INTEGRATING DARWIN'S "VIEW OF LIFE" IN ANTHROPOLOGICAL KNOWLEDGE/EDUCATION: FOREGROUNDING HUMAN-NONHUMAN ENTANGLEMENTS

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Although no anthropologist today, teaching a course in the discipline, would fail to narrate a version of the evolutionary story, the dominant view seems to be that evolutionary dynamics are already superseded by "cultural" processes in the case of humans. What seems to be missing is appreciation of the full toolkit of concepts within recent evolutionary theorizing that are directly relevant to key anthropological/social science debates.

This paper argues that if anthropology is to seriously engage evolutionary theorizing beyond the usual evolutionary storytelling, a formal course in this area should be relevant in advancing the students' grasp of multilevel ecological dynamics. The main purpose of this Darwinian perspective in the social sciences is not simply to tell an edifying story but also to explain present ecological interactions in local communities and appreciate the full range of diversity in life-phenomena, human and nonhuman. The paper surveys some of the most recent theoretical and methodological approaches in recent evolutionary theorizings that are of interest from the perspective of the social sciences.

The social anthropologist Adam Kuper (1994), former editor of *Current Anthropology* and who has taken the 'history and theory of social anthropology' as one of his major foci, greatly simplifies the otherwise complex diversity of anthropology's "research projects" by locating their three foundational cores. However bushy the phylogenies of these traditions are, they always have these generative figures in their ancestry: Boas, Durkheim, and Darwin. Kuper points that the "broad enterprise" of anthropology has been shaped not by one but "three shared abstractions:" "culture," "social structure," and "evolution." They form "a set" and "every anthropological theory is in effect a hypothesis concerning their interactions" (Kuper, 1994, p. 117).

Historically, the first two traditions, coming from American and Western European constellations respectively, have gone through several transformations, with their thematic cores continuing. The Boasian line's relativistic view of 'culture'—concerned with "description and interpretation rather than explanation," "the particular rather than with the general" (Kuper, 1994, p. 113) — eventually took a 'radical form' in 'postmodernism.' The 'social anthropology' of Western Europe, on the other hand, "tends to be Durkheimian," mixed with some Weber and Marx (Kuper, 1994, p. 114) prompting some anthropologists to reify this mantra-like trinity: Marx-Weber-Durkheim. If the former tradition is disciplinarily close to the Humanities, the latter is closely related to, if not an evolutionary branch of, Sociology.

The Darwinian thread of anthropology, rightly pointed by Kuper, is here being re-assessed by presenting a re-reading of the canon of evolutionary framework, *The Origin of Species*. In three takes, the paper will emphasize a perspective—complex interactions of humans *and* nonhumans—that is central in Darwin's "view of life" but quite peripheral in the way 'Darwin' and 'evolution' is presented in most anthropological study and pedagogy. If this Darwinian view is to be fully integrated into the disciplinal core of the "science of humans," such perspective in the study of human reality and the teaching of anthropology needs foregrounding. Anthropological knowledge and education, then, need not always be *anthropo*centric, both in its handling of methodological tools and in its cultivation of key notions like sociality and agency.

Clovers, Mice, Women and Empires: A Darwinian Tale

In a chapter on the "struggle for existence" (Darwin, 1958, pp. 73-86), an ecological narrative is given of this "web of complex relations" linking, via winding threads, beings "remote in the scale of nature." One such web of relations that Darwin outlined was then expanded into a classic socio-ecological case: the tale of the red clover, bumblebees, field-mice, cats—and by extension (Farb, 1970, pp. 35-36)—old maids, cattle, and the British navy.

Mark how, in the 19th century, the above entities, otherwise separate, are wrapped together in a unique kind of Darwinian relations: red clover plants (*Trifolium pratense*) are dependent on species of bumblebees for their pollination; to a great measure, the number of

bumblebees are dependent on the number of field-mice, which destroy the comb and nests of bumblebees; the number of mice are dependent on the number of cats—hence, 'the presence of feline animals in large numbers determine, through the intervention of mice and bees, the frequency of red clovers in a certain district.' In Darwin's time, red clovers are major foodstuffs of cattle; bully beef, in turn, is the staple food of the soldiers and crews of the British Navy, a key plank in its imperial sea powers. Where do old maids enter into the picture? T. H. Huxley, an early supporter of Darwin, half-jokingly cited the cat-protecting behaviors of British spinsters! Delimiting such set of relations, therefore, serves to highlight the possible links that felines and females play in a network of entities, via clovers, bees, mice, and cattle, sustaining[1] the British Empire! This tale, while perhaps loose, is paradigmatic of a Darwinian style emphasizing multi-organismal links and serves to dramatize a central point being developed here.

Human-Nonhuman Dialectics in Darwin's *Origin*

Societies of humans and nonhumans. In the most detailed description, "societies" are always networks of humans and nonhumans and only differ in the configuration and the strength of these relations (Latour, 1993/1999). The elements composing the system/network we call "society" is not pre-given as always of the *human* kind. I want to elaborate this perspective by re-reading Darwin's major text, *The Origin of Species* (1859). I think that a re-reading of that text from the perspective of human-nonhuman dialectics is congenial to its basic design. Secondly, when Darwin positioned the phenomenon of "domestication" into the core of his narrative, he also provided it an explanatory mechanism.

Humans and nonhumans share both an evolutionary past *and* a complex social history. As mentioned above, this is part of the more general interweaving of lives of humans and nonhumans. The histories of human communities are thickly enfolded with the *nonhumans*, defined in its broadest sense—domesticated animals, cultivated herbs, parasitic lifeforms, venerated mountains, polymorphic amulets, magical stones, concocted chemicals, and an allotrope of artifacts. From the perspective of sociality and agency, these entanglements are simultaneously constraining and enabling. In the evolutionary biology of many of our domesticated animals—dogs, pigs, cows, goats, horses, sheep, and many others—humans form as a major selecting agent in their anatomical and

behavioral design. Conversely, the animals, directly or indirectly, also act as one of the agents aiding human evolution and history.

Reading dialectics in Darwin's text. Domestication, selection, and coevolution are significant processes in human-animal relations. To appreciate the theoretical links of these concepts, I present below a re-reading of the canon of evolutionary theory, *The Origin of Species*. I want to show that the logic and flow of the text tie the three together.

The first chapter, "Variation under Domestication," directly opens with the practice of "domestication" by humans and proceeds with an analysis of the principles facilitating it. In domestication, humans are able to direct—to some extent—the shaping of traits in organisms by selecting favored individuals from a population of variants:

> The key is man's power of accumulative selection: nature gives successive variations; man adds them up in certain directions useful to him. In this sense he may be said to have made for himself useful breeds (Darwin, 1958 [1859], p. 48).

The reason why Darwin takes this seemingly simple phenomenon is because he will be using it as a take-off in demonstrating a force acting in life processes. The ordinary practice will be given theoretical standing. In the conscious and "unconscious" selections done by breeders are inscribed the simplified, micro-evolutionary analogues of the more complex selectional processes effected also by nonhumans.

> The second chapter, "Variation under Nature," shows this by its apt preview: Before applying the principles arrived at in the last chapter to organic beings in a state of nature, we must briefly discuss whether these latter are subject to any variation. To treat this subject properly, a long catalogue of dry facts ought to be given... (Darwin, 1958, p. 58).

The succeeding chapters, therefore, are ways of "applying" the power of selection seen under the state of culture ("domestication") to processes under the "state of nature:"

> Can the principle of selection, which we have seen is so potent in the hands of man, apply under nature? I think we shall see that it can act most efficiently. Let the endless number of slight variations and individual differences occurring in our domestic

> productions ... be borne in mind. ... Can it, then, be thought improbable, seeing that variations useful to man have undoubtedly occurred, that other variations useful in some way to each ... should [also] occur... (Darwin, 1958, p. 87).

The next three chapters "Struggle for Existence," "Natural Selection" and "Laws of Variation," complete the five-chapter core presenting the logic of the mechanism being endorsed. These chapters are careful, step-by-step elaboration of the key points: first, the incessant interactions in the biological realm—"struggles"—and then the unequal productive and reproductive chances of varied bio-forms—"selection"—and finally, a second take on the mechanisms generating "variations."

The pervasiveness of available variations already given (II), it now speculates on the conditions that might have produced those elemental differences. This last chapter—evaluated by our present sophistication in molecular details—may be seen to be the weakest of the five chapters. The text gropes in trying to name the reasons why individuals always vary—and in the end, it simply has to acknowledge knowledge-gap:

> Our ignorance of the laws of variation is profound. Not in one case out of a hundred can we pretend to assign any reason why this or that part has varied (Darwin, 1958, p. 156).

But the chapter is so instructive in its very weakness. It shows that the theory can afford to be agnostic of the mechanisms underlying the generation of those variants. Its robustness, in fact, derives from black-boxing this aspect of biological processes. By whatever ways they are generated—whether by "pure chance" or by some degree of organismal/internal channeling—as long as they arise, selectional forces from any one of the interactants opportunistically sort them.

The architecture of the text is so well designed for compressing in only five chapters all the necessary elements of the theory. The succeeding ten more chapters are added refinements and empirical demonstrations in support of the constructed schema. Four chapters are answers to possible points of objection to the theory (VI-IX). Another five chapters are empirical surveys of the three major aspects of life processes—evolutionary time, spatial distribution, and individual developmental process—the geological record (X-XI), biogeography (XII-XIII), and embryology[2] (XIV). The last chapter makes a recapitulation of the basic arguments of the whole book (XV). In tightly-woven fifteen chapters the *Origin* unified the sciences of Life of its time.

Bidirectional selection. By noting the inversive application of selectional processes, the principle of bidirectionality of selection is seen as implicit in the presentation. First, humans are portrayed as the selective agents; next, nonhumans ("Nature") in return are described as even more "incessant" in effecting selectional force. The effects of human "Art" is intertied with the *co*-actions of "Nature:"

> We have seen that man by selection can certainly produce great results, and can adapt organic beings to his own uses, through the accumulation of slight but useful variations, given to him by the hand of Nature. But Natural Selection, as we shall see hereafter, is a power incessantly ready for action, and is immeasurably superior to man's feeble efforts, as the works of Nature are to those of Art (Darwin, 1958, p. 74).

The symmetry of the first two chapters—symptomatically reproducing the long-staying Nature/Culture dichotomy—recurs in the above quote. Variations—acted either by domestication-Man-Art (=Culture) or "Nature:"

> Man selects only for his own good: Nature only for that of the being which she tends.... How fleeting are the wishes and efforts of man! how short his time! And consequently how poor will be his results, compared with those accumulated by Nature.... It may metaphorically be said that natural selection is daily and hourly scrutinizing, throughout the world, the slightest variations... silently... working, *whenever and wherever opportunity offers*... (Darwin, 1958, p. 90, emphasis added).

There, certainly, are textual tensions, but if one views the processes together, one sees also in the text an implicit schema of human/Culture and nonhuman/Nature co-actions. According to the eminent evolutionary biologist Ernst Mayr (1982), the philosophical implications of Darwin's works are destructive of the rigid Nature/Culture dualism, even as aspects of his texts are still haunted by it.

Essentialist vs. populational thinking. Cumulative generational selection leading to biological redesigns presupposes an inexhaustible pool of variants to select from. Mayr (1982) shows that Darwin's realization of the general applicability of the principle of selection is simultaneously aided by his appreciation of the "populational" nature of

what is demarcated as "species"—in sharp contrast to the deeply-rooted tradition of biological "essentialism." Mayr calls essentialism "the most insidious of all philosophies" (1982, p. 249). It conceals the wealth of differences within the demarcated species because of its emphasis on the underlying "essences" (unchanging universal elements) that is supposed to be possessed by individuals to qualify in a given biological "set." Essentialism gives reality to the Type and considers deviations from it as anomaly.

In contrast, the "populational thinking" in biology considers the specimen types as pragmatic abstractions and emphasizes the wealth of individual differences—always present and ever arising—in any population of sexually reproducing organisms. It surely has not escaped one's notice that the anti-essentialist element basic in evolutionary theory makes a fallacy of the notion equating Biology with *universals.* Multiformity, time, and change are the beats in Evolution.[3]

It is quite exhilarating to read even now this more-than-a-century-old text: commencing with the deceptively simple phenomenon of "domestication," documenting the evidences for Variations and Struggle for Existence and—rounding it off by an if-then logic—finally arriving at a still-useful formulation of *one*[4] of biology's arsenal in explaining biological forms: evolution by "natural selection."

Biological "adaptation" is a pre-Darwinian notion long preached by "Natural Theology" even up to Darwin's time (Mayr, 1982, pp. 103-105, 343-393). By grounding it in the selectional principle, Darwin gave dynamism to a static concept. Henceforth, observed adaptations will be interpreted as temporal products—always temporary—radically contingent on the shifting ecologies of interactions. Every adaptation is a durational outcome of the unceasing "struggles for existence" and *changes* its value as contexts and strategies change:

> Battle within battle must be continually recurring with varying success; and yet in the long-run the forces are so nicely balanced, that the face of nature remains for long periods of time uniform, though assuredly the merest trifle would give the victory to one organic being over another (Darwin, 1958, p. 82).

Struggle and interdependence. Although popularly suggestive of a Hobbesian all-out "Warre"— *bellum omnium contra omnis* — Struggle for Existence is to be interpreted "in a large sense" to include *both* the conflict and symbiosis observable in every life process. The text is

conscious of the overtones and so lengthily elaborates on the dual competition-cooperation sense intended by the term "struggle:"

> I should premise that I use this term in a large and metaphorical sense *including* dependence of one being on another.... Two canine animals, in a time of dearth, may be truly said to struggle with each other which shall get food and live. But a plant on the edge of a desert is said to struggle for life against the drought, though more properly it should be said to be dependent on the moisture. A plant which annually produces a thousand seeds, of which only one of an average comes to maturity, may be more truly said to struggle with the plants of the same and other kinds which already clothe the ground. The mistletoe is dependent on the apple and a few other trees, but can only be in a far-fetched sense be said to struggle with these trees, for, if too many of these parasites grow on the same tree, it languishes and dies. But several seedling mistletoes, growing close together on the same branch, may more truly be said to struggle with each other. As the mistletoe is disseminated by birds, its existence depends on them; and it may methodically be said to struggle with other fruit-bearing plants, in tempting the birds to devour and thus disseminate its seeds. *In these several senses, which pass into each other*, I use for convenience' sake the general term of Struggle for Existence (Darwin, 1958, pp. 74-75, emphasis added).

Internal forces and structural constraints. Recently, the late Stephen Jay Gould (2002) provided a very detailed historical-technical discussion on the "structure of evolutionary theory." The over-emphasis given by the *Origin* text to the "external" forces (environmental), the main element of the theory given *directional* power—as opposed to the "internal" forces or "constraints"[5] —e.g., the developmental/genetic *Bauplane* (underlying structure) of the "individual" agents in the macroevolutionary level (e.g., species or phylum)—is re-assessed given the growing empirical findings of evolutionary-developmental biology showing the directional role of "deep homologies" across phyla in the shaping of organisms.

Related to this recognition of the "internal" aspect of evolutionary theory is the underscoring of the *active* role of organisms in shaping their effective environment. Although the co-evolutionary view, as hinted

above, is implicit in Darwin, it is only recently that the *niche-constructing role* of varied organisms is seriously given theoretical attention.[6]

If cleaned of the "externalism" and its "progressivist" tandem (Gould, 1998b), which is a function of the social context, and given a necessary balance of "external" and "internal" approaches,[7] Darwin's core formulation is still robust (Gould, 2002).

The logic of Darwinian explanation. I am paraphrasing-quoting it below to highlight how carefully Darwin presents each condition and weighs the empirical evidence for each, before deducing the principle:

> If organisms show individual differences in almost every part of their structure (and this cannot be disputed); and If there be a severe "struggle for life" at some age, season, or year (and this certainly cannot be disputed); then, (considering the "infinite complexity" of the relations of organisms to each other and to their "conditions of existence," causing an infinite diversity in structure, constitution, and habits) I think it would be a most extraordinary fact if no variation ever had occurred useful to each being's own welfare, in the same way as so many variations occurred useful to man [in reference to domestication or selectional breeding]. But if variations useful to any organism do occur, then, individuals thus characterized will have the *comparative* chance ["the best chance," in original] of being preserved in the struggle for life; and from the "strong principle of inheritance," these will *tend* to produce offspring similarly characterized. This principle I have called Natural Selection (Darwin, 1958, p. 128).

The philosopher of biology Daniel Dennett calls the principle "an algorithmic process," and writes that Darwin's "short and sweet" deduction is a presentation of a formal argument: "*if* the conditions are met, a certain outcome is *assured*"[8] (Dennett, 1995, p. 48). So that if there is an observed pattern and design, *one* of the interesting things worth checking would be the selectional process generating it. The heuristic questions would be: what is the design for?; what available variants historically preceded it?; who/what are the selective agents?; what is the context of the interaction? (Mayr, 1983).

Considering the important role of "constraints," as mentioned above, the other equally interesting question that must also dialectically inform evolutionary analysis should be: what is the relative role of the

organism's structure in directing the change—or, as is equally possible, what is the role of internal channels in "pushing back" selectional forces for change and maintaining relative stasis or non-change in some aspects of the organism (or system)?

Selection presupposes interactions. "Selection" is just a shorthand term and should not be associated always with conscious intentions,[9] as in the case of processes done by breeders (Darwin, 1958, p. 88). And in fact, even among breeders, some "unconscious selection" (*ibid.*, pp. 50-55) happens in cases when one consistently selects for a favored trait and to be surprised later that some other not-intended traits are carried along in a hitchhiking manner. Biological "selection" is simply used to refer to situations wherein variant forms acquire unequal chances in being reconstructed/transmitted[10] cross-generationally. These unequal, non-random chances are complexly generated and depend on: [1] the spatio-temporal context of any biological interaction; [2] the identity and number of the interactants;[11] and [3] the varying effects exerted by the interactants on each other, given (1) and (2).

These interactants are the possible selective agents and they could be animate or inanimate, conscious, unconscious or non-conscious. Needless to say, these varying chances due to selections are what generate some/much[12] of the designs and diversity among lifeforms.

From a philosophical point of view, therefore, Darwin's *Origin of Species* consists of two sorts of demonstrations: "the logical demonstration that a certain sort of process would necessarily have a certain sort of outcome, and the empirical demonstration that the requisite conditions for that sort of process had in fact been met in nature" (Dennett, 1995, p. 49, emphasis added).

Darwin and the anthropology of human-nonhuman interactions. As mentioned above, I am re-reading Darwin to highlight Nature-Culture entanglement in one of the foundational texts of both biology and anthropology. I also dwell at length on this variation-constraint-selection theme because these processes underlie much of the dynamics in animal/plant-human relations. In the case of domestication, humans are presented with an ever-replenished pool of domesticable variants; they then bias the chances of individual traits' reconstruction/transmission into succeeding generations by favorably selecting some individuals as against others according to certain culturally based criteria.

Sustained cycles of selections along a certain line will trace a directional modification in organismal forms within a population: that is why the most apt phrase describing evolution is still Darwin's "descent

with modification." Domestication, by this view, is a kind of "cultural selection." We shape, or reshape, the animals/plants according to our preferences—with each tinkering, of course, incurring benefits and costs. But other lifeforms (and nonhumans in general) also shape humans in return: a kind of *non*human "domestication" of humans! Human populations provide a wealth of variations for other lifeforms to "exploit," in the context of their own "struggles for existence." Selection works bidirectionally, if unequally and with variable values over time. To borrow Lewontin's dictum, all organisms are both "subjects and objects of evolution," and all in all, the chapters of *Origin* are well-crafted links forming "one long argument" for the simple mechanisms taking charge of the complex branching and convergences going on in every life processes (Lewontin, 1985, p. 426).

From a dialectical vantage point, the text can be read as an argument for integrating the observed selectional effects of human actions ("domestication") to a general view in which both humans and nonhumans are considered agents in modifying their very lifeforms. The text, therefore, closes with appropriate grandness:

> It is interesting to contemplate a tangled bank, clothed with many plants of many kinds, with birds on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other in so complex a manner, have all been produced by laws [read: biological regularities and interactions][13] acting around us.... There is grandeur in this view of life, with its several powers, ... that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved (Darwin, 1958, p. 450).

Darwin Beyond Origins: Socio-Ecologies of Humans and Nonhumans

Taking the "view of life" presented by Darwin from the perspective of human-nonhuman ecological relations changes the way "evolution" is usually presented and approached. In the popular view, "evolution" and "Darwin" almost always refer to the search for origins of any present entities. A re-reading, however, of Darwin's *Origin* text, shows that it is,

if not predominantly, *as much* busy with the deep ecological bonds enwrapping organisms as with giving stories about their deep-time origins. Darwin's emphasis on the "deep organic bond" among organisms across, equally, *space* and time—emphasizing the ecological play among humans and nonhumans—should be restored in popular and scholarly presentations in anthropology.

There are a growing number of studies directed specifically on the relations between humans and nonhumans. A sample of these highly interesting works is surveyed below.

Animals as agents in shaping humans. In a recent article on the coevolution of humans and microorganisms, F. Jackson (2000) presents an analysis of the spiraling defensive and counter-defensive strategies developed by the interactants. These strategies are inscribed in the very bodies of modern-day humans and their coevolving parasites. In his words, "the genetic composition of present-day human populations is determined largely by the interactions between the human host and infective agents" (Jackson, 2000, p. 273). These interactions are "fundamentally biocultural" as they "embody both biological and cultural processes" (Jackson, 2000, p. 275):

> There has probably never been a time in our species' evolutionary history when we have not had contact with, hence been influenced by, organisms capable of causing us sickness, disease, or death. Our complex and longstanding interactions with various infectious lifeforms—be they viruses, bacteria, protozoa, or helminths (i.e., worms such as nematodes, cestodes, and trematodes)—have helped define us both phenotypically and genotypically (Jackson, 2000, p. 273).

Jackson's detailed survey recalls the popularized synthesis previously given by Diamond (1999). Measles, tuberculosis, smallpox, flu—to mention a few of the diseases caused by microorganismic pathogens—result from our animal-cohabiting culture. The neolithic, which gave us livestock, was also instrumental in breeding many of the diseases, those "deadly gifts from our animal friends" (Diamond, 1999, p. 195). They are "crowd diseases"[14] and need sufficiently numerous and densely packed populations to sustain themselves. And so because social animals have these demographic prerequisites for breeding disease-causing microbes, when we started domesticating them, "they were already afflicted by epidemic diseases just waiting to be transferred" to the early

domesticators (Diamond, 1999, p. 206). In the long-term, however, these "deadly gifts" have political by-products: the populations that were first infected eventually developed immunity and their *embodied* microbes helped the conquistadors decimate vulnerable natives (Diamond, 1999, pp. 213-14).

Parasite sharing is also common not only between humans and their domesticates but also between humans and their alloprimate relatives. Baulu, et al. (2002) provide a list of viruses, parasites, and protozoans in different monkey species and Vo (2002) reports on the intestinal parasites (hookworms, whipworms, nodular worms, etc.) of *Macaca fascicularis* in a Vietnam forest. Many of those in the list are the same parasites afflicting humans (Soulsby, 1982, pp.779-80).

The varieties of animal relations with humans. But, of course, disease sharing is only one of the themes characterizing human-animal relations. From humans' point of view, there are many "uses of animals." Carlos and Baldrias (2002) give a survey of these in the Philippine context: animals for draft purposes, as sources of food, and as human companions—either hunting companions or domestic pets. Perhaps because they are useful as companions for hunting boars and deer, the early Visayans pamper their dogs by providing them special ladders to their own houses "to come and go as they please" (Carlos and Baldrias, 2002, p. 153). In most middle- and upper-class families, modern-day dogs are provided special foods, get regular medical check-ups, given affectionate names, and are sometimes treated as "members of the family." Among some Christian families, they may even be given human-like burials when they die, with mounds complete with flowers and crucifixes.

Dogs, in general, seem to be the "upper class" in most human cultures' affection. In an article that explores "the evolutionary and social history of canines," Penn cites genetic studies that validate the common intuition that human-dog relation is deeply rooted in time and appear to be "part of human history longer than cows, horses, or goats" (Penn, 2002, p. 1540). An even interesting mitochondrial DNA analysis of 654 domestic dogs points to a probable East Asian origin for our present domesticated dogs (Savolainen, et al., 2002).

Anthropologists Brian Hare and co-researchers (2002) present an experiment in which dogs consistently show superior cognitive abilities than chimpanzees in reading human communicative signals. From the point of view of human-animal relations, the conclusion they arrive at is highly interesting:

> Our conclusion is that as a result of the process of domestication, some aspects of *the social-cognitive abilities of dogs have converged*, within the phylogenetic constraints of the species, *with those of humans through a phylogenetic process of enculturation*, perhaps similar in some ways to the ontogenetic process of enculturation experienced by some nonhuman primate individuals raised by humans (Hare, et al., 2000, p. 1636, emphasis added).

As different animal species show varying attitudes to humans, individuals also within such populations show varying degrees of human-oriented sociability. Diamond's (1999, p. 157) "Anna Karenina principle" in animal domestication ("domesticable animals are all alike; every undomesticable animal is undomesticable in its own way") may only be true at a coarse-grained,[15] species-level comparison. Individuals *within* those domesticable species show diverse attitudes and behaviors toward both humans and other species.

The varieties of human relations with animals. Reversibly, humans also differ among themselves—in historical and ethnographic sense—in the ways they relate to animals. They may differ in the *kinds* of animals they want to care as pets or companions—from dogs, cats, fishes, to the more "exotic" ones, snakes, lizards, deadly spiders, etc. They may also differ in the *manner* they treat different animals. Humans show inequalities in treating different kinds of animals: one society showers one animal with their imagined "good qualities" (e.g., the "sheep" in Judaic culture) and consigns others with all the "bad qualities" (the image of the "goat" and the "snake").[16]

Biosemiotic analysis—studying the complex informational exchanges among animals and the environment—reveals highly original insights into human-animal relations. Working in the tradition of one of ethology's earliest figure, Jakob von Uexküll (1864-1944),[17] Sebeok (1994) presents a highly interesting outline of the biosemiotic method and results.[18]

Variations in human attachment to animals are also dramatized by the mythologies woven by different ethnic groups and religious traditions.[19] There is a long tradition in anthropological studies on animal representations and symbolism in different societies. Folklore researches have also uncovered the extent of the symbolism and the diversity of animal kinds given mythic significance.

Disciplines studying human-nonhuman relations. From a disciplinal point of view, humans, animals, and their interactions, have been studied within the ranges of Anthropology, Psychology, Ethology (including Primatology), and Zoology. On the other hand, representations of animals by humans are approached from a diversity of points: Folklore, Art Studies, Freudian and Jungian Psychology, Theology and Hermeneutics, Social and Cultural Anthropology. All these disciplinal approaches are also reflective of the diverse ways in which humans relate with the nonhuman animals, in the academic context.

In their most basic style, ethology and ethnography are methodologically related to "natural history"—*historia*, in Greek, being simply "an inquiry into what is remarkable" and presented in a direct reporting style, with the "assumption of impartiality"—be they about distant peoples, exotic plants, or intriguing animal behaviors. In a scholarly study on the ancient "histories of nature," like the *Historia Naturalis* of the Roman Pliny, French (1994) mentions *historia's* emphasis on "traveling" to conduct observations and interviews—the Greek 'naturalists' "looked down their noses at those who confined themselves to libraries" (French, 1994, p. 2). Even at present these two now-differentiated methods still reflect the similar attitude: the need "to go to the field," i.e., "distant places" and "to observe organisms in their natural setting" (Sparks, 1982). Given these affinities, it is not totally surprising to hear some two-way traffic calls for linking ethology and ethnography. On the one side are the proposals to integrate ethological approaches into the study of human cultures (see Borgerhoff, Mulder and Caro, 1985). On the other side are suggestions to use "ethnographic approach" in field biology (Rendell and Whitehead, 2001). These last cited authors actually did field biology on cetacean behavior following the proposal they outlined. Their method should be both interesting for biologists and social scientists.

A reading of Darwin's *The Voyage of the Beagle* (1972) can also give one a taste of a report mixing "natural history" and "ethnography," when these two did not yet part ways under the demands of rigid compartmentalization. Because Darwin fills it with interesting observations about animals, plants, and humans, the *Beagle* book is a good naturalistic backgrounder for *Origin* and also an interesting report on the South American Indians of the 19th century. Mayr (1982) emphasizes the important role of natural history in the growth of biological thought: taxonomy and systematics are founded on its compiled observations, the earliest observations on "adaptations" were

conducted through it, and the sciences of ethology and ecology eventually developed from it.

More recently, the study of human-animal relations is given another theoretical deepening by interweaving diverse theoretical insights: from theoretical biology, semiotics, and social anthropology. In the international context, a World Archaeological Congress was held in 1986 on the theme, "Cultural Attitudes to Animals, including Birds, Fish and Invertebrates." Important papers from this conference are provided in Ingold (1994). The wealth of perspectives and data from this collection will be of great help for anyone interested in exploring human-animal studies, both from biological and cultural contexts.

This crossing of perspectives between the human and animal sciences is even more "promiscuous" in the case of Primatology. The density of the result is nowhere described in all its semiotic and material weight than in Donna Haraway's magisterial history of primatology, *Primate Visions* (1989). Haraway documents the two-way traffic of theoretical and methodological borrowings among the sciences of "nature" and "culture." Theoretical tools developed in the human sciences (e.g., Psychology or Sociology) are sometimes imported into the sciences of nonhuman primates and vice versa. Of course there are always dangers and costs in these "trading zones" (*cf* Galison, 1997). In Haraway's words, "interdisciplinarity is risky" (1989, p. 45). But *exaptation*[20] of concepts and techniques has also led to interesting insights.

Endnotes

[1] Bracketing, of course, for a moment—to emphasize the delimited set—the mediation and agencies of the mass of laboring classes.

[2] Embryology has since become Developmental Biology. Developmental-bio is a sub-field that is least developed in the task of integrating evolutionary principles (Mayr, 1982). In the history of evolutionary theory, Geology is one of the earliest to be grounded in the framework of evolution. On the other hand, the field of Evolutionary biogeography is simultaneous with the central theory and its development has been without letup. Darwin's co-constructor of the standard evolutionary theory, Alfred Russell Wallace, also laid its theoretical and empirical foundations. Compared to these two, it is only very recently when serious attempts have been done to link Developmental-bio with Evolution. "Evo-devo" or Evolutionary Developmental Biology is only recently inaugurated (Hall, 1992). Its empirical productions, however, are relatively

fast—as judged by the number of "Evo-devo" reports appearing in *Science* and *Nature*—and the subfield is brewing with sophisticated models. Theorizing and critiquing deep into the core concepts of Darwinism, the works along the Developmental Systems Theory (DST or DSA, Developmental Systems Approach) are also a mine of new insights trying to resolve the problematic parts of Darwin's framework (Oyama, 1985; Oyama, et al., 2001).

[3] Change and stasis, like "essentialist" versus "populational" thinking are, of course, relational categories. The same phenomena can both be viewed as segments of *both* change and stasis but *at different scales/levels* of analysis. Gould (2002) has an excellent discussion of the dialectics of the Formalist-Essentialist (which also emphasizes stability/conservation of biological Type/Structure) and the Functionalist-Populational (which emphasizes change) traditions in the history of biological theory. Gould argues for the relevance of both traditions—if appropriately reformulated given present levels of knowledge—in illuminating the central biological problem of explaining the generation→maintenance→transformation of diverse forms. The Formalist tradition, for example, which was much-maligned with the rise of the neo-Darwinian "Modern Synthesis," has, in Gould's assessment, important insights that can complement the Functionalist tradition (see Notes 10 and 12, for further elaboration of Gould's more recent "synthesis" of biological traditions).

[4] The logic and force of selection is relative and not absolute. In Darwin's careful estimation, although Natural Selection is "most important," it is 'not the exclusive means of modification' in living forms (1958, p. 30). Although construed as the dominant force, Darwin is conscious of the fact that the cross-generational *reconstruction/transmission* of variants are *not always* ruled by selection.

[5] Organisms, although mutable are not infinitely malleable. There are two main reasons for this. First, in every round of selection, there can only be, logically, a finite amount of available variants. Second, there are historical (phylogenetic)/structural constraints that sets broadly the limits/potentials of viable *forms* that can evolve. The role of structural "constraints"—both its negative (limiting) and positive (channeling) senses—in *directing* evolutionary modifications is given a most-detailed historical-technical support in Gould (2002; see also, Oyama, et al., 2001 for relevant discussions). Gould (2002) gives a comprehensive argument why structural "constraints" can co-equally be construed as a creative force in evolutionary change as "natural selection." Gould dialectically balances the role of "external" (selectional forces) and "internal" (structural constraints) aspects in his proposal to refine/revise the way evolutionary theory is formulated by his reading of the basic commitments of neo-Darwinian "Modern Synthesis." He gives a superb historical background of the pre-Darwinian intellectual climate: on the basic issue between those "continental" biologists who usually frame their interpretation of the major cause of biological form in structuralist/internalist terms ("Unity of Type") versus the typical British tradition that favors the functionalist/externalist terms

("Conditions of Existence"). This schema entered into the very framing of Darwin's views and, although he tried to transcend the debate by emphasizing the historical nature of organisms (in contrast to the usually *a*historical framings of both contenders), Gould notes that his dominant leaning still echoes the British functionalist tradition.

[6] Coevolution and the crucial role of behavior in initiating evolutionary trend is well-developed in the works of Richard Lewontin (Levins and Lewontin, 1985) and F. J. Odling-Smee (1994), Kevin Laland, and Marcus Feldman (Odling-Smee, 1994; Laland, Odling-Smee and Feldman, 1985; see also the standard textbook in evolutionary biology, Futuyma, 1998). Ernst Mayr, one of the major forgers of the modern "Evolutionary Synthesis" is also one of the earliest figure arguing for the important "role of behavior in evolutionary shifts" (Futuyma, 1998, pp. 24-29). Compare with Darwin's response to this chicken-or-egg-like question (Darwin, 1958, p. 166).

[7] Gould (2002) emphasizes that the "bare bones" logic (or the "syllogistic core") of Darwin's theory, although very important, does not in itself define the core arguments of Darwin's theory—on which foundations Gould proposes important revisions. The syllogistic core argues for the existence of a causal force and does not yet define its mode (locus and agency), efficacy and scope. Gould argues that Darwin—and the succeeding neo-Darwinists working along his paradigm—argues for three important points about natural selection: (1) its mode: natural selection *exclusively* works on a single level causal locus—the organismal level—and individual organisms—in their populational nature—are its agents; (2) its efficacy: natural selection is *the dominant creative force* bringing *directional* change to organisms; and (3) its scope: natural selection's scope in constructing evolutionary patterns automatically extrapolates from the organismal level downward to molecular level and upward to the species level and paleontological time-scales: that is, the descriptive patterns and causal forces in various scales are fractal-like repetitions of what happens in the organismal scale. The second point is very revolutionary in the context of Darwin's intellectual milieu: while pre-Darwinians recognized the existence of selectional forces, they only recognized its negative role—it eliminates the "unfit"—while Darwin emphasizes also its positive, *creative*, role—it temporally accumulates the available variations and so, gradually, constructs also the "fit." The existence of variations, in Darwin's view, does not provide *directional* power to evolution but is only important as "raw material" for selection. The key assumption is that variation is copious (it gives so many choices for selection to choose), small (so that the cumulated change is very gradual and saltation is prohibited), and isotropic (or undirected: unrelated to the direction of evolutionary change; or in the words of Gould, the assumption is that "nothing about the process of creating raw material biases the pathway of subsequent change" [2002, p.144]). If this assumption about variation is challenged in any specific data—some examples of which Gould cites in his

weighty tome—the first process in standard schema of evolutionary theory, the generation of variations, ceases to remain as only a passive force vis-à-vis the second process, the action of selection, which is conventionally construed as having the more active, directional role. The proposal for revisions and expansions by Gould on the three arguments of Darwin is, therefore, in order. Gould proposes the following points—which correspond to the core arguments outlined above: [1] selection certainly works well on the organismal level as Darwin masterfully defends in the *Origin*: but there is a whole "hierarchy" of level*s* on which selection can also act, below and above the organism-populational level (molecular, chromosomal, cellular, demic, and species levels); [2] selection certainly is a creative and a major force in directing change: but "internal" constraints can also be directional by providing a positive channeling effect in the generation of "variations"—which challenges the automatic assumption given above about variations. (Parenthetically, the "internal constraints" mentioned here refer to the internal structure of *any* evolutionary "individuals": Gould, consistent with his "hierarchical view," recognizes various levels of "individuality" and provides an interesting criteria for "evolutionary individuality" [2002, pp. 602-613]); [3] selection in the microevolutionary level can certainly, given time, lead, extrapolationally, to macroevolutionary changes: Gould, however, gives two qualifications: first, gradualist modes of change in the organismal scale may translate to punctuational patterns when viewed in macroevolutionary time-scales—in Gould's words, the patterns seen in different scales are "non-fractal"; second, developmental constraints—as reflected in the growing empirical cases of "deep homologies" by evo-devo studies—may be more important in constructing macroevolutionary forms: the relative frequency of developmental constraints as a *macroevolutionary* force may be comparable to selection's role in microevolutionary level—constraints and selection may each be dominant directional forces at different scales. These three revisions-expansions are, in the view of Gould, still robustly "Darwinian" in the sense of retaining the three key components of Darwin's theory as the continuing "core."

[8] The almost algorithmic-like assurance of selectional logic that Dennett mentions is not to be interpreted in a deterministic manner. The biological nature of the principle of selection differentiates it from physical theories and laws: the corpulent diversity in the biological world makes its "laws" or formula "neither strictly deterministic nor predictive but probabilistic with a strong stochastic element" (Mayr, 1982, p. 520).

[9] Darwin's reply to those objecting to the intentional tone of the term "selection": "In the literal sense of the word, no doubt, natural selection is a false term; but who ever objected to chemists speaking of the elective affinities of the various elements?—and yet an acid cannot strictly be said to elect the base with which it in preference combines. It has been said that I speak of natural selection as an active power or Deity; but who objects to an author speaking of the attraction of gravity as ruling the movements of the planets? Every one knows

what is meant and is implied by such metaphorical expressions; and they are almost necessary for brevity" (1958, p. 88).

[10] From a developmental systems perspective, traits are described in a fine-grained manner as being "reconstructed" in every life cycles rather than merely "transmitted" (Oyama, et al., 2001; Oyama, 1985).

[11] See: Futuyma (1998) and Oyama, et al. (2001) for the raw sources of the compressed formulation given in this sentence. The term "interactant" is one of the conceptual tools of Developmental Systems Approach and is adopted here.

[12] How much of the design observable in the world is due to the work of selection? The answer is much debated among biologists and philosophers of biology, generating accusation and counter-accusation of being either "ultra-Darwinists" or "anti-selectionists" among same Darwinians. (See Hull and Ruse, 1998 for the arguments of contending factions.)

[13] As mentioned above, biological "laws" are probabilistic. In the text quoted, Darwin (1958, p. 450) lists the following overlapping processes that acts on—and is acted by—diverse lifeforms: Growth and Reproduction, Inheritance, Variability, Ratio of Populational Increase, Struggle for Life, Natural Selection, Divergence of Character, and Extinction. By "laws," Darwin merely refers to *observed* biological regularities—a necessary abstraction of individual variability (see p. 88). In effect, the 'natural laws' at the biological level with which Darwin is concerned, are *aggregates* of observed sequences produced by interactions ("action and product").

[14] Darwin, in a slightly different context, has an early observation related to this (see 1958, p. 80).

[15] The photographic-grains metaphor (fine-grained resolution, coarse-grained resolution) in characterizing the level of detail by which a system is described is borrowed from Gell-Mann (1994, pp. 23-41). 'Zooming in and out' between different levels of granularity in description (from the fine-grained, individual level with its component parts, to the coarse-grained, social level with its various interactions) is a proper method in ethological observation (Lehner, 1996, pp. 112-113).

[16] It is also interesting to study the various ways in which humans use animals in the entertainment business: some receive degrees of care; some employed under inhumane situations. I once saw a live performance held in Davao of a nationwide TV noontime show wherein part of the entertainment was the rappelling contest. Perhaps to make the props more ecologically apt, the "mountaineers" were supposed to climb and descend the steep side of the makeshift-metal "Mt. Apo" matched with animals tied beside the climbing areas. One of the animals was a *fascicularis* macaque who kept shrieking out of fright, to the delight of some onlookers.

[17] Jakob von Uexküll (1864-1944) is not usually mentioned among the "founding fathers" of Ethology: a recognition usually given to the Nobelist trio Karl von Frisch, Nikolaas Tinbergen, and Konrad Lorenz. His founding insights,

however, are recognized by the biosemiotic school. Ingold (1995) also extends von Uexküll's reflections on "how animals and people make themselves at home in the world."

[18] See pp. 69-70 for some of the itemized biosemiotic circumstances under which man may encounter animals: man as partner, conspecificity and insensience.

[19] In the Roman Catholic tradition, the association of St. Francis of Assisi with the ecological-environmentalist tone of "preaching the good news" to 'birds, bees, flowers, sun, and moon,' led to a whole interesting culture of giving baptismal sacraments to pets during the Feast of St. Francis of Assisi. It is interesting to see if there are actual chains of links from the 13th century ecological vision of St. Francis leading to some of the present environmentalist and animal rights philosophies. In another religious tradition, Jainism, with its awareness and supreme respect (through the principle of *ahimsa* or non-injury "to any and all living beings") for diverse lifeforms, might also be explored for its role in environmental activism in South Asian context. See Noss and Noss (1984, pp. 96-97) for a description of the ways of Mahavira (599-527 BC) showing how an avowed respect for life forms may be lived by a human being.

The ways in which diverse religious traditions perform (or not-perform!) propitiatory rituals (e.g., the *sumbali* of the Muslims) when killing a life for food ("Cannibals? who is not a cannibal?," was Ishmael's prick of conscience when pondering upon "the whale as a dish" in *Moby Dick*) may be compared with the "primitive" practice of sharing portions of the harvests "to the spirits" and pouring libations of animal blood during feasts. An interesting point I observed in my fieldwork with the Bisaya Moncadistas of New Israel is their use of the category *naay kinabuhi* ("with life") to refer only to animals—plants excluded. *Niundang na ku'g kaon sa kanang naay kinabuhi* (literally, "I already stopped eating those [things] that have life."), is a line I usually hear from the devoted elderly women of the community: referring to the fact that they are straight vegetarians. Perhaps the defining characteristics of the category *kinabuhi* are mobility and blood, so that the relatively immobile and "blood-less" plants are not categorized, in a particular usage, as *naay kinabuhi*.

[20] The concept of "exaptation," 'exapted' here, is developed by Gould and Vrba (1998) in the context of evolutionary biology: it refers to a process wherein a character, previously evolved for other usages, is co-opted for a different use.

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