (in a different domain of reality) that the trekking of a very long distance on bare feet to and from the end of the world just to throw the bottle away could be considered an act of ignorance, an illusion or primitiveness. But again this classification of a knowing act as an act of ignorance is made by an observer through reference to another domain of experiences that could again be classified as a mistake through reference to another domain of experiences (Maturana, 1988a&b). Such a view is not total relativism. Given the fact that the physical bottle
had specific forms that the human perceptual-motor system, the human body could interact with in given ways, the domains of experience although infinitely many are not arbitrary.

Lakoff (1991) asserts that in between arbitrariness and predictability is motivation. The domains of reality we bring forth are motivated by our experiences. The notion of motivation provides a way in the middle of solipsism and absolute objectivity. Unlike a single versum, in a plural or multiversa we anticipate myriad domains of reality. This is indeed not a scary thought to ecological-complexity theorists. Only motivated domains of reality are possible. By way of embodying our histories, by projecting our bodily and basic experiences into the more imaginative ways of being, and by happening in language, our knowing is concrete and local through and through. However, this realization calls for ethical and social knowing. Living in mutual acceptance, say, with the Bushmen or the ‘ignorant’ child or others who know in different ways requires more than operational and symbolic knowing.

In what ways can curriculum have an explicit place for embodied knowing, especially, if such knowing is contextually dependent and fluid and suggests multiple domains of reality? We have seen that an education system that is oriented by a view which entails multi-domains of reality does not in any way invite a relativistic anything goes mentality. However, does such a view justify the tendency of curriculum, especially with current trends toward globalization, to focus mainly on the abstract and general that are seemingly less context dependent? These are broader questions that von Foerster (2003) refers to as, undecidable questions. Such questions we can only decide by choosing a conceptual framework in which they are rendered decidable.

Ecological-complexity theorists have interacted in one way or another across cultures and their interactions have made the traditional stance that privileges a single domain of reality seem highly implausible for them. Many people that have interacted across cultures by ways ranging from watching movies casting lives of other cultures, reading anthropologically based texts to culture immersions might find a universum world implausible. But what we learn from interacting with people of other cultures may have to do with whether we find it comfortable to bracket the objectivity of our own cultures (objectivity-in-parenthesis); otherwise we will view other cultures as less legitimate.

The Bushman’s immediate and concrete experiences motivated such distinctions as the gods, gifts from the gods, evil objects and the spatial end of the world. Their behaviors in which they brought forth these objects were, in fact, adequate doing and knowing from the perspective of Bushmen. In the Bushmen’s domain of reality you and I are ignorant, akin to the way the Bushmen are when seen from the some agricultural and animal herding African tribes and from western-urbanized people. In a way, this is ignorance for all that all might know that others know. With the acknowledgement of multi domains of reality, illusion or errors could only be seen as just indications of—adequate actions and interactions in—different domains of reality: Domains of realities that we can consensually co-participate in when we interact and act in mutual acceptance. Maturana and Varela challenge us to view differences in stance as invitations to participate or appreciate yet another domain of reality which when juxtaposed with ours might expand our domains of reality or hopefully lead to hybrid domains of reality (Davis, forthcoming). In a hybrid domain of reality, for instance, the Coke bottle is transcendentally seen as neither a soft drink container nor a gift from god, but as … who knows what?

**Objects and Concepts as Ever Brought Forth by Communities of Observers**

The Bushmen appear to have brought forth objects or concepts—whether material or mental—of knowing in action and interaction. As Xi continues to coordinate actions with fellow Bushmen (virtual—ancestors and acquaintances—or present family members and colleagues) the bottle arises at first as a gift from the gods. Knowing in a way appears not to refer to coming to know more about an independent reality or the reality of the dominant other (Maturana, 2000). Knowing is considered as a manner of living by bringing forth objects, descriptions and explanations dependent on what we do and what we are with others and within the spaces where we live. The Bushmen bring forth a compelling meaning of the bottle with what Varela refers to as a ‘surplus of signification’, a surplus[2] between what we the non-Bushmen observers see when we see a bottle fallen from the sky and what we would have seen if we had the opportunity to stand where Xi as a harsh Kalahari desert intergeneration, resilient survivor stood in relation to the bottle (Merleau-Ponty, 1964; Varela, 1999).
Objects of scientific study are usually distinguished as natural and/or physical objects whereas objects studied in domains such as mathematics are increasingly recognized as cultural, social or mental objects. The latter are increasingly distinguished as objects that arise in a community of observers and as such are expected not to be universal. However in the ecological complexity perspective it is possible and helpful to view all objects as ever arising in the flow and dynamics of peoples’ actions and interactions in their locales within a collective that has a particular manner of languaging. The distinction between material-natural objects and symbolic-cultural objects thus condenses. To the Bushman the bottle—a physical object—takes on a form very different from the one it has for Kate. For the Coke bottle to be universally known as soft-drink container, as it currently appears to be the case, only means that all peoples have in one way or another participated in the Coke culture. It would be misleading to interpret it to be because a Coke bottle is tangible and can be verified as a Coke bottle. What is evidently a material object—an, old style, glass coke bottle—is a cultural, discursive object. Material objects in their appearances seem to be independent of perception, actions and interactions. The stability of things touched, seen, felt, smelled, nonetheless, co-arises with continuous and large numbers of actions and interactions given our human bodies and the communities that we language in. Naturalness of an object is, to adopt the complexity science terminology, the dynamical stability across given communities of observers and describers.

A Coke bottle arises as a Coke bottle among observers that have consensually participated in the drinking of Coke. Otherwise it could virtualy be any thing depending on the consensual domain of observers which arises with it. Here Maturana and Varela interrupt our traditional view of objects and concepts—either physical or mental—as pre-given. They assert that objects and concepts are brought forth in action and interaction with others, given our histories and structures. Thus when it comes to knowing it is not the objects, the facts, the concepts or the knowledge that are primary. It is the actions and interactions in our niche and with consensual observers given our bodies that are primary. Physical and mental objects are not as primary to knowing as is our embodiment and our situatedness in environments and in cultures and the co-participation in the collectives which we are compositionally part of. In our acting, interacting and living together we continuously bring forth objects that constitute our domains of reality. Moreover our domains of reality are fluid—they change with further knowing; Witness the bottle arising first as a gift from the gods and turning into an evil thing not much later.

The objects and relation and patterns among them (as well as who we are) arise from the webs of interactions we find ourselves coordinating our behaviors in. A Bushman arises as a Bushman as far as he identifies a bottle with the other Bushmen (fellow doers, observers and describers) as a gift from the gods. We can hardly if ever, even as anthropologists know the Bushman’s world explicitly, except if we become Bushmen. The Bushman will always obscure his world since he arises with it and it arises with him. Put differently, it is impossible for an outsider to distinguish the Bushman’s culture and environment without referring to the Bushmen, who do not merely inhabit it but also bring it forth. In a similar manner it would be impossible to distinguish the Bushmen without specifying the Bushmen’s domain of reality, what Maturana sometimes refers to as the ecological niche. When, for example, the Bushmen participate in the drinking of centrally manufactured foods and drinks (as is increasingly the case with governments resettling the Bushmen and saying government is modernizing the stone age people) the community of Bushmen might structurally change, or, what we refer to as, learn. In some cases through such actions and interactions particular Bushmen might cease to be members of the Bushmen community. Or worse still, the community of Bushmen might disintegrate. Whether the Bushmen tribes learn to live in ways that the policy makers may desire them to or whether their cultures disintegrate, Maturana (1988a) explains, depends on how the community of Bushmen structurally changes (the plasticity of their community) to maintain its interaction with its environment that recently has grown to include other communities. This might explain why some particular tribes of Bushmen are now extinct after only a few hundred years of interacting with the Bantu farmers and cattle herders, with the white settlers, with the colonialists or with the post-colonial governments.

The symbolic and more reflective knowing, the abstract significance of the bottle arises only in ways that are operationally preferred by the Bushmen’s domain of experience. Therefore, basic and symbolic knowing, although distinct ways of knowing do not differ in their realization in the braiding of bodyhood and languaging of humans (Maturana, 1991). With the notion of inter-objects, traditional notions of objectivity and universality are only indicators of widely shared
domains of operational coherences (that result from our bodily functioning and interactions environments) and nothing more.

Varela and Maturana draw heavily on philosophical work such as that of Merleau-Ponty and Wittgenstein. They also draw from their own biological and neurological research and from some work in artificial intelligence. They view perception as participation with the world that we perceive. For Varela and Maturana, our actions are perceptually guided in a perceiver-dependent world. Similar notions are echoed in the work of others such as Spence-Brown’s mathematical work, Lakoff and Johnson’s cognitive semantics and Von Foerster second-order cybernetics. In all this work the co-implicitness of observations, descriptions, explanations and measurements (Davis, forthcoming) are foregrounded. Everything said is said by an observer to another observer who could be him/herself and cognition is life are the central adage in these discourses.

The view of cognition as living and of observer-dependent observations is now widely elaborated upon under the umbrella discourses of ecological-complexity. This approach to knowing and observation is increasingly embraced, even in the traditional sciences. It offers alternatives to the assumption of objective observations as well as to disembodied knowing. Maturana refers to this view as one of objectivity-with-parentheses (as opposed to objectivity-without-parentheses). Ecological-complexity appears to have radical implications and consequences for the understanding of learning and teaching. In the ecological-complexity framework, would be undecidable questions such as “how come the Bushmen could not see the Coke bottle as such?” could be decided.

Who is the observer or community of observers when I say that the object that the Bushman disposed at the end of the world was just a Coke bottle? To which observer could I meaningfully say so? Or, to ask a more education related question, how can the Bushman act with the Coke bottle in ways that we see as appropriate? Or, better still, how can we collectively participate with the Bushmen (with the students and with the others we wish to participate in our domains of reality), to the extent that it is possible, in their domains of reality? In what ways is a Coke bottle indeed an evil thing? Such questions, from the eco-complexity view of cognition, can be surmised in one question: In what domains of experience is it the case that the Coke bottle is viewed as such?

Herein lies a parallel for teaching. In our daily lives as we interact within cultures and microcultures, we are blind to the origin of the objects, entities and propositions of our knowing. It is only when we travel to live in another culture, with another community of observers and actors, that the universality and objectivity of our knowing is challenged. Yet even in our day-to-day activities in which we closely interact within our community of observers as urbanized people, for instance, such challenges exist, albeit on a contained magnitude. When the differences become discernible we are quick to dismiss them as ignorance, primitivism or insanity on the part of the other. Varela (1999) refers to the kind of knowing that would allow us to bracket our common knowing as ethical or mindful knowing.

We do not only enact different domains of experiences but we also constitute varied cognitive domains and collectives, such as at work, at home, at a club, etc. We are “actual body-nodes of a dynamic intercrossing network of discourses and emotions that continuously move us from one domain of actions to another in a continuous flow of many changing conversations.” (Maturana, 2000, p. 43) A teacher in a classroom is a matrix of operational coherences and of all the collectives she or he participates in and constitutes, and so are her students. The teacher and the students each participate in varied cognitive domains some of which are shared but most, especially in areas of escalating cultural and economic diversity, are not. Some objects together with their domains of existence obviously exist and so make sense for the teachers but not for some of the students, and vice versa. And those that might appear to be common might have a surplus of significance added, a surplus that is contingent to the operational coherences, histories, and sensory-motor coherences of individual students.

Our restricted view of human interaction and co-existence, thus, could benefit from this eco-complexity view in which educating has ethical obligations. Teaching could benefit from attending to learners as complex agents and individuals who are inter-nodes of the communities that they participate in. Students in classrooms could be viewed as a collective of people that has the potential, with continued and guided interactions, of arising as a learning community of observers. Educators, teachers, curriculum developers and other people in positions that, in
traditional ways, have been looked upon as positions of authority require more than basic and symbolic knowing. They require a third order knowing that Varela, drawing heavily from the Eastern meditating and teaching tradition, proposes. Ethical knowing as co-participatory knowing promotes responsibility while diminishing absolute authority. Davis (forthcoming) asserts that such knowing does not only involve know-how and know-why, but enters the level of deep ecology and spirituality, a level of knowing to act and interact adequately in the moment and with the human and the more-than-human others.

**Knowing as Adequate Co-Participation in Worlds of Mutual Significance**

In what domains of experience would it be the case or make sense that the Coke bottle is an evil thing? To bring the argument more closely to teaching of school disciplines such as mathematics, in what micro-domain of experiences does it make sense to multiply two amounts, only to get a smaller amount? Indeed a half multiplied by a half is a quarter only in the fractions micro domain which arises:

- In a particular functioning body (a body that has informally shared a pie with siblings, formally folded paper and cut fraction pieces, for instance),
- When a student acts with particular tools and mediums (fraction strips and kits, paper, egg cartons etc.),
- When students interact with particular others (the mathematics teacher and other students) in a particular emergent domain of fractions reality, a reality usually brought forth through participation in communities of mathematical observers (school mathematics observers).

What counts as knowing thus could not essentially be expressed in terms of what Xi the head of a Bushman family knows about the Coke bottle. Knowing is adequate actions, interactions and imaginations within a community of observers. It is a specific community of observers in which Xi continuously coordinates his actions (of ‘wandering’, hunting, gathering, painting, and doing ritual ceremonies together) in an expansive remote part of Africa that objects such as the end of the world and gods arise. From the eco-complexity perspective it would mean less to explain to the Bushman that the object that fell from the sky was not a gift from the gods but rather a Coca-Cola bottle that a pilot threw from the sky. In a similar manner it would be a fruitless endeavor to explain to the Bushmen that there is no end of the world. Abstract explanation and explicit formulation of knowledge, as evidenced in the work of earlier anthropologists, most missionaries, colonial educators and some present-day policy makers, are severely limited in such cases.

Herein lies a fundamental parallel to teaching mathematics, sciences, poetry etc., domains in which the pedagogy of ‘telling’ has unfortunately continued to marginalize some strands of students such as the non-white, the non-middle class and the non-male student. Maturana and Varela’s biological theory of cognition offers the pedagogy of co-participation and co-existence. With the pedagogy of co-participation, teachers invite students in common sensical domains of reality as well as accept invitations by children to participate in other domains of reality. It is in these ways that teachers attempt to generate a common domain of reality, what Maturana and Varela refer to as a world of significance and relevance; rather than claiming access to a privileged independent mathematical, chemical or poetic reality. Co-existence and co-participation with the ones we live with as teachers appears to be a more appropriate and especially more ethical and social way of being in spaces of knowing and learning.

In consensually generated worlds, such as worlds of mathematical significance in a given classroom, as it were, children are not only invited to think about dividing fractions by inverting the divisor, for instance, but also it makes sense for the children to divide one fraction by a fraction to get a bigger quantity—a world that is not only mathematical, but a particular domain of mathematics and a specific sense of division that is somewhat different from that one of dividing as subtracting repeatedly. Our worlds of significance are dynamic and nuanced, thus they require more attention than focusing on explicit and formulated knowledge.

**Concluding Thoughts**

Using the movie, I have done a preliminary exploration of Maturana and Varela’s biological
theory of knowing. I have elaborated on notions of domains of reality, operational knowing, community of observers, objectivity-in-parenthesis and inter-objects, in ways that appear to be generative for teaching. Maturana and Varela’s theory of knowing in particular and ecological-complexity theory in general elucidate an attitude to knowing that compels educators and teachers to act in ways so as to co-participate with learners in generation of worlds of mathematical, scientific, literacy, etc. significance—worlds in which unique micro-worlds of significance could also be nested. As we interactively generate these spheres of signification, moreover, we ourselves arise as learners, teachers, researchers or educators. It is in such doings, descriptions and observing with the people we repeatedly interact with from which communities of observers or collectives (such as classroom collectives) and sub collectives arise.

In a given collective, objects and concepts of knowing do arise as people coordinate behavior. This is a recursive process. What were actions of yesterday generate objects of today to facilitate further actions, generating other objects, relations between and patterns in objects. In turn, with recursive doing and recursive coordination of actions a way of languaging and living with stabilities (with a culture) or a cognitive domain arises. We find ourselves as human beings happening in this praxis of living with others. Von Foerster (2003) in, more mathematical languaging, observes that even though we behave as though objects and concepts existed prior to our iterative actions and interactions, prior to our languaging, the objects themselves are tokens, dynamic equilibriums, eigen values for our actions and interactions. When objects arise they obscure the behaviour for which they arose to coordinate, and as such they coordinate further behaviour without explicitly referring to the initial behaviour. In this way, these emergent objects and concepts appear to us to be objective.

Our bodies, our manners of languaging, and the ecologies we continuously structurally interact, the individuals that we socially interact with as well as the collectives we compose motivate our ways of knowing. It is in this perpetual action and interaction in our coherences of experiences that knowing does count.

References


Northwestern University Press.


[1] African Bushmen (the San people) live in the deep isolation of the Kalahari Desert, they gather and hunt for a living. They are believed to be the ‘original’ inhabitants of Southern Africa. Bushmen were ‘hunted’ almost to extinction by the Bantu-agro-pastoralists, the White settlers and the colonialists.

[2] Pronounced Chi; Bushmen’s languages incorporate ‘click’ sounds represented in writing by symbols such as !.

[3] There are a couple of reviews of the movie that pop up when you do a search e.g. one by Daniel Leary http://cspar181.uah.edu/RbS/job/gods1.html

[4] Dating as far back as Aristotle, scholars have differentiated between kinds of knowing: A more recent distinction is that of ethical or mindful knowing by Varela (1999). I attempt to maintain the distinction between operational/concrete/basic knowing and symbolic/reflective/abstract knowing.

[5] Bushmen traditionally did not make pottery; rather they used ostrich eggs and other animal parts as vessels. They painted on flat rock walls, engaged in ritual and myth ceremonies that involved singing and dancing, and some proto-mathematical activities such as calendar marking on bones.

[6] When we think with objectivity-without-parenthesis it is only seen as a deficit, since we privilege ours as the only possible world. But with objectivity-with-parenthesis, it is a surplus that only that particular knower, given his/her experiences, his/her interactions and his/her history, could add.

[7] Varela limits the connotation of surplus to the imaginative capacity that, he says, human beings have whereas animals do not. Humans bringing forth different meaning from what animals do in the same situation. I have elaborated on this connotation to differences in worlds of reality brought forth by people.
About the Author

**Immaculate Namukasa** is currently a Ph.D. candidate in Mathematics Education at the University of Alberta. She is a Canadian Commonwealth scholar from Africa. In Uganda, Immaculate taught mathematics and social studies at the secondary school level, and worked with the Ministry of Education as a curriculum developer and examiner. Although she was born in a city, Immaculate visited relatives and took refuge during the civil war in the remote countryside of Uganda. It is from this movement back and forth between radically different settings that questions about how people make sense of their worlds began to interest her. Her dissertation research investigated questions related to how students make sense of mathematics. She enjoys studying issues related to globalization and education as well as the phenomenology of knowing. Recently, she has become interested in the work of researchers who adopt complexity and ecological science theories, such as dynamic systems theory, to investigate learning and teaching. Immaculate has co-published an article, *Collective Learning Structures* (2003, PME27 proceedings), and completed a manuscript, *Globalization and School Mathematics* (forthcoming, *Interchange*).

Email: namukasa@ualberta.ca.