

# **The Dynamics of Meaning Expression and Communication Among People, Dogs, and Other Creatures**

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The present paper describes an exploration and analysis of biosemiotics from the perspective of Gregory Bateson's (1972/2000, 1979/2002, 1991) notions of relationships, contexts, communication, and epistemology, as well as from Nora Bateson's (2010) theory of symmathesy or mutual contextual learning and my own framework of contexts of meaning (Bloom, 1990, 1992, 2006). It is hoped that these perspectives or lenses will provide a fruitful way to interpret and analyze biosemiotics phenomena across the Kingdoms of living organisms.

One of my interests during the last years in academia and during retirement have been particularly focused on dogs and their communication, cognition, and emotions. My laboratories have been my home, a number of dog parks, and forests, where my dog and many other dogs romped. What I want to do in this paper and presentation is explore dog cognition, communication, and epistemology to the extent possible given the restraints of my informal research settings. However, I also have spent significant time observing other organisms, including fish, birds, rats, and a large variety of invertebrates, macroscopic organisms. It is from these observations that I am presenting an exploration and analysis of that is based in the theoretical perspectives described in the previous paragraph.

## **Paradigmatic Obstacles and Premises**

The study of semiosis has been in many ways affected by the ongoing legacy of positivism, reductionism, and mechanism. These three intertwined paradigms can deeply affect our understandings of complex living systems. Even the complexity sciences themselves have suffered from the tenacious lingering effects of these paradigms. It often is very tempting and even personally satisfying to think that one has produced a "correct view" and simplified explanation of the world, and that one has managed to find and explicate a neatly organized series of steps or processes that demonstrate the functionality of some system. However, we very well may have entirely missed providing a meaningful description of the complexity of some living system. Understanding complex living systems is much more complicated, uncertain, unpredictable, variable, and generally just slippery to pin down. So, with this cautionary note in mind, I will attempt to describe the epistemological nature of biosemiotic dynamics. For the most part, I will focus on the human—dog, dog—dog, dog—spatial, and dog—temporal contexts and relationships. However, I will include other examples from fish, birds, cats, and other organisms where appropriate.

One premise that has been guiding my own thinking relates to the very nature of life, and that is the notion of shared attributes. All life as we know it is comprised of the same building blocks, from the biochemical, including RNA and DNA, to the cellular. In addition, the shared and basic functional approaches to survival are address in amazingly diverse ways at the level of organs and organelles, while the core biochemical process are the same.

For example, all aerobic organisms have diverse adaptations for obtaining and utilizing oxygen: from simple transfer across membranes to the complex organ system of lungs intertwined with a closed and separated circulatory system. However, at the cellular level, “respiration” always occurs in the Krebs’s Citric Acid Cycle. And, barnacles have taken that Citric Acid Cycle a step further with what is commonly called the Reverse Citric Acid Cycle, where part of the cycle is skipped so that they can continue their respiration while the barnacles are out of the water during low tide. The premise I am suggesting is that all living things are comprised of similar “things” (propensities, abilities, functions, etc.) and that all living things have manifested these “things” in ways that are adapted for their survival in their own sets of temporal, spatial, and relational contexts. This premise aligns with the notion that all organisms alive today have gone through the same degree of evolution. Without overlaying our inherent bias of regarding humans to be at the pinnacle of evolution, we may find that each species of organism has developed ways of problem solving, of relating to one another, of communicating, and so forth that are exceptionally well adapted to their particular organic forms and the contexts in which they need to survive and maintain the continuity of their species. For instance, we as humans often consider our cognition as the gold-standard of cognitive processes. However, from the perspective of my proposition the dog’s, the tree’s, and the bacterium’s cognitive process are exceptionally well-adapted to their particular ways of surviving, both individually and as species. From such a perspective, the challenge is to find ways of understanding any particular “ability” or whatever without getting stuck looking through the lens of values we have placed on the human version of that ability. Such challenges are further complicated by varying degrees of spatial and temporal differences. We should all agree that people and dogs play. We can easily observe both, although occasionally people have difficulty distinguishing what is and is not play in dogs. But, do plants play? This particular question points to the difficulties encountered when trying to contend with a time-scale and form that are completely different from the one we experience, and with the spatial differences of where play might occur and what it may even look like.

The attributes that are discussed below are what I have been using as a working guide to observing and making sense of the actions of living things. They are by no means a complete or substantiated description of life’s attributes. The first of these shared attributes of living systems is that of *perception*. All living things perceive or take in information from the contexts in which they live.

The second attribute is that those perceptions are immediately associated with some sort of neurotransmitter (emotion) that lead to avoidance or elimination of some “thing,” to ignoring or not paying heed to that “thing,” or to some basic attraction to that “thing.” The early Buddhists and in their “universities” studied mental phenomena ad infinitum. One of the basic concepts that arose from such work has been referred to as the wheel of karma

and the three poisons. Within this framework of karma, the sixth and seventh of 12 stages of the wheel of karma are referred to as contact and feeling or perception and emotion. Perception gives rise to emotions. The three poisons aspect of this scheme is depicted at the center of this cycle or wheel. The three poisons are the three core emotions from which all of the other emotions arise: (a) passion or attraction to some “thing” or perception; (b) aggression or a desire to push away or destroy some “thing” or perception; and (c) ignorance, which has nothing to do with our common definition of ignorance as stupidity, but rather as a state of ignoring, avoiding, or dismissing some “thing” or some perception (Thera, 1956/1979; Trungpa, 1976). Such a perspective of the relationship between perception and emotion also is being established in Western psychology (Zadra & Clore, 2011). From the perspective of evolutionary adaptation, such emotional responses to perceptions function as assessors of information so that appropriate actions can be taken.

The third attribute, at this post-perception point, is that all living things formulate abstractions of the significant information that has been perceived. Korzybski (1948) referred to this process as creating a map or abstraction of the territory. Such maps or abstractions, however, cannot be mistaken for the territory or the actual “thing.” In part, the problem with confusing the map for the territory is that two organisms of the same species and that are located in the same place will create different maps. There is, of course, shared similarities, but the two representations will differ. The maps are affected by the individual epistemologies and differences in the entire process of dealing with incoming information. Nora Bateson (2016) coined the term “symmathesy” to describe the learning of all living systems at the level of interaction. Symmathesy, or mutual contextual learning, describes the way in which organisms, ecosystems, or social systems learn in terms of how to relate within the contexts in which they live and function. Briefly, the set of features that come into play in symmathesy include: (a) internal biases; (b) calibrations to how one relates and functions; (c) the contexts affecting the individual or system; (d) the boundaries across which information flows between entities and the boundaries that designate the points of contact; (e) time or the temporal contexts that affect interactions and functions; (f) play as the set of processes through which organisms learn, the way to find the limits of what is possible (Bateson, 1979/2002), and the ways in which relationships can be developed; and (g) stochastic processes, which allow for new information to be incorporated and responded to in ways that may enrich or alter learning.

I see symmathesy as the foundational (not to be mistaken with a sense of solidity) learning that occurs in all organisms. In addition, I see symmathesy as the sets of processes that feed into the development of personal and social epistemologies, where information, relations, and further abstractions continue to morph and interrelate. Personal and social epistemologies are not static like the philosophical version of epistemology. Knowledge and

meaning are continually changing in response to new information and to the ever-changing internal and external contexts.

The fourth of these attributes of living systems involved responsiveness. All living systems respond to incoming information and to various loopings of information within their own system as either an individual organismic system or as a social system of multiple individuals.

## **Context**

Bateson (1979/2002) delineated three basic types of patterns, which also apply to contexts. The context versions are spatial contexts, temporal contexts, and formal contexts. Spatial contexts include physical locations, ecosystem, habitat, and so forth. Temporal contexts are those where there is some action, activity, or event taking place in some time-period, such as a fight, a mating ritual, hunting, play, and so forth. In terms of patterns, Bateson considered formal patterns to be those that involve formal, conceptual relations. He used the example of an elephant's nose for all three types of patterns. He described how one could ascertain that the trunk is a nose by (a) its location between the eyes – a spatial pattern; (b) its function in breathing – a temporal pattern; and (c) the embryological origin of the trunk – a formal pattern. So, we may think of formal and conceptual contexts as those contexts that involve the conceptual and formal relations within the biological form. However, we need to include a fourth type of context, which involves the cognitive—emotional space of individuals and groups. In summary, there appear to be four primary types of contexts: (a) spatial contexts, (b) temporal contexts, (c) formal contexts, and (d) cognitive—emotional or epistemological contexts. Although our tendency may be to separate and compartmentalize these four types of contexts, they are always intertwined. If we observe a dog playing with her human father, the play may be taking place in the setting of a dog park, which is a spatial context. The action of the play is temporal in that it is taking place as a sequence of looping or recursive actions over time. The play also involves the neuromuscular interactions, along with the actions of various neurotransmitters, and complex sets of perception and coding; and both parties are also involved in various combinations of cognition, communication, and emotional responses, which is a combination of the spatial, temporal, and cognitive—emotional contexts. As discussed earlier, the latter type of context involves symmathesy (mutual contextual learning), contexts of meaning, and epistemological development. These cognitive contexts align with Korzybski's maps or abstractions. They are "mental" representations, whereas the first three types of contexts, are essentially the "territory," that exist for all practical purposes as separate from mental constructs. However, "formal contexts" may straddle the border between the actual territory and mental representations. For example, the actual embryological relations that lead to the development of an elephant's trunk are expressions

of the territory or the actual “thing.” Our understandings of those relations are abstractions. But, noticing such formal relations requires a certain level of mental abstraction. A casual observer will not “see” the formal relations, which are at a higher level of abstraction from noticing that an elephant’s trunk is located in the same position as other vertebrate noses, and also serves a similar function in breathing. A casual observer is likely to notice these relations. Of course, anything that is observed immediately becomes an abstract representation. If you close your eyes and I say “bird,” you may see representative image of a bird in your mind. This is at a level that is a very direct and uncomplicated level of representation, whereas embryological, genetic, neurological, philosophical, or theoretical sets of relations are at a less direct and more complicated level of abstraction. They may have a territory basis, but the connections to the representations are much more complicated and distal.

In taking contexts into account, we do need to keep in mind that contexts are not static and clearly definable “things.” Like cognitive contexts of meaning, all contexts are in flux. They are continually changing. And, they have no clearly identifiable borders. Where is the exact borders of a home, an ecosystem, or our cognition? Contexts are not containers in the sense of a box of some sort. They have extremely fuzzy and porous borders. The forest animals do not always stay in the forest. They move between contexts. Contextual situations are much more complicated and complex than even this description suggests. For example, the contexts of my dog and the contexts of me walking in forest contexts, where there are contexts of other people, of other dogs, of the trees and other plants, of the fungi, of the mountain lions and jack rabbits, and so forth. And, other contexts can intertwine, such as a forest fire and the contexts of human responses to that fire. The flows of information within and among these contexts are so dynamic and changeable that trying to pin down the description of such complexity is probably impossible.

### **Story 1 – Forest Contexts: Signs in Changing Contexts**

The semiosis involved in contextual complexity must be similarly dynamic. Whenever my former dog, Mugetsu, and I entered the forest for our twice daily excursions, she immediately went from uncontrollable excitement about going on our hike to focusing on all the information she could gather from the forest. She relied mostly on scent and sight, along with some significant use of hearing. Her nose moved from pointing up into the wind to down inches above the ground. The intensity of her use of sight would move from treetops and sky to ground level. Any movement was noticed and assessed. If a person or a dog appeared in the distance, she would stop and stare intently. People would often come up and say they felt like she was looking at them as a possible lunch. Such “misreading” of her signs was common. Her initial stares were always assessing the signs of others. Are they friends? Are they dangerous? When she made these

assessments, any continued staring was most likely a “what’s next” assessment. Do they have treats? Do they want to play? She carefully and astutely read the signs coming from other people. Most of these signs were not signs of intended meaning, but were signs of the meanings of one’s personality traits or state of being. However, people who understood dogs sent messages of engagement – smiles, talking to her, extended hands, clapping, and so forth. These encounters with intertwining contextual dynamics were always new and fresh for my dog. Even if she saw a friend approaching, she was reading the contextual signs just as intently, but with a sense of excitement of greeting a friend.

### **Story 2 – Forest Contexts: Signs of Danger**

On another occasion we were walking off trail on the side of a mountain. We came to a place with a lot of dense vegetation. I saw an opening on the other side of a tree with low hanging branches. So, my reading of the situation, which as it turned out was not very astute, was to crawl under the branches to get to the opening. When we got about halfway into the overhanging branches, Mugetsu started getting very agitated and then stopped walking. She tried to get me to go back. In fact, she would not budge in the direction of “forward.” It took me a moment, but I finally realized that she sensed that there was danger ahead, which was most likely a Mountain Lion. As soon as we turned around and headed back out the way we came, she calmed down. We went through the rest of our hike without incident. Her abilities to read the signs in contexts were quite remarkable. She could quickly discriminate between “danger” and “safety.” In this case, I don’t know what signs she was readings, but her assessment of the status was definitive.

### **Story 3 – A Dog in Human Contexts: Signs of Danger**

Another context assessment that was intriguing involved going to a new veterinarian after we moved to a new city. Mugetsu had an ear infection, so we made an appointment with a vet we found from an Internet search. She had been to quite a few different vets in the past. She never particularly liked going to the vet, but she tolerated it and enjoyed any attention she could get from the staff and the vet. At this new veterinary practice, the vet tech took us into an exam room to wait for the vet to come. Mugetsu was acting in much the same way as she did in previous similar situations. Then, the vet opened the door and Mugetsu immediately started snarling intensely. I had never seen her do this before with any human encounter. But, as slow as I am to pick up on the “signs,” I just sat there with my arms wrapped around her while she continued to snarl. Over time, the vet became much more aggressive and nasty with me, then left the exam room leaving two vet techs behind. The moment the vet left, Mugetsu stopped snarling and resumed her typical behavior for a vet’s exam room. The two techs could take blood draws and do whatever and she was calmly

tolerating the pokes and prods. When I got the bill for the visit (\$650), I finally realized what had just happened. And, Mugetsu knew this new vet was a problem in the first tenth of a second. The vet, on reflection, had the attributes of a sociopath. She seemed to be in the business of just making as much money as she could. Over the years, I met a number of people who had the same reaction to this vet. But, when Mugetsu entered the office of the new vet, she assessed that it was a different, but familiar context – it was a vet’s office. Everything was fine, until the new set of contexts (i.e., the vet) entered the context of the exam room. A week later, Mugetsu got a bladder infection. We went to a different vet. But, when this new vet entered the exam room, her reaction was typical of most of her other vet experiences. She immediately assessed this new vet was just fine and not a danger.

Taking contexts into account are critical to understanding the types of signs that are expressed and communicated by various organisms. Organisms situate meaning within sets of contexts. And, such meaning can vary over time, space, or mind. For example, at one point, my dog and I visited a friend’s house. She knew my friend from previous visits to my house, but she had never been to his house. When we entered the house, she became very nervous, which was communicated by her restless pacing and whining. This was a typical behavior whenever she went to some building outside of the home, except for her dog sitter’s house, in which she practically grew up. A few months later, my friend moved to a new house. This time when we entered the house, she walked in, found the sofa, and climbed up and lied down with her head on the armrest. The people were the same, but something about the house was different. It could have been any number of things different between the contexts. It could have been some change in her cognitive—emotional contexts. But, there was a distinctive difference in her behavior and what that behavior signaled between the two houses.

In terms of temporal contexts, dogs certainly live in time, relate to time, and use time (Horowitz, 2009). My previous dog did, and many other dogs, seem to have an extraordinary sense of time. We went for hikes or to the dog park every day between 6:00 and 9:00 am and then again between 4:00 and 7:00 pm depending on the time of year. We were out for one to two hours each time. It does not take long for dogs to remember this experience of time. About an hour before the designated outing time, my dog would show up in the same room as I was in, if she wasn’t already there. She would lie down and watch me. After about 30 minutes, she would start heavy breathing scattered with highly noticeable sighs. After another 15 minutes, she would sit or lie down by my side and start whining occasionally, but with increasing frequency over time. As the designated time arrives, she started yelping, then pacing and yelping. If the designated time passed, she would start her higher pitch barks with increased the frequency and intensity as time



passed. Sometimes she would grab my shoes and bring them to me. Other dogs I've known would get their leashes and bring them to their human parents.

At the dog park, especially as my dog grew older, she had set her internal timer to one hour at the dog park. At one hour, she would start a similar sequence of signaling behaviors. She would start by sitting or standing by me while staring at me. This was such an obvious sign that other people at the dog park would point out that my dog was ready to go, when they observed her sitting behind me and staring. Then, heavy breathing, followed by whining, and yelping. At a certain point, she would walk towards the gate and then back again. After more time, she would run towards the gate, then run back and bark. This sequence would always occur unless we left early. However, if she met a friend and started playing, or if she saw a rabbit or other rodent she had to chase, then the time to leave was adjusted.

## **Relationship**

Examining the manifestation of semiotics through the lens of relationships reveals more about the complexity of signs and about the meanings than may be expressed or communicated by these signs. Using the lens of relationship, allows us to examine events, objects, actions, and so forth in a more richly interconnected or interdependent context. As Bateson (1972/2000) describes, in order to find out why a dog is barking, we have to pay attention, not only to his or her body language, but also to his or her line of vision, to the context she or he is in, and to whatever else might be happening in the dog's experience. Such a view connects to what Gregory Bateson (Bateson, N., 2010) suggested, that we and all living things live in a world of relationships. He was referring to the fact that everything in our world is in relationship to other "things" in the world. Such a perspective describes a world of interdependencies. Our understandings of these interdependencies are significant, if we wish to capture the complexities of living systems and their expression and communication of meaning.

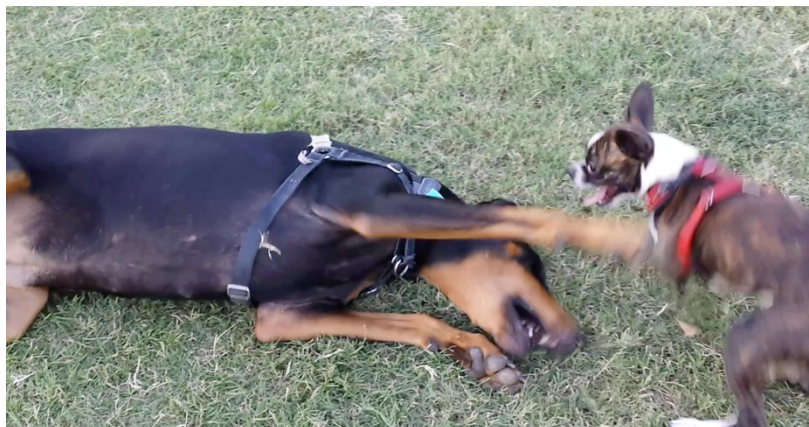
In Mélanie Frappier's (2021) review of Carlo Rovelli's new book, *Helgoland: Making Sense of the Quantum Revolution*, she emphasizes that from the view of quantum mechanics "there is simply no God's-eye perspective, nothing outside of relations between systems, no absolute account of a series of events" (p. 1158). Such a perspective that also moves in the direction of a world of relationships also appears in the biosemiotics literature (Deely, 2001; Harries-Jones, 2017; Martinelli, 2010) What is puzzling is how we humans seem not to recognize or value the interrelational and interdependent nature of the world we live in. However, other living things, including dogs, pay close attention to the relationships within the world of their experiences.

For dogs, the scope of relationships include those with people, with other dogs, with their immediate “home” surroundings including other pets, and with the diversity of contexts outside of the home to which they go. For my dog, those outside contexts involved a number of areas in a local forest, car, dog parks, pet stores, other stores that allowed dogs, her veterinarians, her pet sitter’s house and property, and the local neighborhood and other areas around town. Within these types of contexts, dogs are very attuned to the living and non-living objects, animals, and all of the sensory information of which we are only partially aware. Contexts continually overlap and change, which also affects the relationships between the contexts. But, dogs and everything living in these contexts are keenly aware of the changes between and within contexts. Such keen awareness of relationships and contexts are necessary adaptations for survival. All life forms, from the bacteria and fungi in the soil of a forest to the birds, mountain lions, skunks, and trees, have to monitor, assess, and make the necessary calibrations in order to survive. And, this awareness of context and relationship is fundamentally involved with the complex, intertwining of information moving within the overlapping and interdependent contexts and relationships. We may consider this as an ecology of information within a particular set of dynamic contexts.

#### **Story 4 – Dog Play: Reading Signs, Developing Trust**

When I began observing my dog, Mugetsu, as well as other dogs and other animals, through the lens of “relationships,” my own views on dogs began to change. What I noticed is just how important social relationships are to dogs. With dogs, play is essential to the development of relationships. Although dogs vary in their approach to and engagement in play, once they begin playing with another dog, play helps them develop trust. When Mugetsu was a young puppy she would try to play with all the dogs she met. But, after encountering dogs who did not want to play or were aggressive in social situations, she became much more cautious. She started to assess other dogs, which was a process of looking for signs that would suggest that a particular dog might be a friend. Then, she would progress slowly from gentle play to much rougher play. She also would adjust her play style and intensity to the sizes and personalities of other dogs. Mugetsu was around 90-pounds, but she loved playing with dogs that were 15 to 30 pounds. The communication and calibration between her and the other dogs were all a part of process of symmathesy and adding to the epistemological contexts of meaning that continued to build relationships.

Over time, the relationships between Mugetsu and various dogs changed in their outward expression. Play became



*Figure 1 Mugetsu, at 90 pounds, adjusting play to signs from Nico, a 15-pound Boston Terrier.*

much less tentative and often more intense. There was a sense of trust between the dogs. I did observe an interesting twist to this pattern of increasing frequency and intensity over time. As dogs seemed to achieve a certain level of trust in their relationships, the frequency of play appeared to decrease. Play still occurred, but the dogs seemed quite comfortable just hanging out together, which involved lying down next to one another or just sitting or standing next to one another.

From a dog's perspective, play with humans seems to serve the same purpose of developing trusting relationships. However, play can be used to address other concerns with relationships, as well as to provide a sense of enjoyment.

### **Story 5 – Dog Play: Cheering Up**

Mugetsu often initiated play immediately after she noticed that I got upset with her or upset about some other situation. In one case, we were getting out of the car at the dog park. I grabbed her leash and moved aside to let her jump out. When she jumped out, I reached down to grab a bag with water and a container. As soon as I bent over and when I was not paying attention, she saw a rabbit and lunged for it. She pulled the leash and my arm over the car door. This action is the suspected point at which my rotator cuff was torn. I shouted out in pain and anger. Mugetsu stopped and looked at me intently with what I interpreted as a look of great concern. When I recovered my composure and realizing it was as much my fault for not paying attention to the context, we started walking down to the dog park. Mugetsu was still staring at me with concern, then she grabbed her leash in her mouth and started playing tug-of-war, while still staring at me. This sort of action on her part was used whenever she seemed to feel that I was upset or angry, even if it was after stubbing my toe while walking around the house.

### **Story 6 – Dog Play: Deceit and Gaming for Mental Stimulation**

At other times, Mugetsu made up games in different situations. In these situations, the game seemed to be more for some combination of mental stimulation, dealing with excitement and anticipation, or for just pure enjoyment. She developed a routine of a made-up game when we were getting ready to leave the house. Almost every day from the time Mugetsu was approaching two until the day she died, we would go to the door to get ready to leave. I would pick up her attached harness and leash. Mugetsu would look at me with wide opened eyes and raised eyebrows and start the game she had invented. She would run away from me every time I approached with the harness. She would run around the kitchen island counter, run into bedrooms, run around the coffee table, and run around the couch with me in pursuit. When she reached the point where she considered the game to be over, she would walk over and walk into the outstretched harness. Then we would leave for our outing. This little ritual was a

standard event. She did not do this with my wife, but always did it with me. What was she doing? A major part of a dog's play is developing and tending relationships. Mugetsu seemed to be ready to play whenever the opportunity arose. She loved making up new games with people and dogs. This focus on playing seemed to fit well with the intensity she showed for developing and tending relationships.

Each of these types of games and play began with certain facial expressions that for Mugetsu were centered on her eyes and ears, and to some degree on body posture. But, she seemed to rely mostly on the way she looked at me. These signs seemed to communicate to me some sense of playfulness often bordering on what we might consider deceitfulness or mischievousness. One might think that attributing such meaning to facial expressions and other signs is a problem of anthropomorphism. However, dogs have evolved in mutual learning (symmathesetic) contexts with humans. Their epistemologies have no doubt incorporated ways of sharing meaning across species.

Encountering the "other" is the beginning of some sort of relationship, whether that relationship will be antagonistic, neutral, or friendly. Such encounters start with reading signs of the other. These signs may be at the level of signification of one's present state of being. Such signs also may be intentional or somewhere in between the two. Certainly, such initial encounters occur within species, as well as across species. *Story 1* addresses a type of initial encounter between dogs and people. In this story, the initial signs as expressed by Mugetsu were evident in her posture and facial expression. When she first spotted a person or dog in the distance, her posture was upright and alert. This upright posture wasn't the excessive one often exhibited by dogs that indicate fear or some sense of "toughness" (I am trying to avoid using "dominance," which has become a highly suspect term in canid behavior analysis.) Her posture was just one of alertness and attentiveness with ears up and out from the sides of her head. However, as the people or dogs approached, her posture would slowly drop with her head at or below shoulder level. Such a posture was a way of intentionally sending a message of non-aggression and friendliness. The initial attentive posture was a sort of unintentional sign that was either noticeable or not by people, but was probably noticed by other dogs. Even the drop in the head position was rarely noticed by people, but was definitely noticed by other dogs, whose approaches were generally friendly. However, this is an intriguing situation where signs are not read or are misread. On several occasions, Mugetsu would be in a neutral posture walking through the forest or in a dog park, when a few dogs just charged her aggressively. They almost seemed to come out of nowhere and attacked her when she was not even aware of their presence. Was this a misreading of signs or did the attacking dogs have issues with aggression?

More commonly, misreading of signs, which were most often metamessages about play, occurred between dogs who did not know each other and began playing. However, much

like little children playing and getting increasingly hyper-energetic until a fight breaks out, dogs occasionally seem to go through a similar process. Mugetsu and one particular friend, a Malamute mix, occasionally got to a point during play where a fight might arise. However, the signs of such impending issues were obvious to me and to the Malamute's human parents. During the increasing intensity of play, Mugetsu and the Malamute showed signs of irritation and jumpiness. The co-reading of signs began to get jumbled and confusing. At these points, the human parents had to stop the play and insert a "break time" for the two dogs. After a few minutes break, they could continue playing without incident.

Another common misreading of signs occur with dogs, especially puppies, who have not learned the social graces. In one particular case, a somewhat older dog (about 3 years old) who acted like a young puppy entered the dog park and started jumping all over Mugetsu. It started from the first time this new dog came to the park and continued until the end of Mugetsu's life. Mugetsu was extremely tolerant. She knew the dog was friendly, but she just could not figure out a way to deal with it. She sent all sorts of messages, from yelps to barks, from stay away from me postures to quick warning snarls, but this dog never relented. Most puppies seem to go through a process of learning the signs, so that when they reach 2 years old or so, they have learned the social "rules" of dog-dom. This 3-year old dog was well beyond the age where she should have learned these rules. This adult "puppy" was one of many older dogs I have observed with the same lack of understandings of social rules. My question at the time was whether dogs can suffer from Asperger's Syndrome. This dog and others with similar conditions did not seem to be able to read the signs or messages being communicated by other dogs, much in the same way people with Asperger's have difficulty reading the signs expressed by other people.

## **Epistemology and Meaning**

In my early research, I stumbled upon a much broader sense of meaning in children's learning than is typically discussed in the cognitive psychology, learning, and teaching research literature. While I started out with questions about the nature of children's *science* learning, I quickly found that these questions missed the mark. Basically, left to their own approaches, children do not learn in disciplines and do not learn in ways that are purely semantic. Their learning is transcontextual and abductive. Such learning incorporates flights of imagination, emotions, humor, and memories of past experiences. During the data collection and analysis stages of this research, I began noticing such sets of patterns in the way children talked and thought about organisms and objects in the natural world. I coined the phrase "contexts of meaning" to describe these patterns (Bloom, 1990, 1992).

The phrase *contexts of meaning* captured the sense that the meanings children hold are contexts containing many different dimensions, modes of knowing, and qualities of

information. This variety of information includes emotions, values, aesthetics, beliefs, interpretive frameworks, memories of personal experiences, metaphors, biases, assumptions, relationships, abstractions (maps, images, models, etc.), patterns, analogies, humor, fantasy, immediate or longer-term memories of sensory information, as well as what we typically think of as formal or school-type semantic knowledge. Interestingly, “school-type knowledge” seemed to comprise a rather minor role in the scope of meaning held by children, although it did come to the forefront depending on the actual context in which children are engaged.

These types of information seemed to be consistent across cultures. Children from very different cultures engage in meaning-making in much the same way. However, the major differences across cultures lie in the specific cultural, social, and environmental contextual details. For instance, children in North America, when engaged in talking about or representing their “ideas” about forests, generally focused on the aesthetic beauty of forests, on the recreational aspects of forests (summer cottages, hunting, fishing, hiking, camping, etc.), and on the environmental issues facing our forests. On the other hand, nomadic tribal children in India emphasized food, medicines, fuel for fires, and materials for shelters, as well as elements of aesthetics and emotional reactions (Bloom, 2006; from research conducted in collaboration with Jayashree Ramadas, Chitra Natarajan, Sugra Chunawala, et al., Homi Bhabha Centre for Science Education, Mumbai, 1994). They all drew on emotions, values, aesthetics, beliefs, etc., but the details comprising the “meanings” were embedded in their geographic, social, and cultural contexts.

As I continued exploring contexts of meaning with different age groups, the same components of contexts of meaning were found in adults, including professional scientists. Curiously, scientists often relied on their unfounded beliefs and assumptions, as well as socially-shared emotional connections to formulate explanations and rationales for how to deal with certain environmental issues. Although they did utilize the established knowledge of their disciplines, they did not rely entirely on this knowledge to make decisions (Bloom, 2006). However, the context in which this data was collected was not a formal one. The ideas we use and express (including our contexts of meaning) vary with the contexts we are in. In the case of this data collection, the spatial and temporal contexts were an informal interview and chat while sitting in the scientists’ offices. What was discussed in these interviews had no real-world consequences, such as actually trying to solve an environmental disaster, but were posed as hypothetical scenarios and what actions should be taken.

Contexts of meaning seem to be ubiquitous among humans. However, my current inquiries focus on whether such contexts of meaning are at play in animals and other organisms. In the spirit of Gregory Bateson (1972/2000, 1979/2002, 1991), this notion of contexts of

meaning is really another way of describing personal and social epistemology. Such an epistemology is not limited to our formal knowledge, which is the focus of philosophical investigations of epistemology, but rather includes a much broader scope of information that plays a major role in meaning development, expression, and communication. In addition, Bateson's "epistemology" or the knowledge held by individuals or groups includes the information contained within DNA and other molecules, as well as the information "remembered" in the brain and throughout the body (also described by Pattee, 2012). As a distributed system, such information also is "remembered" in artifacts (e.g., nests, tools, etc.) and habitats.

One issue with epistemology involves what Korzybski (1948) referred to as a map vs. territory or abstraction vs. reality problem. Personal, social, and philosophical epistemologies are all abstractions. They are NOT the things being described. However, these maps are what we have for making sense of our worlds. Bateson (1972/2000) cautions that a major problem we make is confusing the map for the territory, which is an issue of logical typing (Whitehead & Russell, 1910). The actual object (not observed) is of one type, while each level of abstraction of that object from the moment of perception is of another logical type. Each level of abstraction is the result of the observer's filters, biases, beliefs, and all the rest, including those things not observed. With people, these abstracted representations are a combination of images, semantic description, and the rest of what I have described as contexts of meaning. For a dog, the same combination is still at play, minus most of human semantics, although dogs can acquire extensive knowledge of words, the categories to which words refer, grammar (Hare & Woods, 2013), and even sentences.

### **Story 7 -- Dogs Learning Language**

I have known dogs who take great interest in language. They listen intently and often have a puzzled look as they try to understand human speech. Other dogs I have known were not as interested in language, other than key words, like walk, food, sit, no, etc. Mugetsu was one of those dogs who listened intently and seemed to have a strong desire to understand. Whenever I talked, her ears perked up and she stared at me intently. As a puppy, I took her to a series of dog training classes. Each week, the trainers would give us things to work on, but I was far too busy to spend much additional time going through all the things Mugetsu was supposed to learn. However, I found that I didn't have to spend the extra time. By the time, we finished each class session, she had already figured out what to do. But, this was only the obvious learning of verbal commands. Outside of the contexts of formal training, I would just talk to her in sentences. When walking in a pet store, we'd be approaching an aisle we needed to go down, and I would say, "turn left." After two or three of these repetitions, she would have figured out the meaning, which would work in the forest, in other stores, or on other walks. This sort of learning from talking in sentences occurred

throughout her life, from playing with toys to playing other sorts of games, from how to respond to visitors to telling her “Greg, Guy, or Pepper,” etc. (some human or dog friend) was on the way over (at which point she would stand by the window or door looking outside with anticipation exhibited by wagging her stubby little tail and restlessly changing her weight



*Figure 2 Mugetsu's facial expression as a sign of questioning and anticipation: eyes wide open, ears perked up, mouth open, and in an upright, but not tense, posture.*

distribution on her feet), and so forth. Tone of voice did not seem to matter. I could say such things quietly and flatly or with more excitement. Her response was always the same. She would perk up her ears and her eyes would open widely, then she'd go to the window.

### **Story 8 -- Maps and Territory: Dog and Buried Bone in Forest**

Mugetsu and I would hike (she would run) in the forest near our house almost every day for a couple of years. She knew every part of a  $\frac{3}{4}$  by 3-mile area that was closest to our house. But, one remarkable example of her mapping skills occurred over three days. On the first day, we had be hiking all around our regular part of the forest both on and off trail. She would occasionally run off to chase jackrabbits, then return to continue our hike. On one her rabbit chases, she found a part of a deer skull. When she returned with the skull, she played her typical game of keep-away. When this game involved a skeletal find, it could take hours to either trick her and catch her, which rarely happened, or, more typically, I had to wait until she decided to bury the bones. Sometimes this occurred well-after dark and maybe a hour past when I had intended on getting home. On this particular occasion, she buried the skull off-trail and part way up the side of a mountain. On the way back to the car, we followed the trail south, then east for quite a  $\frac{1}{4}$  mile, the south for about a half mile to the parking lot. We did not go to the forest the following day, but returned on day 3. The minute that I took off her leash. She immediately headed in a NNNW direction to the buried skull, which was about one mile away. So, rather than follow the path we took on our return to the car two days earlier, she beelined it to the buried skull. The dominant wind was from the southwest, so she didn't follow a scent, nor did she follow the scent of our own path which was a zigzag. Her mental or epistemological map of the forest was her guide back to the buried skull. This sort of representation or abstraction is the process that occurs at the moment of perception. Sensory information that is not ignored is



immediately translated into an abstracted representation (Korzybski, 1948). The “tree” in our head is not the tree that was seen, but it does serve as a reasonable representation of the tree, at least in most cases.

The question of the epistemological underpinnings of such language learning and responsiveness is intriguing. Dogs, in this case, attend to human talk, body language, visual signals, and activity. With Mugetsu, my activity was almost always attended to, especially at certain times of days. Mornings or late afternoons were the times for our outings. If I started walking around the house at these times, she would follow me closely with a look of anticipation on her face. However, if I started to put on my shoes, even in a different room and as quietly as could possibly do it, she would appear within seconds with her look of questioning anticipation: the “Are we going somewhere?” look. What was going on in her mind? Certainly, she had all sorts of connections between various actions on my part and possible things we might do together. These interactions were connected to understandings of time. But also, an array of emotions, memories of experiences, and imagery mixed with elements of the English language were involved. Her “maps” or abstract representations of everything in her world of experiences provided rich contexts from which to make sense of everything and from which to communicate and take action.

### **Story #9 – Patterns, Relationships, Contexts and Individual Interests in Dog Epistemology**

As has been explored, dogs’ astute awareness of relationships and contexts play a significant part in their personal epistemologies. Such awareness is also connected to their seeing and acting upon patterns they perceive. In addition, there is an emotional element when combined with what they learn about their contexts that lead to interesting actions on their part. After our first two or three outings in the forest, Mugetsu quickly picked up on the pattern that fallen trees and logs on the ground were associated with lizards. She had three big fundamental animal passions: lizards, rodents, and rabbits. She had passing interests in deer, elk, horse, and cows, but chasing them was always a short run without much continued effort. She also had a big interest in chasing joggers and especially people on mountain bikes. As with logs and lizards, Mugetus also made contextually based connections to other animals. In the forest, rabbits were associated with certain areas of open forest and open meadows, but not the forest on the mountain side. She also knew which specific parts of the forest she was likely to see rabbits. The most common rabbits she saw were jack rabbits, which were about the size of a medium-sized dog. Chasing jack rabbits usually lasted 10 to 15 minutes. One time, we were walking along a trail we had walked on many times. We were about 75 yards up a hill into the forest, when we rounded a curve in the path, and there not 10 yards in front of us were at least two dozen cottontail rabbits. Mugetsu stopped in her tracks. Her eyes looked like they were

about to pop out of her head. But, at the same time, she looked confused. After about 15 long seconds, she realized what was actually in front of her and started yelping excitedly as she took off after the soon to be completely dispersed rabbits. The first sight of these rabbits did not fit into her epistemological map and it took her a while to come to terms with this initial perception.

At the dog park, she quickly realized that rabbits were not in the park, but were found outside the park in specific areas. She knew exactly where to find rabbits in the three primary dog parks she went to. The same sort of contextually-based mappings were applied to rodents. Holes in the forest, which were often just off the trails or next to trees, were connected to rodents. Holes along the inside and outside of the dog park fences, were also rodents. She was not all that interested in birds, unless she found a dead one on the ground, but many of her dog friends were obsessed with birds. Instead of looking at ground level for rodents and lizards, her friends were looking at trees and at tops of fences and poles. Mention the word “bird” and these dogs were running and jumping around the base of trees.

Reading the signs or patterns within specific contexts is certainly a significant adaptive ability in animal cognition and epistemology. For dogs, such abilities are not necessary for survival, but for wild animals, these abilities are essential.

## **Communication**

Communication is a flow and exchange of information. From Bateson’s perspective, such perspective opens up the scope of communication beyond just the intentional, back-and-forth, dialog that typifies everyday understandings of communication (Bateson, 1972/2000, 1979/2002; Ruesch & Bateson, 2008). The three common semiotic phenomena, of signification, representation, and communication, as described by Martinelli (2010), are from a Batesonian perspective all a part of the same system of communication. Even the information from a fallen tree in a forest communicates a difference that has occurred to the dog who typically roams through the area or to the deer and rabbits that live in the area. This is not intentional communication, but it is a flow of information from the forest that may communicate a difference or change that has occurred. Signification appears to be related to unintentional communication. It is the information that may or may not be attended to and made sense of by the perceivers of that information. Representation, in this wider sense of communication, seems to be a transition between unintentional and intentional communication. One creature may take some action to may or may not communicate information to others. A male dog peeing in the forest may communicate all sorts of information that was not intended as well as information that may

be intended. Like the World War II graffiti, “Kilroy was here.” It may communicate with others, but it may not.

### **Story 10 – An Intended Forest Sign as Unintended “Sign” for Non-Humans**

On one occasion, Mugetsu and I drove up to one of our favorite forest trailheads and parked about 50 feet from the entrance, which was demarcated by a gap in the fences. One fence was around the backyard of a house and the other was a simple wire fence separating the National Forest from a church parking lot. As soon as I parked the car, Mugetsu became agitated, which was very different from her typical bounding excitement to be at the trailhead. She was barking with different intonation and pitch, while staring nervously and intently at the trailhead. And, there it was. A National Forest Service sign just inside the fence opening. This sign was new. On our walk up to the sign, Mugetsu continued to bark nervously. She could not figure out what this new “thing” was and why it was there. One thing about Mugetsu was that she always wanted to “know,” she always wanted to figure out events and objects in her world. And, this sign was an issue for her. As we got within a few feet of the new sign, she stopped barking, but nervously smelled and inspected the sign. After a few minutes, she decided it posed no particular threat. Unfortunately for her, the sign was a warning about a new forest fire that was under control, but smoldering in a location about half a mile from the sign. It was a “sign” of danger, but not one she could “read.” Later in the hike we did come across the smoldering remnants of the fire. She examined it with some interest, but with agitation. New objects that were not in her epistemological “map” were very notable to her. Newly fallen trees, new litter, and other differences were always met with interest, and had to be examined. These differences or changes were unintended significations, which needed to be assessed.

### **Story 11 -- Making Meaning: Mugetsu’s Need to Understand – Dogs in Carts and Dogs in Arms**

For Mugetsu, but certainly not all dogs, objects and events in her world needed to be understood. She needed to make sense of almost everything in her world. Maybe this “need” stemmed from her breed, a Doberman Pinscher. Dobermans are sensitive and considered to be very smart. They love being as equal a part of the family as possible. And, they are working dogs, who, in family contexts, will look for and self-assign jobs, whenever possible. As a part of this “working dog” mentality, Mugetsu needed to understand what was happening around her. One particular type of situation she had particular difficulty understanding was dogs in shopping carts or dogs being carried. For the first few years of her life, she would bark with a slightly higher pitch, whenever she encountered such situations. The people whose dogs were in carts or being carried rarely reacted well to her barking, but the dogs never seemed to care. In one instance, we were coming out of a pet store’s grooming salon, where Mugetsu had

just had her nails trimmed, when we bumped into one of her dog trainers who had her own puppy in a shopping cart. Of course, Mugetsu started her high-pitched barking. The trainer, whom Mugetsu loved, was a bit taken aback by the barking. I told the trainer the story of carts and asked her to put her puppy on the floor. With some hesitation, the trainer put her puppy on the floor. Immediately, Mugetsu stopped barking and approached the puppy with her head way down almost touching the floor. The puppy started jumping all over Mugetsu. And, Mugetsu appeared to be satisfied with the change in cart-dog relationship and was quite happy with the new friendship. Mugetsu never fully understood the cart and carrying situation, but her response mellowed. She stopped barking, but always approached such situations with a great deal of sniffing and closer examinations, until she was satisfied that there was no harm being done.

This sort of assessment of danger or harm seemed to be of great importance to Mugetsu. If dogs got into a fight, she would try to distract them into chasing her. If a dog was being harassed by another dog, she would put herself in between the two dogs. If a person was being harassed by a dog or even another person, she interceded in the same way. Although her sense-making of situations was not always accurate, such as with the dogs in carts, she was quite good at assessing other situations of dog to dog, dog to people, and people to people conflicts. The signs she perceived and assessed often were not apparent to the human observer. Two dogs might start fighting, and Mugetsu would sprint towards them, while also assessing the situation. On quite a few occasions, she would get halfway to the two dogs, stop, turn around, and come back to where I was standing. During a full sprint, she would see that the situation was not serious and abort her mission. Sometimes I could see that the situations were not serious, but most of the time, I just saw a fight starting.

### **Story 12 – Working: Understanding, Meaning, and Action**

Mugetsu was member of a working dog breed. Originally, Doberman Pinschers were bred for protection. Mr. Doberman was a tax collector and bred them for his own protection. However, in recent decades they have been used for a variety of different “jobs.” Mugetsu was just a family dog. But, her self-assigned job was to alert us of anyone passing by the house in cars or walking, as well as any rabbits, dogs, or coyotes that might be in our yard or nearby. However, she also looked for work to do. If my wife and I were raking the yard, she would find twigs and branches, then bring them over and drop them on the leaf pile. On another occasion, we had a repairman come over to fix broken pipes in our inherited underground watering system. As he dug holes at each leak, Mugetsu followed him from hole to hole “finishing” the digging he had done. Okay, you might be thinking that is just a dog doing her digging thing. But,

after the repairman had replaced the pipes, he started filling in a hole. When Mugetsu saw this, she ran to another hole and started pushing dirt back into the holes.

After this incident, I started to notice that when these same sort of watering systems were running in the dog park Mugetsu would dig up the watering heads and remove them. I am sure this did not please the city employees who took care of the park. However, I began wondering if her experiences with the repairman, affect her sense-making around sprinkler heads. Did she in some way associate water coming up out of the ground at the problem and that removing the watering head would help address the problem? I have no idea what she was thinking, but such transferences across contexts is intriguing.

Bateson also described how the codification of shared experiences and shared common aspects of anatomy and bodily function allow for communication to occur more easily within species. However, there are examples of such shared codifications occurring across species, as well. A few examples of such common codifications are described in the following stories.

### **Story 13 – Communication of Pain**

Mugetsu hurt herself on several occasions. A couple of these occasions involved intense pain resulting in her lying on the ground yelping and whining. Such behaviors certainly communicated her pain, but they were not necessarily intentional communicative actions. However, there were numerous incidents of Mugetsu stepping on a cactus. She rarely made any sounds, but would just sit staring at me while holding up her paw. If she stepped on a cactus while out of sight, she would limp towards me, then hold up her paw. These intentional communications were simple and direct.

### **Story 14 – Communication of Desires, Timing, and Gratification**

During my career in science education, I had set up several “science teaching education rooms” with a variety of equipment and supplies for involving students in teaching through inquiry at different universities. In my last university, I added several saltwater aquaria and a balanced freshwater pond aquarium. In the saltwater aquaria, most of the fish acknowledged people’s presence by staying at the far side of the aquarium or by just ignoring us as best they could. However, we had a few Porcupine Puffers, who were much more social. One would follow people back and forth as they walked by. I suspected it wanted to be fed and often. Another larger one, developed a more direct way of communicating. When we showed up to feed the fish in the Puffer aquarium, this big Puffer would be at the surface waiting when we opened the cover. If we didn’t put the food into the aquarium quickly enough (on the order of two seconds or so), he would spit at us. This spitting involved a significant volume of saltwater,

which ended up on our shirts and pants. He was given the name “Little Shit” from the utterances we made when getting drenched. But, his direct way of communicating worked. We prepared the food and had it ready when we opened the cover. If we forgot or got distracted, we always paid the price.

Fish in the pond aquarium did not need to be fed, since there were plenty of things growing and reproducing in this habitat. But, the fish in the aquarium started hovering around the glass and following us whenever we walked by. After of week or two of this, we began throwing in some food occasionally. Before long, feeding became a regular routine.

Back in one particular saltwater aquarium, we had two Picasso Triggerfish. One was about five inches long and the other was about two inches long. The larger one would rub up against our hands or arms as we cleaned the aquarium or when we just put in our hands to “say hello.” However, the small one never came near us and usually hid behind rocks when we put our hands in the water. One morning we came into the room and found this small Triggerfish on the floor. He was dried out and red. I thought he was dead, then my student worker noticed gill movement. I picked him up, and moved him through the water trying to get oxygen into his system. After a few minutes, he started breathing and then somewhat awkwardly swimming with slight loss in an ability to stay up right. We then added some antibiotics to the water. Within a few days, this little Triggerfish was back to normal with one exception. When we put our hands into the aquarium, he no longer hid behind rocks, and came up to us. His epistemological orientation seemed to change with his brush with death.

### **Story 15 – Points of Contact**

Anatomic orientation between species is intriguing. Some dogs who are not afraid of looking into human eyes will come almost nose to nose and stare into your eyes. Mugetsu did this with me all the time and even with complete strangers who she seemed to like. However, strangers almost always looked away or backed off. For dogs, who do not feel comfortable with this close-up eye contact will still make intense eye contact from a distance (Horowitz, 2009). They seem to be able to “read” a great deal from people’s eyes.

The idea behind eyes and face is that it is this part of the anatomy where the primary point of communicational contact lies. Faces of mammals are reasonably similar, as are the eyes. However, as the anatomical layouts begin to vary between different Phyla, the “face/eyes” point of contact still appears to be significant. When I was about 19-years old, I was working in an aquarium showplace. One day, the curator asked me if I could fill in for one of the divers for a demonstration dive in their two-story

freshwater aquarium. Of course, I said, “yes,” and quickly changed into a swimsuit and donned the Scuba gear. After I swam down to the bottom, I stood there. After a few seconds, a school of about 30 catfish swam around the bottom of the circular aquarium and came towards me. As they came near, they started coming up off the bottom until they reached the level of my head, at which point, they all stopped and stared into my face mask. I could hear the oohs and ahs of the people watching on the outside. It struck me at the time, that even with a face mask on, they moved to that point of contact, rather than my knees, feet, or stomach.

The same sort of recognition of anatomical point of contact seems to occur between even more divergent species. The octopus and the diver in *My Octopus Teacher* film made tactile contact, but also my eye contact. The Puffers in my aquaria made eye contact with humans. The extent of such recognition of anatomical points of contact is an intriguing question. What sorts of information flow between species and individuals of organisms without the features and organs of animals? Some hint of such information sharing is being found between trees (of the same and different species) and fungi (Buhner, 2014; Witzany, 2006).

## **Discussion of Relationships, Contexts and Epistemology in Biosemiosis**

Throughout this exploration and analysis, I have primarily relied on Gregory Bateson’s notions of context, relationship, communication, and epistemology. Both context and relationship are given very little attention in the biosemiotics literature. And, epistemology as a description of personal knowledge is only discussed occasionally (examples: Bopry, 2002; Pattee, 2013). However, umwelt which appears to overlap with personal epistemology is a significant part of the semiotic literature (Deely, 2001; Martinelli, 2010). Umwelt concerns how the world is perceived by an organism. Umwelt also appears to be related to a more expansive version of Pepper’s “world hypotheses” or worldviews (Pepper, 1970; Cobern, 2000). In contrast, personal epistemology is the codification of perceptions and experiences, along with emotions, imagery, and so forth as might be generated along with the perception, experiences, and thoughts or ideas in whatever form they take (Bateson, 1972/2000, 1979/2002; Hofer & Bendixen, 2012). In addition, epistemology is a loosely organized, fluid, and dynamic feature of cognition, which again can vary in form. What is being discovered about the cognition of trees (van Duijn, 2017; Wohlleben, 2015) is dramatically different from the cognition of mammals, including humans. Yet, the fundamental processes of information intake, storage, organization, and utilization follow similar patterns.

In the present Batesonian-situated paper, personal and social epistemologies include information about contexts and relationships. Communication is an expression of this epistemology, as well as a contributor to an individual's or group's epistemology. Social epistemology also is related to the idea of distributed cognition (Cárdena-Garcia & Ireland, 2017; Hutchins, 2000). Shared social epistemologies arising from distributed cognition are interesting in that we often assume that the informational codings among individuals in a group are identical. This assumption is a deeply embedded fallacy of educational institutions. Socially-mediated codings are still subjected to individual biases, prior knowledge and experiences, and so forth. This sort of variation in coding can lead to misinterpretations of signs or messages and meta-messages, such as when fights arise during play in dogs or when people find themselves in awkward or hostile situations when such misinterpretations occur during various sorts of interactions.

We also need to remember that contexts, relationships, epistemology, and communication are not solid, unchanging entities or features. They all are fluid and dynamic. In addition, it is important to keep in mind that all the information held by individuals and groups (i.e., epistemology) about context, relationships, and so forth are abstractions (Bateson, 1970/2000, 1979/2002; Bopry, 2002; Korzybski, 1948). Such a view of cognition, in whatever form that takes, appears to be ubiquitous among all life forms. From bacteria that communicate, negotiate, and organize themselves (Popkin, 2017) and bacteria and archaea that use electricity in a variety of ways, including to build electrical conduits to warm their colonies (Conley, 2019; Straub, et al., 2018) to the diverse cognitive abilities and communication of mammals, epistemology and the abilities to communicate certainly appear to be a characteristic of life.

Examining signs as expressed visually, audibly, tactilely, and odiferously (including other chemical sensing such as taste) through the lenses of Batesonian relationship, context, communication, and epistemology, changes our perspectives in interesting ways. In contrast to the long-standing notion that dog play is prep for fighting, dog play seems to be more focused on developing relationships and trust, as well as for maintaining a sense of psychological well-being (Gray, 2011). Another similar interpretive pattern of dog behavior involves barking as a warning along a scale of aggression. Although some rare barks can be warnings, most barking manifests as an alert, as a sign of wanting something, as an expression of nervousness or fear, as a greeting, as an expression of excitement, and so forth. Some barks are difficult for humans to decode, although other dogs usually have no issues doing so. The tonal quality, frequency of barks, loudness, etc. all seem to have different meanings in specific contexts and relationships. Not understanding barks often occur when we cannot discriminate the subtleties in the barking or when we cannot fit the barking to the appropriate context. One such example with Mugetsu first occurred when my wife and I were sitting on a small couch watching TV. Mugetsu started barking while



looking intently at us. After several seconds, I thought that maybe she wanted to go outside even though the signs were not typical for that particular meaning. However, when I got up to go to the door with her, she promptly climbed up onto the couch and lied down where I had been sitting. I ended up sitting on the floor. She repeated this scenario over the years, but we had learned to read the signs.

In order for signs to have meaning, there must be rather elaborate learning taking place. Nora Bateson's theory of symmathesy, or mutual contextual learning, describes the primary processes of learning. Such learning is at the fundamental level of "point of contact" between organisms and organisms, organisms and contexts, context and contexts, and so forth. Symmathesy usually is not intentional or particularly evident to the organism that is learning. At the same time, learning at this level involves a dynamic of survival and relationship, but such learning also involves even more than just survival. The roots of meaning, of developing relationships, and of stimulating further learning all take place within symmathesy. All the learning that occurs during symmathesy also feeds into the development of personal and social epistemologies. Such epistemologies may occur in spaces such as those described in schema theory. From a schema theory (McVee, Dunsmore, & Gavelek, 2005) perspective information is loosely associated in somewhat contextually bounded spaces. McVee and others describe such spaces as Vygotsky Spaces. I do not like using the mechanistic language used by McVee and others, such as "knowledge construction," so instead, a language more compatible with complexity, we can refer to schema spaces as the places where organizing and associating of knowledge occurs. The boundaries of these spaces or contexts are, in themselves, rather fuzzy and highly porous. Information flows, often recursively, across boundaries as well as within the contexts or spaces themselves.

The epistemologies or knowledge that develop in organisms and various social contexts are relevant to the contexts of living and survival, with the exception, as far as we know, of humans. In order to be useful for survival and everyday life activities, epistemologies need to be comprised of information about relationships and contexts. An example of such relationships may include a focus on food locations as related to time of year or time of day; to what foods are located where; to what is needed to obtain food, etc. However, in the experience of human beings, knowledge of relationships and contexts mostly occurs outside of formal education. The emphases of educational institutions are focused on providing fragmented, non-relational, and de-contextualized information (Marshall, Sears, & Allen, 2007; Sears & Marshall, 1990). Our assumptions about learning often are based on our experiences in the educational system. Such assumptions then affect the way we think about the meaning of knowledge and personal epistemology. Human personal epistemologies are most often a collection of disjointed information and unfounded beliefs. However, in the rest of the living world, epistemologies are essential for surviving and living

more or less successfully in the contexts in which various organisms live. These organisms cannot afford to have personal epistemologies riddled with disjointed information.

The development of epistemologies in the non-human realm are based on learning from parents, from intraspecies interactions, from interspecies interactions, and from interactions across contexts. The basis of this epistemological development, as mentioned, is through the processes of symmathesy. Play, as one component of symmathesy, is critical not only to learning and epistemological development, but also to the development of cognitive processes (Underwood, 2019). With Mugestu, her play began in typical puppy fashion with lots of chasing and wrestling with her human and dog friends. But, over time, other features were added to this kind of play. She began adding more subtle games, such as those focusing on deception and tension building. Each of these extensions appear to fit with what Gregory Bateson (1979/2002) described as finding the limits of possible through play, as well as exploration and crime.

The expressions of signs, whether intentional or not, are expression of context and relationship. They also express different levels of abstraction – contexts of contexts and relationships between relationships. This sort of metacommunication is essential. Dogs cannot play without metacommunication. They have to, as clearly as possible, communicate that what appears to be aggression is not aggression, but is play (Bateson, 1979/2002). In Story 2, Mugetsu's communication that the context we were in had changed because of another level of context. The context of our forest walk exploration was suddenly superseded by the context of a Mountain Lion. But, even the "not aggression, but play" is a communication of meta-contexts. The same sort of contextual meta-messaging also was evident in Story 10, where Mugetsu noticed a sign that did not belong in the context of the forest. Her abstraction, a mental map of the forest, did not have this physical object (a Forest Service sign) in it. Something was out-of-place, and that new object signaled that she should be on alert.

From the perspective I have described here, living organisms, various groupings of organisms, species, and biological communities or ecosystems must be intensely aware of the contexts and the world of relationships in which they live. At the same time, the symmathesetic learning that takes place within these two critical areas of experience feeds into the development of personal and social epistemologies. These epistemologies, in turn, provide the substance for unintentional and intentional communication within and across species. Also, from this perspective, all of these aspects or components (i.e., relationships, contexts, symmathesy, epistemology, and communication) are comprised of dynamic processes that are a part of the complex adaptive systems, which are critical to the survival of individuals, species, and various social and ecological systems.

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