



CHICAGO JOURNALS

The
Wenner-Gren
Foundation

For Anthropological Research, Inc.

Biosemosis, Technocognition, and Sociogenesis: Selection and Significance in a Multiverse of Sieving and Serendipity

Author(s): Paul Kockelman

Source: *Current Anthropology*, Vol. 52, No. 5 (October 2011), pp. 711-739

Published by: [The University of Chicago Press](#) on behalf of [Wenner-Gren Foundation for Anthropological Research](#)

Stable URL: <http://www.jstor.org/stable/10.1086/661708>

Accessed: 29/09/2011 05:18

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



The University of Chicago Press and Wenner-Gren Foundation for Anthropological Research are collaborating with JSTOR to digitize, preserve and extend access to *Current Anthropology*.

<http://www.jstor.org>

CA☆ FORUM ON THEORY IN ANTHROPOLOGY

Biosemosis, Technocognition, and Sociogenesis

Selection and Significance in a Multiverse of Sieving and Serendipity

by Paul Kockelman

This essay theorizes significance in conjunction with selection and thereby provides a general theory of meaning. It treats processes of significance and selection in conjunction with processes of sieving and serendipity and thereby systematically interrelates the key factors underlying emergent forms of organized complexity. It theorizes codes in conjunction with channels and thereby links shared cultural representations and networked social relations. And it develops the consequences of such conjunctions for various domains at various scales ranging from biosemiotic processes such as animal-signal systems and natural selection to technocognitive processes such as lawn mowers and Turing machines. In part, it is meant to meaningfully reframe the relations among the linguistic, biological, cultural, and archeological subfields of anthropology. And in part, it is meant to show the nonreductive relations between the concerns of anthropologists and a variety of allied disciplines: linguistics and psychology, cognitive science and computer science, and evolutionary biology and complexity theory.

Introduction: Relations between Relations

A core idea of twentieth-century anthropological theory is *relations between relations*, which is an insight into how various systems, themselves involving disparate kinds of meaning or value, are organized. While this phrase was first introduced by Evans-Pritchard (1969 [1940]) in the conclusion of his classic study on Nuer social relations, the concept goes back to Aristotle's discussion of various forms of justice in the *Nicomachean Ethics* (Aristotle 2001). In particular, Aristotle argued that equivalence of value should turn on geometric ratios (fig. 1). For example, if we are engaged in a system of redistribution (e.g., what kinds of people should be given what proportion of goods from the collective share), then the following relation between relations should hold: as my status is relative to yours (e.g., you are a knight and I am a knave), so should my share be relative to yours (e.g., you receive 10 jugs of wine and I receive one). Aristotle generalized this logic of equivalence to forms of exchange more akin to reciprocity than to redistribution and to forms of value turning

on discipline and punishment (e.g., an eye for an eye, or a Hail Mary for an impure thought) as much as utility and price (e.g., how many bottles of wine for a pair of shoes, or how much wage for how much work). Building on Aristotle's idea, Marx (1967 [1867]) characterized value in similar terms but with a focus on capitalist economies in which the people were (formally) equal and the goods were (qualitatively) different. In particular, value was a relation between people (e.g., different kinds of roles within a division of labor) mediated by a relation between things (e.g., different kinds of commodities within a market; fig. 2). Marx, of course, was not just interested in where value comes from or why people strive for it but also in how the systematic misrecognition of the origins of value is both cause and effect of the very relation-ality that mediates it.¹

The idea of relations between relations was not just crucial to understanding value in the sense of what someone strives for; it was also crucial for understanding meaning in the sense of what something stands for. Saussure (1983 [1916]), for example, famously introduced this idea with regard to linguistic structure: within a given language, the relation between any particular linguistic form and its meaning (e.g., a word and a concept) must be analyzed in relation to the relations

Paul Kockelman is Associate Professor in the Department of Anthropology at Barnard College, Columbia University (3009 Broadway, New York, New York 10027, U.S.A. [pk2113@columbia.edu]). This paper was submitted 24 IX 09 and accepted 16 VII 10.

1. I am, to be sure, glossing over the complexities of both thinkers. Indeed, it may be argued that Marx also had a prescient understanding of the other kinds of relations between relations discussed in this section (Kockelman 2006c).

$$\frac{\text{Status \#1}}{\text{Status \#2}} = \frac{\text{Share \#1}}{\text{Share \#2}}$$

Figure 1. Aristotle's relations between relations.

between other linguistics forms and their meanings (e.g., other words and concepts within a particular grammatical construction or semantic field; fig. 3).

Peirce, in contrast to Saussure, was focused on semiotic processes instead of semiological structures, and inference and indexicality rather than convention and code. But he too defined such processes in terms of relations between relations: a sign stands for its object on the one hand and its interpretant on the other in such a way as to make the interpretant stand in relation to the object corresponding to its own relation to the object (Kockelman 2005; Peirce 1992 [1868]; fig. 4). Joint attention is perhaps the exemplary semiotic process: a child turning to observe what her father is observing involves an interpretant (the child's change in attention), an object (what the parent, and later the child, is attending to), and a sign (the parent's direction of attention or gesture that directs attention). Here the relation between relations, what Peirce called "correspondence," is the relation between the parent's direction of attention and the object and the child's direction of attention and the object.

The economist Veblen (1971 [1899]), himself a student of Peirce, merged both of these visions, theorizing the relation between seemingly nonpecuniary values (such as social status) and seemingly nonlinguistic signs (such as indexes of effort). Inspired by Darwin's account of sexual selection (1981 [1871]) and the expression of emotions in man and animals (1965 [1872]) and providing the basic template for many influential theories (such as Bourdieu's account of distinction and Labov's account of hypercorrection), his vision of pecuniary emulation was an attempt to explain the selection of social processes over historical time by relatively unintentional pathways. For example, he argued that any nonintentional or "natural" sign of one's ability to produce some original value (e.g., a large store of yams that by happenstance indicates that one is a good farmer) may become a derivative value insofar as it is a sign of one's distinction from other farmers. And this sign may therefore be intentionally sought in addition to or even at the expense of the object for which it originally stood (e.g., people strive to have large yam houses even if this no longer correlates with having lots of yams). In short, the same entity can be a sign of two different objects: both a natural or happenstance sign of sustenance and a nonnatural or covertly communicative sign of status. And the relation between these two simultaneously active semiotic processes was a condition of possibility for complex forms of sociogenesis (fig. 5).

This Veblenian process bears a pronounced family resem-

blance to its Nietzschean cousin (1989 [1887])—the imposition of new values on old objects, new functions on old forms, and new meanings on old signs. Indeed, one particularly colorful quote of Nietzsche's might serve well as the epigram for this essay (serving both to detour more optimistic readings and to counter potential misreadings) and seems to presciently capture the lion's share of insight generated by twentieth-century critical theory.

But purposes and utilities are only *signs* that a will to power has become master of something less powerful and imposed on it the character of a function; and the entire history of a "thing," an organ, a custom can in this way be a continuous sign chain of ever new interpretations and adaptations whose causes do not even have to be related to one another but, on the contrary, in some cases succeed and alternate with one another in a purely chance fashion. The "evolution" of a thing, a custom, an organ is thus by no means its *progressus* toward a goal, even less a logical *progressus* by the shortest route and with the smallest expenditure of force—but a succession of more or less profound, more or less mutually independent processes of subduing, plus the resistances they encounter, the attempts at transformation for the purpose of defense and reaction, and the results of successful counteractions. The form is fluid, but the "meaning" is even more so. (Nietzsche 1989 [1887]:78–79)

Building on these ideas, the first part of this essay argues that the key unit of analysis underlying the various subfields of anthropology as well as allied disciplines is a relation between two kinds of relations between relations. It thereby theorizes as concomitant processes the way signs and interpretants relate to significant objects and the way sensations and instigations relate to selecting agents. After carefully defining such a unit, it develops the consequences of such a definition for various domains—ranging from biosemiotic processes such as animal-signal systems and natural selection to technocognitive processes such as lawn mowers and Turing machines. It thereby foregrounds the environment-organism relation at any level of complexity and with respect to any kind of life form. More generally, it shows how an expanded typology of relations between relations is necessary to analyze processes of significance and selection at disparate scales—

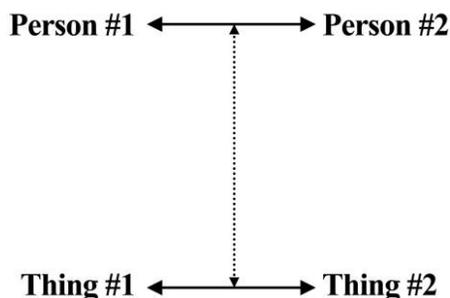


Figure 2. Marx's relations between relations.

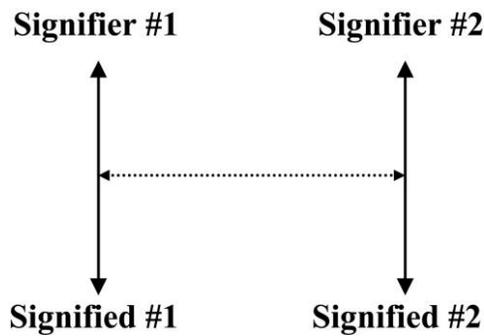


Figure 3. Saussure's relations between relations.

from the nervous system to the Internet, from the evolution of species to the interaction of signers. While such disparate processes on such different scales are radically different as to their details, this essay aims for a level of (diagrammatic) generality that captures their similarities.

Framed another way, this essay attempts to synthesize a number of seemingly disparate processes. It offers a theory of significance in conjunction with a theory of selection and thereby provides a general theory of meaning. It treats such processes of significance and selection in conjunction with processes of sieving and serendipity and thereby systematically interrelates the key factors underlying emergent forms of organized complexity. And it theorizes codes in conjunction with channels and thereby links shared cultural representations and networked social relations. In making such conjunctions, it necessarily obviates many of the usual divisions—semiosis versus cognition, mind versus body, human versus animal, nature versus artifice, meaning versus mechanism, interpretation versus explanation. Its ultimate goal is to clarify and interrelate modes of biosemiosis, technocognition, and sociogenesis at various levels of scale.

As just seen, this essay borrows extensively from some of the key theorists of the (late) nineteenth century—all of whom might be considered “shadows” of the Enlightenment: Darwin, Marx, Nietzsche, Saussure, Peirce, and Veblen. And while most of the ideas it brings together have thus been around for more than 100 years, it offers a condensation, synthesis, extension, and—perhaps most importantly—perturbation of such ideas. In part, it is meant to meaningfully reframe the relations among the linguistic, biological, cultural, and archeological subfields of anthropology. And, in part, it is meant to show the nonreductive relations between the concerns of anthropologists and a variety of allied disciplines: linguistics and psychology, cognitive science and computer science, evolutionary biology and complexity theory.

Finally, this essay is meant to be accessible, technical, and succinct—and, indeed, it was born as a squib. While it is tempting to expand and qualify every claim, I instead present them in the spirit of an ideal type—that last refuge of the scoundrel. Some points have been further developed in other

essays, and these are cited when relevant. In particular, Kockelman (2010a) serves as this essay's evil twin, focusing on parasitism, enemies, and noise. It massively complicates the otherwise simple division made in section 8 between code and channel. It undermines the nature of “function” or “purpose.” It theorizes the range of entities that prey on the products of selection and significance. And it shows the relation between such ideas and foundational texts in cybernetics (in particular, Claude Shannon), linguistic anthropology (Roman Jakobson), and actor-network theory (ANT; Michel Serres).

Section 1 theorizes two kinds of relationality—selection and significance—and shows their symmetry and complementarity. Section 2 shows how such processes may be concatenated to describe communication between individuals, be it of humans engaging in discursive practices or animals engaging in signal responses. Section 3 shows how such processes may be enminded and embodied to describe cognitive and affective processes within individuals. Section 4 generalizes over sections 2 and 3, showing how the very same process of significance and selection may be differently framed by investigators working with different units on disparate scales. Section 5 shows the relation between these processes and classic understandings of natural and artificial selection as well as their connection to less celebrated processes of sieving and serendipity. Section 6 shows the relation between these processes and material artifacts such as hammers and logic gates. And sections 7 and 8 show how all the foregoing relations between relations play out in any ensemble of signifying and selecting agents, focusing on the network of channels, or infrastructure, that interconnects such agents.

1. Selection and Significance: Diagramming the Envorganism

There are two processes that need to be defined: selection and significance. If our stereotype of the first process is a tool, our stereotype of the second process is a symbol. More spe-

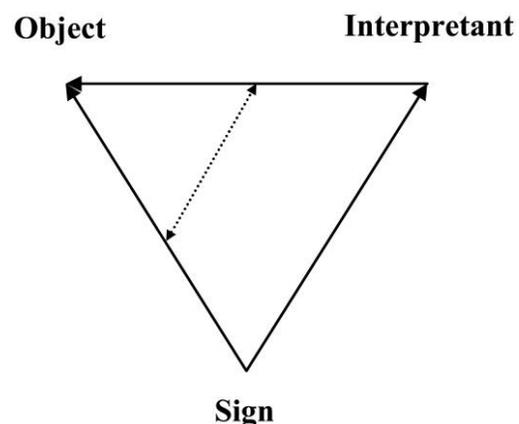


Figure 4. Peirce's relations between relations.

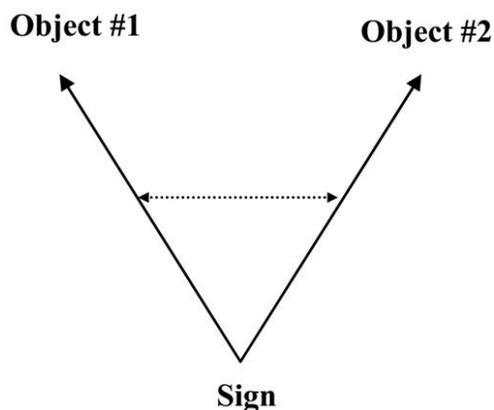


Figure 5. Veblen's relations between relations.

cifically, selection involves an agent wielding a means for the sake of an end. And significance involves a sign standing for an object and giving rise to an interpretant. As will be seen, each process makes reference to three distinct entities, each turns on a relation between relations, and each is intimately linked to the other.

We may start with a simple example. To understand *selection*, focus on the bottom half of figure 6. Let S be the sight of a predator, let I be a flight from that predator, and let A be the prey that both sees and flees. In other words, there is a sensed event (S), there is an instigated event (I), and there is a sensing and instigating agent (A). We may say that I makes sense in the context of S from the standpoint of A.

To understand *significance*, focus on the top half of figure 6. Let O be the predator, let S be a sign of that predator (as sensed by the prey), and let I be an interpretant of this sign (as instigated by the prey). In other words, there is a sign event (S), there is an interpretant event (I), and there is a signed and interpreted object (O). We may say that I makes sense in the context of S given the properties of O.²

Being an *agent* means two things.³ First, A is capable of

2. Given the discussion of Peirce's notion of relations between relations offered in the introduction (with the example of joint attention), the top half of figure 6 should already be familiar to readers. I develop the consequences of this fundamentally Peircean relationality (sign-object-interpretant) for key analytic concepts in linguistics, anthropology, and psychology (Kockelman 2005); however, like Peirce, this work also focuses on significance and sidesteps the question of selection.

3. In another work, I theorize semiotic agency from the standpoint of significance (Kockelman 2007a). For example, in the case of gaze following, we might ask the following questions: to what degree can a signer (1) *control* the expression of a sign (determine where and when it is expressed), (2) *compose* a sign-object relation (determine what object is stood for or what sign stands for it), and (3) *commit* to an interpretant of this sign-object relation (determine what effect the expression of the sign will have so far as it stands for that object)? It is argued that along any one of these dimensions, various degrees of agency depend on semiotic properties of signs, social properties of semiotic communities, and cognitive properties of signers. It is argued that accountability—the more one can be praised or blamed for the effects of some semiotic process—

sensation and instigation. More specifically, A is capable of being affected by events (that have causes outside of A) and capable of being causal of events (that have effects outside of A). Second, A is capable of selecting or capable of being selected. In other words, to say something makes sense from the standpoint of A is to say that there is a reason that A would have selected it or have been selected for it. Selection may range from natural selection through cultural sanctioning to self-conscious intention. It may involve processes as “dumb” as brute sieving and as “intelligent” as rational choice; as embodied as heeding an affordance and as enminded as proving a theorem.

Objects are dependent on agents. In particular, an object is just a bundle of features (or projected propensities to exhibit certain features) relative to which an agent's sensations and instigations make sense (given some process of selection). In other words, an agent senses a feature (S) that is reliably correlated with an entity (O) that has a host of other features, and the event that the agent instigates (I) makes sense only in the context of one or more of those other features. Thus, while one may see that it is a bear from its size and shape, one flees from it because of its speed and strength.

More carefully defined, the key idea is this: *Given the relation between the O-S relation and the I-O relation (which may be external to A), the A-I relation makes sense in the context of the S-A relation (from the standpoint of A).* This demon-

usually scales with the degree of agency one has over that process. Finally, given the contextual and conventional nature of semiotic processes as well as the ways they enchain and embed, it is argued that agency does not necessarily—or even usually—inhere in specific people: the “agent” in question may be distributed over time (here and there), space (now and then), unit (subindividual or superindividual), number (one or several), entity (human and machine), and individual (Bob and Susan). In this way, semiotic agency involves processes that are multidimensional, graduated, and distributed.

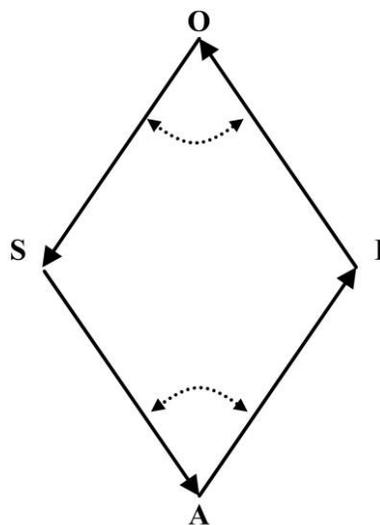


Figure 6. Selecting agent and significant object.

strates the indivisibility of organism and environment: there exist two relations between relations (fig. 6, dotted lines), neither of which may be understood without reference to the other. It also demonstrates the symmetry between our theory of the object (and our theory of significance) and our theory of the agent (and our theory of selection). Selection and significance are concomitant processes.

This last point deserves a longer discussion. Terms such as “meaning” and “information” are usually defined in terms of an O-S relation.⁴ In particular, S is reliably correlated with O (within some causal domain) such that knowing something about S allows one to know something about O. Phrased in Peircean terms (Peirce 1955), S is both an index and an icon of O. As an *index*, it is causally connected to O (no matter how long or short the chain of intermediaries). As an *icon*, it has properties in common with O (at the very least, its time and place, with more or less leeway and displacement). The causal domain may be relatively large or small (spatio-temporally) and relatively complicated or simple (interactionally). What matters is that the correlation be reliable enough for A’s selection to make sense.

However, S could provide information about every single causal process it is caught up in, so to define information only in terms of the O-S relation is not helpful. As shown above, to specify the O-S relation one must specify the I-O relation, and to specify the relation between these relations one must specify the relation between the S-A relation and the A-I relation. That is, the properties of objects make sense only relative to the interests of agents. Moreover, given the fact that much selection is ultimately grounded in natural selection, we may also say that agents make sense only in the context of objects. In short, there are no isolated environments and organisms, there are only *envorganisms*. This last point is, to be sure, well rehearsed by scholars such as Darwin, von Uexküll, Gibson, Heidegger, and Lewontin.⁵ The point here is to frame it in an explicit theory of meaning and to thereby show its natural emergence from more basic and more well-defined processes.

2. Biosemiosis (Part 1): Communication between Conspecifics

Communication between conspecifics is readily described (fig. 7). Suppose A_1 and A_2 are genetically related agents (such as shrieking monkeys or thumping bunnies).⁶ Suppose O_1 is a

4. Compare the papers of Dretske (1981) and Millikan (2004:31–46) and contrast that of Peirce (1955; and see Colapietro 1989:6). Another widespread way to try to theorize meaning turns on signs, objects, and interpreters—and thus, from the standpoint of the framework offered here, elides sensation, instigation, and interpretants (and more importantly, the relationality that mediates such components and the tight connection between significance and selection).

5. For example, developmental systems theory (Oyama, Griffiths, and Gray 2001) is compatible with this approach.

6. See Cheney and Seyfarth’s (1990) classic study.

predator, S_1 is the sight of that predator, and I_1 is a danger call. And suppose S_2 ($= I_1$) is the sound of that call, I_2 is fleeing from the context of that call, and O_2 is just O_1 as stood for by a different sign. Indeed, just as O_1 and O_2 are essentially instances of the same object (or two relatively overlapping objects) as stood for by different signs (the latter indexically “inherits” its meaning from the former), A_1 and A_2 are really instances of the same agent as instantiated in different individuals. Genetically speaking, they are both parts of a single unit of accountability (Kockelman 2007a, 2007c). With communication of this kind, an individual not only gets eyes in the back of its head, it also gets legs detached from its body. The sensing and instigating agent is extended.

We may examine the animal danger call from several perspectives. First, what is crucial about this example is that both interpretation and signification were selected for. That is, not only was A_1 ’s interpretation of S_1 (as well as A_2 ’s interpretation of S_2) selected for, but also A_1 ’s expression of S_2 . Here, then, we have made the critical move from natural meaning to *nonnatural meaning*, from “natural information” to “intentional information.” However, unlike Grice’s (1989b) classical formulation of this distinction, which focused on signs that were selected on interactional timescales by intentional human agents, we are focused on information that was selected on evolutionary (and historical) timescales by agents that may not be intentional (or may have been intending other effects).⁷ While the predator’s giving off of signs of itself to the prey was not selected for (in the case of the bear example given above), one prey’s giving off of signs of a predator to another prey was selected for. This is what it means to say that the O_1 - S_1 relation constitutes natural or nonselected information and the O_2 - S_2 relation constitutes nonnatural or selected information. Many human speech acts are the exemplar of non-natural information insofar as they are addressed or inten-

7. See Enfield’s (2009) related notion of enchrony.

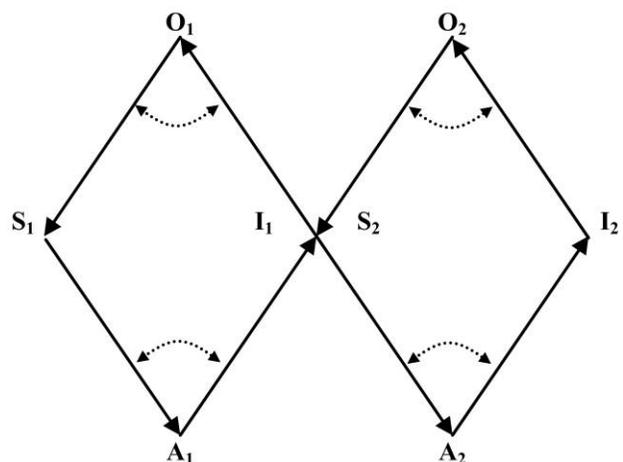


Figure 7. Communication between conspecifics.

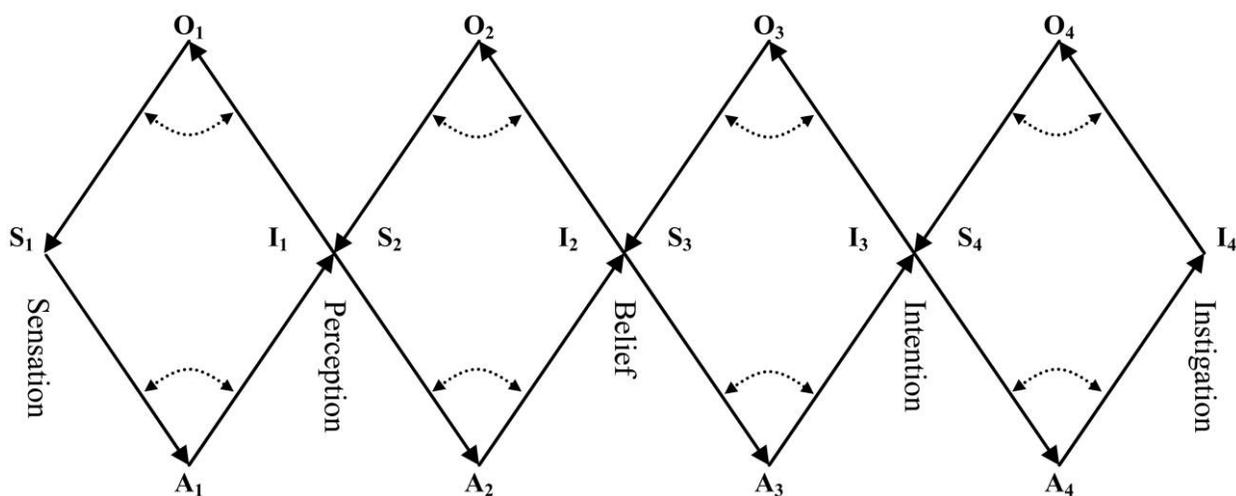


Figure 8. Indexical and inferential enchaining of cognitive processes.

tionally expressed for the sake of others' interpretants of them (a point we will return to and expand on in sec. 3).

Second, the danger call has *roots* and *fruits*: it is simultaneously the interpretant (I_1) of a sign (S_1) and a sign (S_2) with an interpretant (I_2). In this way, it is both retentive and protentive, oriented to both the past and the future. Moreover, insofar as it was selected, it may fail in either of these functions: any one of the sign-object-interpretant relations may go awry. Just as a sign may (be taken to) stand for the wrong object, a sign may also give rise to the wrong interpretant. In this way, the *tokens* instantiated may fail to conform to the *types* selected. In the tradition of Austin (2003 [1955]), one might more generally compare human speech acts and interactional moves (Goffman 1983) whose immediate roots and fruits may be mental states and social statuses⁸ and which, by failing to have the right roots and fruits on a given occasion, may be inappropriate in context and ineffective on context.

Third, the *mapping* between the object (O_2) and the sign (S_2) and the *remapping* between the sign (S_2) and the interpretant (I_2) are relatively simple. The mapping in question has one kind of content (there is a single type of object to be stood for by a single type of sign: snake_{here-now} \Rightarrow scream_{here-now}). However, one could imagine a more elaborate mapping depending on whether the object was a terrestrial, arboreal, or airborne predator. And the remapping in question has one kind of mode (there is a single type of interpretant to be created by a single type of sign: scream_{here-now} \Rightarrow scam_{here-now}). However, one could imagine a more elaborate remapping depending on whether the interpretant should be freezing, fleeing, or fighting. One might contrast the relative complexity of human

8. Or intersubjectively recognized commitments and entitlements more generally (Kockelman 2005).

speech acts, where the content consists of a proposition and the mode consists of an illocutionary force.⁹

3. Technocognition (Part 1): The Organization of Cognitive Processes

Just as our diagram may be extended to account for objects and agents that are "larger" than the individual, it may also be extended to account for objects and agents that are "smaller" than the individual. As an example, we may focus on a few stereotypic properties of *mental states* (fig. 8).¹⁰ A sensation (S_1) is caused by a state of affairs (O_1) and indexically (or "causally") gives rise to a perception (I_1). A perception (S_2) represents a state of affairs (O_2) and inferentially (or "logically") gives rise to a belief (I_2).¹¹ A belief (S_3) represents a state of affairs (O_3) and inferentially gives rise to an intention (I_3). And an intention (S_4) represents a state of affairs (O_4) and indexically gives rise to an instigation (I_4), which may itself either immediately constitute or eventually cause the state of affairs so represented. In other words, between the original "sensation" and the ultimate "instigation" may be any number of other cognitive processes that are themselves framable as significant and selected processes.

It is worth discussing the intentions underlying noncom-

9. The term "mapping" is often a misnomer (as will be seen in sec. 3, when we discuss inferential communication).

10. The causal and rational, or indexical and inferential, nature of mental states has been fruitfully analyzed by Anscombe (1959), Brandom (1994), Davidson (1984), Grice (1989a), and Searle (1983). And the concatenation (and ramification) of semiotic processes is a simple Peircean insight that the interpretant of one sign is usually itself a sign to be interpreted.

11. The distinction between indexical and inferential processes is not disjunctive. All inferential processes presuppose indexical processes.

municative actions in detail: opening a door, making a U-turn, scratching one's chin, and so on. In particular, an intention (S_4) represents a state of affairs (O_4). For example, one intends *to start the engine*. It indexically gives rise to an instigation (I_4) that either immediately constitutes or eventually causes the state of affairs represented. For example, whereas the agent's instigation ends at turning the key (I_4), this is itself the cause of a further effect, such as the engine's actually starting (which is mediated by considerations outside of the agent's immediate control: wiring, batteries, etc.). And the intention (S_4) is itself the conclusion (I_3) of an inference involving a contextualized belief (S_3) and a contextualizing proattitude (such as a desire, obligation, or value).¹² For example, one believes that starting the engine is a means to driving to the cinema as an end, and one wants to drive to the cinema (because one wants to see a movie, and so on). This is what it means to say an intention has inferential roots (practical reasoning) and indexical fruits (causal chaining).

All this may be couched in slightly different terms. We said that whatever represents (such as an intention) has both a propositional content and a propositional mode: the content specifies what conditions must be satisfied, and the mode specifies how those conditions must be satisfied. In particular, we may say that an intention represents its satisfaction conditions: a certain state of affairs is to be brought about (content), this state of affairs is to be caused by the intention (fruits), and this intention is to be justified by a reason (roots). To specify the satisfaction conditions of an intention is therefore to specify how it may go awry or fail to be satisfied. Crucially, none of these steps need to be consciously represented, and our evidence for their existence comes from attending to unsatisfied outcomes: the times one turned the key (but the battery was dead), the times one started the car (but could not remember where one wanted to go or why one wanted to go there), the times one's fingers slipped (in turning the key), the times one turned the key and started the car (but unintentionally so), and so on. At the very least, all are but potential moves in explicitly articulated and temporally retrospective rationalizations.

Although not shown in figure 8, a belief (S_3) may also give rise to any number of other beliefs before giving rise to an intention (S_4). That is, the "innards" of such a process could be indefinitely extended. Moreover, the instigation (I_4), or whatever state of affairs it ultimately brings into being, may itself constitute an object that causes a sensation, and so such processes could continue indefinitely. That is, the "output" of one such process could become the "input" of another such process, ad infinitum. Cognitive processes are the roots and fruits of other cognitive processes.

In particular, the agent (A), shown at different stages in the process (A_1, A_2, A_3, A_4), is not a homunculus. Rather, it

might be thought of as a set of "devices" that have been selected to process representations in a manner that is causally and logically coherent (from the standpoint of that agent). Such selection may involve neurological processes selected for on evolutionary timescales as much as cultural processes selected for on historical timescales as much as personal processes selected for on biographical timescales as much as intersubjective processes selected for on interactional timescales. Moreover, given the potential enchaining of outputs to inputs maximally intensified with the introduction of speech acts, the agencies involved are as likely to be interpersonal as intrapersonal. In short, the relations (between relations between relations) introduced above may embed and scale indefinitely. In other works, I use a similar framework to analyze mental states and speech acts, or private and public representations, in all their indexical and inferential detail, focusing on human-specific modes of intersubjectivity and agency (Kockelman 2005, 2006a, 2010b, 2010c). This work also attempts to account for, leverage, and critique the range of folk-psychological assumptions that are built into this kind of framework.

Indeed, if you are wary of cognitive or enminded processes (in the context of human speech acts, themselves framed in intentionalist terms), you may focus on affective or embodied ones. For example, the facial expressions described by Darwin (1965 [1872]) or the affect programs studied by Ekman (2006) are framable in similar terms—from their roots, involving an appraisal of a situation (qua "sensation"), through autonomic nervous system arousal, to their fruits, involving a set of behaviors (qua "instigation"). Moreover, whether the agent is framed in enminded intentionalist terms (e.g., as a believing and intending "subject," via Descartes) or in an embodied habitus-like idiom (e.g., as a circumspecting and associating "Dasein," via Heidegger) is of no concern here. As will be taken up in section 3, whether the focus is representations of the world (Kockelman 2006a, 2010b, 2010c) or residence in the world (Kockelman 2006b, 2007a), there is significance and selection. To be sure, the timescales on which selection occur may be different, the degrees of agency by the individual may be smaller, the significant features of objects may be more constrained, and the unit of accountability may be larger. Accounts of affect and embodiment are no less dependent on significance and selection than are accounts of cognition and mind.

In short, human cognitive processes and semiotic practices are easily compared with animal-signal systems. One assimilating and accommodating agent relates to another assimilating and accommodating agent, where each of the agent's interests are caught up with the others'. Such interactions are shot through with selectional processes, from evolutionary selection of cognitive capacities through historical selection of linguistic constituents to individual selection of actual utterances (that incorporate such constituents and actualize such capacities). Indeed, even those emblems of human cognition, *symbols* (i.e., conventional relations between signs and

12. For example, a belief may give rise to an intention in the context of a proattitude such as a personal preference, a social obligation, or a religious commitment (Davidson 1984).

objects that seem to be minimally motivated and maximally arbitrary), are subject to selection. Human-specific cognitive processes and linguistic practices are just particularly complex modes of significance and selection.

It is worth pausing a moment to return to human-specific modes of intentional communication (or “nonnatural” meaning) and to thereby link some of the concerns of this section with some of the concerns of the last by synthesizing some insights of the two most important theorists of inference and indexicality, Peirce and Grice.¹³ In particular, reframing Grice’s insights (1989*d*; and see Strawson 1971 [1954]) in a semiotic idiom, there are at least four (significant) objects of interest in nonnatural meaning: (1) my intention to direct your attention to an object (or to bring an object to your attention); (2) the object that I direct your attention to (or bring to your attention); (3) my intention that you use 2, usually in conjunction with 1, to attend to another object; and (4) the object that you come to attend to.

There are several ways of looking at the details of this process. Focusing on the relation between 2 and 4, there are two conjoined joint-attentional processes (recall the Peircean example from the introduction), the first as a means and the second as an end. Using some kind of pointing gesture as a sign, I direct your attention to some relatively immediate object in concrete space (relatively indexically recoverable, e.g., some gunk on the bottom of your shoe), and this object or any of its features is then used as a sign to direct your attention to some relatively distal object in abstract space (relatively inferentially recoverable, e.g., my desire that you take off your shoes before you come in). Loosely speaking, if the first sign causes your head to turn, then the second sign, *itself the object of the first sign*, causes your mind to search.

Objects 2 and 4, then, are relatively foregrounded. They are what Peirce would call *immediate objects*: objects that signs represent (and hence that exist because the sign brought some interpreter’s attention to them). Objects 1 and 3 are, in contrast, relatively backgrounded. They are what Peirce would call *dynamic objects*: objects that give rise to the existence of signs (and hence are causes of, or reasons for, the signer having expressed them). In other words, whenever someone directs our attention, there are two objects: as a foregrounded immediate object, there is whatever they direct our attention to (2), and as a backgrounded dynamic object, there is their intention to direct our attention (1). Grice’s key insight is that for a wide range of semiotic processes, my interpretant of your dynamic object is a condition for my interpretant of your immediate object. In other words, learning of your intention to communicate is a key resource for learning what you intend to communicate.

A crucial commitment of both Peirce and Grice is that communication, and meaning more generally, does not rely purely on codes (in, e.g., the stereotypic Saussurian sense, qua

relatively conventional pairings between signs and objects) but is highly inferential or abductive in some of the ways just described. What is not stressed enough is the simple fact that the key constraint guiding our indexical and inferential searches within such concrete and abstract spaces (such that we may interpret our interlocutor’s signs correctly) is context, co-occurring text, and culture. And so no matter how sophisticated your formal model of inference and cognitive processing is (e.g., relevance theory and formalist approaches to pragmatics more generally), the real devil remains in the non-reductive details of such contents—themselves often best analyzed by classic holistic interpretive techniques from disciplines such as discourse analysis, cultural anthropology, textual hermeneutics, and social history.¹⁴

4. Framing: Significance and Selection at Different Scales

The last two sections brought the issue of *framing* to the fore: how the very same process of significance and selection may be described, diagrammed, or theorized in a wide variety of relatively compatible ways (Kockelman 2005). In section 1, for example, we showed the ways in which the same event qua sign may be reliably correlated with a range of other events qua objects. In section 2, we examined an animal-signal system from the standpoint of two signing and interpreting agents and from the standpoint of a single agent composed of two conspecifics. Moreover, the very same event (the uttering of a predator cry) was treated as an interpretant from one agent’s perspective and as a sign from the other’s. And in section 3, for example, we opened up the agent, diagramming the putative mental states—themselves significant and selected processes—that lie between any two publicly available speech acts or signal responses. Thus, just as one can focus on smaller or larger kinds of agents (that may overlap), one can focus public or private kinds of processes (that may enchain), and just as one can frame the same event as an object, sign, or interpretant, one can focus on either the roots or the fruits of an event.

To take an extended example from my own subdiscipline, one may take speech acts (or sign events more generally) to be the roots and fruits of mental states, or one may take mental states (or cognitive processes more generally) to be the roots and fruits of speech acts. Either view is basically

14. In their classic contribution to pragmatics, Sperber and Wilson (1995 [1986]) were the first to capitalize on Grice’s insights through the lens of cognitive science. Nonetheless, they also made some very ill-considered, almost bizarre claims (Sperber and Wilson 1995 [1986]:3–9) about what Peirce’s theory of meaning entailed (e.g., they seemed to think it is noninferential, or “code-based,” in a stereotypic Saussurian sense). Moreover, they completely undervalued the relative utility of understanding, in semiotic and semiological terms, the relatively stable group-relative sign-object relations many associate with “culture” as well as all indexical signs more generally (in particular, context and co-occurring text)—and hence precisely the contents that constitute and constrain the search space of indexical and inferential communication.

13. Left aside here are key issues related to the intersubjective nature of such intentions (Tomasello 2008).

equivalent, like the two faces of a Necker Cube. In the context of such variant frames (and, in particular, their concatenations), two relatively antagonistic traditions have arisen (alluded to at the end of the last section). On the one hand, there are those who argue that “meaning is public” (and tend to focus on public representations, such as speech acts and discursive practices more generally). On the other hand, there are those who argue that “meaning is private” (and tend to focus on private representations, such as mental states and cognitive processes more generally). The first group, best exemplified by conversational analysis (with roots in George Herbert Mead and as practiced by scholars such as Harvey Sachs and Emanuel Schegloff), has attempted to deal with communication without reference to mental states. Such a tradition treats speech acts, or interactional moves more generally, as begetting speech acts, never mind any intermediate mental states. And the second group, exemplified by relevance theory (with roots in Paul Grice and as undertaken by scholars such as Dan Sperber and Diedre Wilson), has attempted to deal with communication with primary attention to mental states and minimal reference to actual interactions or all the dirty little details of semiotic processes more generally. Perhaps not surprisingly, to their detractors, the former has remained a highly “empirical” discipline (meaning not very theoretical) and the latter has remained a highly “theoretical” discipline (meaning not very empirical).

In short, the same event may be understood as a component of different processes of significance and selection depending on the interests of an actor or the stance of an observer (themselves both selecting agents caught up in significant objects). In particular, what is a sign component in one frame may be an interpretant component in another (giving rise to a future-oriented vs. a past-oriented perspective). What is an object component in one frame may be a sign component in another frame (a lower-order vs. a higher-order perspective). Figure 6 may be iterated to produce figure 7, or figure 7 may be subsumed by stretching figure 6 (a proximal vs. a distal perspective). One may switch from a private to a public frame (an actor-centered vs. an observer-centered perspective). And finally, when analyzing some complicated process, some agents and objects may be treated as figures (often because the mapping from sign/sensation to interpretant/instigation is relatively fluid or poorly understood), while others may be treated as grounds (often because this mapping is relatively fixed or carefully studied). *Our analysis of significance and selection is itself significant and selected.*

The issue with framing, then, is not so much what does a sign stand for or give rise to or how do an agent’s instigations make sense in the context of its sensations—these are essentially empirical questions. Nor is it an issue of whether such questions are answered correctly or incorrectly by a particular investigator or whether they count as “knowledge” or “ideology” to an epistemic community. The issue is which time-scale, empirical locus, vector of causality, agency, or objectivity is most relevant to the investigator. Does one zoom in to

focus on cognitive processes or neurological signals, or does one zoom out to focus on implicated meanings rather than encoded ones or distal ends rather than immediate ones? Does one look backward, toward the roots of an event, or forward, toward its fruits? Does one ask questions about selection on interactional, biographical, historical, or evolutionary time-scales? Does one focus on agents that are neurons, organs, instruments, individuals, dyads, groups, or species? *Framing, then, not only makes explicit the co-constructive nature of the relation between the organism and the environment, it also makes explicit the co-constructive nature of the relation between the analyst and the organism-environment relation.*¹⁵

On the one hand, such claims have relatively prosaic implications. For example, much of what counts as intradisciplinary divides and interdisciplinary differences are essentially questions of framing or different ways of dividing up what are otherwise hopelessly complex processes of significance and selection into individually manageable and institutionally fundable projects. On the other hand, such issues are at the center of human-specific modes of significance and selection. For example, given the fact that for humans, at least, Nietzschean and Veblenian processes are constantly parasitic on (and generative of) our semiotic practices, our interpretant-sign relations are tightly coupled to our object-sign relations (not to mention Marxist ones—in particular, the fact that any envorganism, or process of significance and selection more generally, may become the use value of a commodity and hence be shaped or sought for the sake of its exchange value). In other words, *how we frame our own and others’ processes of selection and significance is often a key factor in the creation, spread, and stability of those very processes.*

5. Biosemiosis (Part 2): Artificial and Natural Selection, Sieving and Serendipity

It may now be argued that the terms “artificial selection” and “natural selection” are misnomers: such processes involve significance as much as selection and are readily described using the foregoing framework. To treat artificial selection first, take the object (O) to be an ensemble of genotypes (or a distribution of alleles) within an interbreeding population. And take the agent (A) to be an individual (or group of individuals) interested in transforming the genotype of the population over a series of generations. This agent senses aspects of the phenotype, which are signs (S) of the genotype, that are reliably correlated with it by causal processes of development. And this agent instigates actions (such as selective breeding, isolation, etc.) that are essentially interpretants (I) of those

15. In part, this claim is meant to analytically complement (as well as disciplinarily extend) classic reflexive stances toward (and in) the methodology of the social sciences (Weber 1949). See, in particular, the collections of essays edited by Clifford and Marcus (1986) and Lucy (1993) in relation to ethnography and linguistic anthropology, respectively.

signs: on the one hand, they point to the genome (by causal processes of inheritance and reproduction) as reliably as the phenotype; on the other hand, they make sense in the context of the signs given the interests of the agents.

In particular, selection at this level may often be understood in individualist intentional terms: the agent may have beliefs about how the sign is caused by the object (qua generation N) as well as beliefs about how the interpretant is causal of the object (qua generation $N + 1$), and the agent may have desires about what the sign and thus the object (and thus, ultimately, the interpretant) should be. To invoke Weber (1978; and see Kockelman 2010*d*), these desires, however tacit, may be grounded in instrumental values (e.g., the price that a petunia of a certain color, size, or shape will fetch) as well as existential values (e.g., an aesthetic sensibility regarding what constitutes the ideal dachshund) and traditional values (e.g., achieving results consistent with those of one's mentors). And these beliefs (about the causal processes underlying the mechanism qua means) in conjunction with these desires (about the outcome of those processes qua ends) may lead to an intention that gives rise to an instigation: for example, I shall breed this one with that one.

To be sure, the beliefs may be untrue and the desires may be unsound such that the outcome in the short run or the long run may be bizarre, self-defeating, unintended, and even unimaginable. Moreover, different agents can have radically different theories, however tacit, about the object and its causal connections to what they sense and instigate and yet still do so effectively. Consider, for example, the theories of Darwin or Mendel, an American farmer or a Mayan peasant. Indeed, it may even be the case that the selection was entirely unintentional, occurring by processes akin to sieving and serendipity, as will be discussed below. *Note, then, that it is not just the case that one cannot offer an account of significance without an account of selection; it is also the case that one cannot offer an account of selection without an account of significance.*

Indeed, it is possible to push these ideas further, showing the similarity between the relations embodied in these diagrams and processes such as natural selection. For example, we may take the object (O) to be the ensemble of genomes (or frequency of alleles) within a population of (interbreeding) organisms. Through the causal pathways of development (however complicated), this object gives rise to an ensemble of phenotypes or a distribution of traits (S). The environment then acts as an agent (A) that sieves these phenotypes so that some fraction (I) manage to survive, meet, and mate. Finally, through the causal pathways of reproduction, however complicated, these survivors then give rise to the ensemble of genomes (O') that constitutes the next generation.

Notice from this example that the ensemble of genomes is being framed as the object, having a loose identity (truly a family resemblance) with itself over generations. And notice that this object is simultaneously instigative of a new ensemble of phenotypes (via developmental pathways) and sensitive to an old ensemble of phenotypes (via reproductive pathways).

To be sure, it is probably wrong to say that the environment “senses” and “instigates” and thereby to treat it as an agent, however original or derivative, as something that was selected to sense and instigate in precisely this way. Instead, we may invert the frame for a moment such that what the organism-qua-agent instigates (via developmental pathways) and senses (via reproductive pathways) is perhaps best treated as the input and output, respectively, of an environment-qua-object that is essentially a *sieve*, giving rise to consequences for no reason other than *serendipity*.¹⁶

For example, the environment might involve a gradient (constituted by gravity, temperature, illumination, etc.), and so individuals who make it farther along the gradient (e.g., up the hill, or into the winter, or toward the light) are more likely to reproduce and thereby contribute to the next generation. Thus, while we may say that some aspect of some organism was naturally selected (by complex processes of sieving), that which sieves is not necessarily, of course, an artifact or a consciously designed instrument that has this selecting of phenotypes as its intended function.

(It should be noted that the environment of any organism is in part constituted by other organisms, themselves selected. Moreover, the environment of any organism is also in part constituted by the products of that organism as well as the products of other organisms—from bat excrement to bird nests, from shade to oxygen. This means that whatever is doing the sieving may itself have been selected—though not necessarily to sieve in this manner. Moreover, one should not discount the possibility that an ability to be sieved in such a way was selected for. In short, it is just as easy to underestimate the degree of significance and selection in the world qua reification as it is to overestimate it qua fetishization.)

Such selection is, as it should be, merely a dumb “letting through” and hence the idea of an agent as a sieve operating for reasons of serendipity. Nonetheless, note that this letting through is fundamentally relational: it is not a function of the phenotype per se but rather a function of the phenotype's relation to the affordances of the environment, a point we will take up below. And notice that this relation may turn precisely on the sensory and instigatory capabilities of the population of organisms as phenotypes: the better they can sense and instigate within an environs (i.e., be agentive) and the better these sensations and instigations take into account the “real” features of objects (qua significance), the better they can forge up those gradients to reproduce, and so what is selected by brute sieving may be precisely nonbrutish selectivity and nonarbitrary significance. In this way, the processes represented by this diagram act as initial causes of the processes represented by the other diagrams. Significance and

16. In a cybernetic idiom, sieving and serendipity are similar to enemies (or that which intercepts) and noise (or that which interferes), and both are closely related to the notion of a parasite (Kockelman 2011; Serres 2007 [1980]; Shannon 1949; Shannon and Weaver 1963 [1949]).

Table 1. Material Culture and Semiotic Processes

Semiotic Process	Sign	Object	Some Possible Interpretants
Affordance	Natural feature	Purchase	Action that heeds feature or instrument that incorporates feature (in light of the purchase it provides)
Instrument	Artificed entity	Function	Action that wields entity or instrument that incorporates or contextualizes entity (in light of the function it serves)
Action	Controlled behavior	Purpose	Action that reacts to behavior, instrument that is realized by behavior, or instrument that contextualizes behavior (in light of the purpose it undertakes)

selection are best friends with, if not bedfellows of, sieving and serendipity.

6. Technocognition (Part 2): Lawn Mowers and Logic Gates

Through the work of psychologists such as Vygotsky (1978) and philosophers such as Austin (2003 [1955]), it has long been known that symbols are tools. Less well understood are the various ways in which instruments are semiotic processes, a point we may now consider.

In this view, an instrument is not a material artifact *per se* (e.g., the configuration of wood and steel that we call a “hammer”). Rather, an instrument is a relational process of selection and significance (table 1, middle row). In particular, the sign is the configuration of wood and steel that may be sensed by an agent. The interpretant is an action instigated by the agent (e.g., hitting a nail). And the object is the function of the instrument: both the form of the tool (*qua* sign) and the wielding of the form (*qua* interpretant) point to this function. The agent, then, is simply someone who can sense and instigate such that what is instigated (pounding in a nail) makes sense in the context of what is sensed (the assemblage of wood and steel) from the standpoint of the agent, given the features of the object.

Whether the agent wields the form for the sake of its creator’s intended function is not that important: sometimes the intended and actual functions converge, and sometimes they diverge. An agent with different interests (e.g., someone unable to reach the small of their back to scratch) could of course find (or rather “frame”) a very different function in the same assemblage of wood and steel. Though to be sure, not anything goes. Both natural causes and social conventions regiment the possible interpretants of material objects, guiding what counts as appropriate and effective uses (conventionally) and what counts as feasible and efficacious uses (causally). For example, try pounding in a nail with a diaper, and you will be sanctioned by “nature”; and try wearing a diaper as a hat, and you will be sanctioned by “culture.”

To be sure, the same assemblage of wood and steel can enter into more obvious processes of selection and significance. In one framing, for example, such an assemblage may be the object referred to by a word such as “hammer.” In another framing, it may be a natural or noncommunicative

sign that the one holding it has a certain skill or plies a certain trade. In another framing, it may be an emblem of solidarity, a sign of manual labor, or a symbol of status. In another framing, it may be a sign that some group had contact with another group, were connected to a trading route, or possessed the knowledge to mine a certain ore.¹⁷ Finally, this assemblage of wood and steel may not be just a sign or an object, it may also be the interpretant of a prior relation of significance and selection. For example, just as an action of wielding a hammer may constitute an interpretant of the function of a hammer, a hammer may itself constitute an interpretant of the purchase afforded by the wood and metal that it incorporates. That is, a larger instrument as a whole provides an interpretant of the smaller instruments and affordances that compose it as parts: its sign component (or “form”) relates to their sign components as whole to part, and its object component (or “function”) relates to their object components as ends to means.

But instruments enter into a more interesting relation of significance and selection. In particular, instruments are not just signs, objects, and interpretants, and instruments are not just means and ends: instruments are also agents that process signs to produce interpretants, however derivatively. This is not true of just relatively complicated instruments (such as computers and robots); it is also true of relatively simple instruments (such as hammers and lawn mowers), as may now be seen.

In particular, while it is perhaps too much to say that a lawn mower “senses” and “instigates,” lawn mowers are also agents—not because they select *per se* but because they were selected (as per the definition of an agent in sec. 1). In particular, a lawn mower was selected (in part through some original process of fabrication and in part through some subsequent process of pushing) to take in uncut grass (*qua* sensation) and to turn out cut grass (*qua* instigation). (Indeed, such selectional agency is distributed across a long lineage of envorgansisms that include the designer, the fabricator, the instrument-wielding actor, and the actor-wielded instrument,

17. It may also be a sign in the Nietzschean sense—a symptom that some mode of power has been operative, perhaps by reframing the function of a form, or the object of a sign. And it may also be a commodity in Marx’s sense, a use value (sign), whose value (object) is related to its exchange value (interpretant).

among others.) And this process makes sense from the standpoint of the agent only given the features of the object.

So if we treat a lawn mower as something that senses and instigates, however derivatively, that which is sensed must itself be a sign and that which is instigated must itself be an interpretant such that each point to that set of correlated features we call an “object.” This means that we may frame grass as a semiotic process as surely as hammers, but perhaps it is best understood as an affordance rather than an instrument. In particular, the sign is a set of natural features that may be sensed, the object is a set of purchases provided by those features (or something that reliably correlates with those features), and key interpretants are actions that heed those features because of the purchases they provide (table 1, first row). This is a retheorization of Gibson’s famous notion of affordances (1986) in terms of more basic processes of significance and selection (Kockelman 2006*b*).

Different agents in different contexts may of course find (or frame) different purchases (qua objects) in the same features (qua signs). For example, one may use the same grassy field to play golf or feed sheep. Lawn mowers, then, are oriented toward a particular subset of the purchases provided by grass. For example, with their blades, they are oriented to the fact that grass allows cutting by certain-shaped things; with their wheels, they are oriented to the fact that uncut grass affords passage for pushing; with their handles, they are oriented to the fact that human hands will be doing the pushing; and so on. While it is well known from the work of Gibson and von Uexküll that an environment has different purchases depending on the agent that senses and instigates within it, it is also true that an environment provides different purchases for the very same agent depending on the instruments they are currently wielding and the actions they are currently undertaking. To generalize the key Boasian insight, one both apperceives (or ap-senses) and apintends (or ap-instigates) through one’s instruments, be they “tools” or “symbols,” actions or roles, or affordances or identities.

It is worth pausing for a moment to make clear the foundational importance of holism as a staunchly nonreductive analytic stance and to relate some of the foregoing issues to phenomenological and textual concerns. There is *incorporation*: certain signs as parts make sense only relative to other signs as wholes.¹⁸ For example, to understand the meaning of a word we may need to know the sentence in which it occurs (Frege 1955), and to understand the meaning of a sentence we may need to know the speech genre in which it occurs (Bakhtin 1986). There is *contextualization*: certain signs as figures make sense only relative to other signs as grounds. For example, to know who “I” refers to may require that we know who is speaking, qua context (Jakobson 1990), and to know who “he” refers to may require that we know who was

18. Loosely speaking, for a sign “to make sense” means that an actor (or analyst) can figure out what object it is meant to have and what interpretant it might give rise to.

previously spoken about, qua co-occurring text (Halliday and Hasan 1976). And there is *realization*: certain signs as effects make sense only relative to other signs as causes. For example, Mead (1934) and Goffman (1981) were hypersensitive to the ways in which the meaning of an utterance may make sense only in the context of its roots (e.g., the utterance it is in response to) and its fruits (e.g., the utterance that will respond to it). Indeed, much of the work of interpretation turns on an interpreter’s constant tracking of and tacking between such causes and effects, parts and wholes, and figures and grounds. (Recall our discussion of framing more generally.) When we speak of a text as having “texture,” it is precisely the infinitely rich crisscrossings of such incorporating, contextualizing, and realizing relations that we are referring to. And when we described at the end of section 4 some of the ways in which context, cotext, and culture constrain indexical and inferential spaces, these are some of the relations we were describing.

Indeed, we generalized such patterned relations from symbolic texts and interactional sequences to material culture, and being in the world more generally, as a relatively coherent (or “textured”) ensemble of affordances, instruments, and actions (as well as roles and identities). As an example of incorporation (qua part to whole), the function served by a spoke may make sense only in relation to (the function of) a wheel. Or the purchase provided by clay may make sense only in relation to a pot. As an example of contextualization (qua figure to ground), the function served by a sheath may make sense only in relation to a sword. Or the function served by ice skates may make sense only in relation to ice. Such relations can be shown to structure not just modes of residence in the world (Kockelman 2006*b*) but also representations of the world (Kockelman 2007*c*) or the way mental states and speech acts acquire coherent contents only in relation to each other (and, indeed, in relation to modes of residence in the world).¹⁹ Moreover, such relations arguably hold for bi-

19. In offering his account of worldliness in *Being and Time* (1996 [1927]:59–106), Heidegger begins by focusing on practical things, or “equipment,” such as hammers and shoes. To describe the nature or meaning of such things, he introduced the concept of references (*die Verweisungen*), which may be loosely understood as the relations things have to each other by virtue of being caught up in practical concerns. With his theory of references, Heidegger was critiquing a tradition that focused on representations (e.g., the mental states and speech acts we discussed in secs. 2, 3). For Heidegger, references are a more originary mode of meaning than representations; they are not meant to replace them so much as to displace them.

To best exemplify references, we may focus on instruments. An instrument refers to the action it is used to undertake (what Heidegger called its “in-order-to”). For example, a hammer makes reference to the action of pounding in a nail. An instrument refers to the other instruments that contextualize it (in-terms-of). For example, a hammer makes reference to nails and wood as well as vices and benches. And an instrument refers to the work it will realize (what-for), itself often another instrument. For example, a hammer makes reference to the desk that the actor is making. This work in turn refers to whoever will use it as an actor (for-whom). For example, the desk makes reference to one’s son or daughter as the person who will one day sit there. This work refers to whatever materials

ological entities in the stereotypic sense (e.g., organs in relation to other organs within the organism and organisms in relation to other organisms within an ecological niche). At this level of analysis, psychologists, linguists, archaeologists, and biologists (inter alia) are engaged in very similar—and fundamentally holistic and interpretive—projects. Note, then, that the classic techniques of so-called humanistic scholarship are often precisely the tools needed for studying nonhuman modes of significance and selection.

We may now turn to more explicitly technocognitive instruments such as logic gates (e.g., AND), algorithms (e.g., Archimedes' sieve), artificial languages (e.g., LISP), and computers per se. In particular, consider a logic gate that has two inputs and a single output. In a limited sense, it senses its inputs and instigates its outputs, and it was selected (by some other agent, of which it is derivative) to instigate in a certain fashion in the context of a certain sensation. For example, if both its inputs register voltages above a certain threshold, its output is to create a voltage above a certain threshold. And just as the inputs may be reliably correlated with events in the world, so may the output be reliably correlated with events in the world. Indeed, the latter should make sense in the context of the former from the standpoint of the agent, given the features of these events. For example, perhaps the inputs reliably correlate with high humidity and high wind and the output reliably correlates with the closing of a house's shutters. Thus, while the creator of the logic gate (as one of the more original agents contributing to this scenario) may have

it incorporates, themselves often other instruments (from-what). For example, the desk makes reference to legs and a surface, lumber and paint, struts and joints. And this work refers, after a potentially long chain of intermediate works, to a final work (for-the-sake-of-which). For example, the work makes reference to the role of the actor—for example, as a carpenter, inhabiting a workspace with familiar tools. And more distally, the work makes reference to the identity of the actor—for example, as a father incorporating the role of carpenter while making a desk for his son or daughter for the sake of being a good parent.

Crucially, Heidegger's references are self-embedding and indefinitely reticulated. For example, the instrument may itself be the work realized by a prior action, and the work may itself be the instrument wielded by a subsequent action. Similarly, the materials may themselves be the work realized by prior actions, and the work may itself be the material incorporated by a subsequent work. Finally, the user may herself be the actor who wields the work as an instrument, and the actor was herself the user of the work realized by a previous action. For Heidegger, coherence of references (the way affordances, instruments, actions, roles, and identities make sense in the context of each other) is more originary than correspondence of representations (the way a subject is adequate to an object or a mental state or speech act is adequate to a state of affairs).

As should be clear, the account of affordances, instruments, and actions (roles and identities) sketched above is meant to replace Heidegger's account of references. Rather than framing such entities as "referring to" each other, we think of them as semiotic processes that contextualize, realize, and incorporate each other. More boldly stated, Heidegger had no theory of meaning (though he had brilliant intuitions regarding the need for such a theory), and scholars working in this tradition (e.g., folks into "dwelling," and so forth) generally inherited his lack of a theory and so tend to use Heidegger mumbo jumbo as a substitute for "hammering out" an actual conceptual framework.

had a very general object in mind, whoever later places the gate in a particular circuit (as a subsequent agent) projects a much more specific object onto the inputs and outputs of the logic gate—in this example, bad weather.

One might therefore think of such devices and any function with inputs and outputs more generally as shifters—semiotically akin to words such as "here," "now," and "us" (Jakobson 1990). Their meanings (qua significant features of the object) and motivations (qua interests of the agent who selected them) are fully specified only in a larger context—for example, one that takes into account a longer circuit (e.g., an accumulator), a contextualizing affordance (e.g., electrons), an incorporating instrument (e.g., a personal computer), a realizing action (e.g., uploading a file), and a performed identity (e.g., a playful and irreverent hacker).

Indeed, all of the usual questions of framing arise. For example, the same gate (along with many identical siblings) might be used in a latch (a very basic form of memory), itself used in an accumulator (a very basic kind of adder), itself used in a CPU (e.g., a Turing machine built with a von Neuman architecture). And just as a bicycle (as a relatively large instrument) provides an interpretant of the function of the smaller instruments that make it up (e.g., spokes, pedals, chains, etc.), and just as these smaller instruments provide interpretants of the purchases provided by the affordances they incorporate (e.g., steel, plastic, rubber), an accumulator provides an interpretant of each of the logic gates that make it up, and each of these logic gates in turn provides an interpretant of the purchase provided by the affordances it incorporates (from silicon to solder, depending on the current state of technology). In short, just as one can zoom out to the function served by many interconnected digital computers (qua the Internet), however wide, one can zoom in to the purchase provided by many incorporated silicon atoms, however narrow.

The logic gate, then, is a relatively derivative agent (its own placement in a circuit and sensing and instigating function being determined by whoever made it and whoever connected it). While it may have a far smaller degree of agency than more originary agents, it should be remembered that those more complicated agents (that seem to select) were themselves selected to serve various functions (however broad) on other timescales (however long) as parts of other units of accountability. In other words, do not get hung up on the fact that instruments are "derivative" agents. There is no life form that is not a derivative agent in this account. Indeed, there is probably nothing that is not at its root selectionally grounded in the dumbest of agencies—sieving and serendipity. (Which is not to say that human agency, be it understood from an intentional or a semiotic stance, is not spectacularly unique and efficacious in its power and flexibility. Indeed, human beings were selected to have the widest of functions oriented to different meanings for different motivations depending on the context of their cultures. *Homo sapiens* should be renamed *Homo shifters*.)

Finally, while the focus has been on logic gates and lawn mowers, one could probably give a similar albeit much more complicated account of neurons. And one could give a similar account of the functions that make up computer programs or mathematical formulas. And just as we shifted frames in section 2 to focus on the cognitive processes that mediate between speech acts, we could also shift frames to focus on the neurological processes that mediate cognitive processes. All of these are input-output devices, or sensing and instigating agents, that can be scaled up and sometimes down, to infinite degrees of complexity, with such wholes and their parts functioning as relatively derivative agents and having a variety of more or less specific objects given the shifting contexts of their circuitry. Moreover, they themselves are “hooked up” with speech acts and cognitive processes and material practices such that the entire “circuit” (qua network of interconnected envorgansisms) functions as a single system of selection and significance with a huge number of inputs and outputs and with the entire ensemble sensing and instigating “differences that make differences,” to use Bateson’s famous phrase, *whether the original or ultimate agents are selected, and whether the original or ultimate objects are significant*. In other words, while our focus has been on selection and significance, sieving and serendipity may be operative on any scale within such a network.

7. Relations between Relations Revisited

We just saw how we may take more basic processes of significance and selection and interconnect them to any degree of complexity imaginable, from a neuron to the nervous system, from a logic gate to the Internet, from an organism to an ecological niche, from a signer to a semiotic community. In the context of such interconnections, it is worthwhile to review some of the simpler kinds of relations between relations that are always present as well as to describe a more complicated kind of relation between relations that is simultaneously at play.

Figure 9 shows the interrelations among the various relations between relations that are discussed in this essay. As may be seen, it is meant to be an expansion or a blow up of a tiny piece of a much larger network—for example, a small piece of a conversation that is currently in the frame of an investigator, itself a five-minute swatch in the life of two members of a particular speech community. Moreover, just as it is meant to represent the fine structure of some link in the top network, any of its own links could be expanded to reveal their fine structure—for example, the cognitive processes that mediate between what the speaker just heard and what she is about to say, or the material infrastructure of the digital environs that connects this speaker to an addressee some 5,000 miles away. Dashed lines indicate the ways in which this kind of interrelationality may fractal in or rhizome out indefinitely.

The subset of relations between relations marked *a* are the classic Saussurian kind: the relation between any sign and

object (or signifier and signified) makes sense only in the context of other sign-object relations within a semiological structure or code. While these relations are made explicit in only one part of the diagram, they should be understood as potentially holding along any object-sign (and interpretant-object) relation within the diagram. As may be seen, while such relations were an object of awe and contempt in structuralist and poststructuralist circles, respectively, they are at best only a tiny sliver of onion in the whole enchilada. Perhaps never before was the aim of an entire generation of critical theorists thrown so far off the mark in thinking they had understood or undermined the foundations of meaning.

The subset of relations between relations marked *b* are those linking signs, objects, and interpretants as introduced by Peirce with his notion of correspondence.²⁰ In other essays, I have argued for the centrality of this kind of relationality and its paradoxical elision from much of twentieth-century social theory, and I have used it to provide a semiotic ontology of commodities (Kockelman 2006c) and analyze the distribution of semiotic agency (Kockelman 2007a). In these works, I have taken up questions of power and knowledge, exploitation and domination, enclosure and disclosure, materiality and mind, and so forth, and thus here I do not pursue the stakes of such an analysis for humanist framings of self and society.

The subset of relations between relations marked *c* are those linking agents to sensation and instigation. In some sense, these go back to Aristotle’s theory of the soul (as that which “senses” and “moves”) and should be intuitable to anyone who ever thought about organisms. But von Uexküll’s (1926) account of the disinhibiting ring and drive organ in animals, along with his exquisite diagrams, comes closest to this conception. In the present essay, such relations between relations were also generalized to describe more “derivative” agents such as instruments and environments.

The subset marked *d* are the relations between the foregoing two relations that have been the central focus of this essay: the essential complementary and symmetry of sign-object-interpretant relationality (*b*) and sensation-agent-instigation relationality (*c*). This is the relation between relations that constitutes the organism-environment interface or rather the envorganism itself. As is made explicit in this essay, such envorgansisms are subject to various modes of framing via processes such as contextualization (figure vs. ground), realization (cause vs. effect), and incorporation (part vs. whole). Where such a boundary is drawn is a function of the relation between the analyst and the envorganism being analyzed, which is itself an agent-object (analyst-envorganism) relation.

20. Notice how much this differs from the more widespread sense of correspondence as “truth” (in the sense of an assertion, or belief, being adequate to a state of affairs), which is essentially the signifier-signified relation all over again. Also note Geertz’s narrowly missed opportunity (not to mention the failure of generations of scholars—in anthropology, literature, religion, and so forth—who work under the banner of “interpretation”) to theorize “the *interpretants* of culture.”

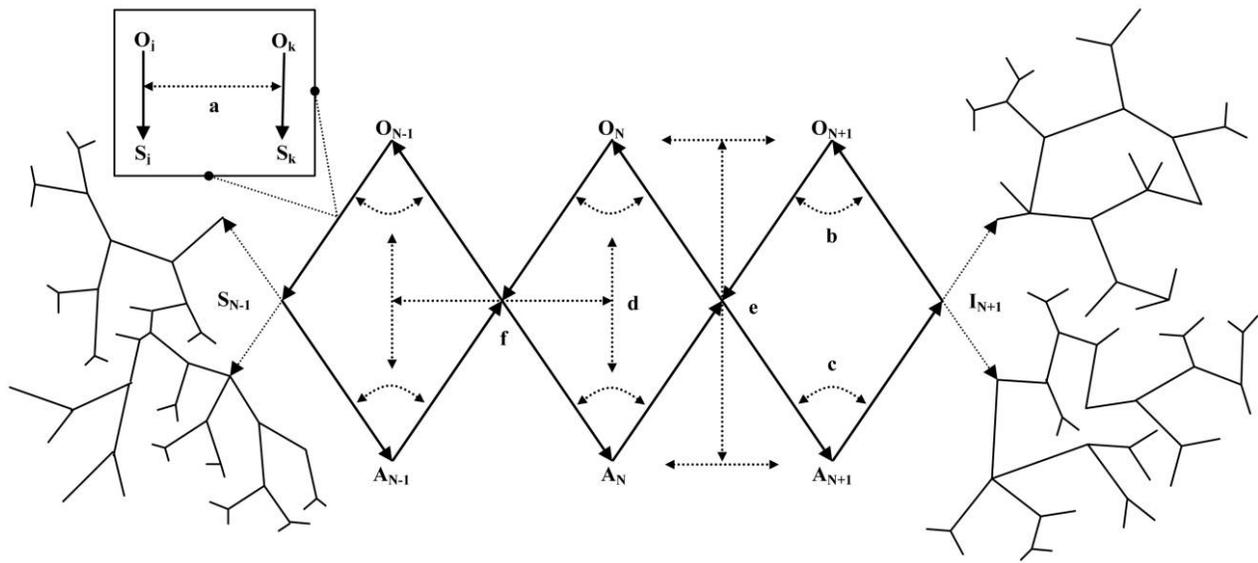


Figure 9. Relations between relations revisited.

The subset marked *e* represent the social relations introduced by Aristotle and Marx: a relation between people mediated by a relation between things, where both of these modes of relationality are themselves grounded in significance and selection. Crucially, this essay has generalized this kind of relationality: a relation between agents (which can also be “things”) mediated by a relation between objects (which can also be “people”). More generally, the people so related may not be only buyers and sellers, speakers and addressees, selves and others, they may be interactors at any scale, from afferent neurons to ecological niches, from communities to corporations. For example, the interrelated agents and objects can be vervet monkeys and predators, logic gates and bad weather, a woman and her lawn mower in relation to her purpose and its function.

The subset of relations marked *f* is different from the subset marked *e* even though they seem similar. These relations may be understood as relations between relations of type *d* as constituted by an ensemble of interconnected envorganisms—be they neurons or logic gates, speech acts or mental states, instruments or actions, intentional individuals or sieving gradients. These relations, then, are mediated by actual and possible configurations of channels such that the sensations and instigations, or signs and interpretants, of one such envorganism make sense only in the context of the sensations and instigations, or signs and interpretants, of other such envorganisms.²¹ In some sense, this is a way of generalizing Saussure’s insights from codes or “languages” (qua relation between signs and objects) to channels or “infrastructure” (qua relation between signers and interpreters), a point that requires some unpacking.

8. From Code to Channel: Networks of Interconnected Envorganisms

8. From Code to Channel: Networks of Interconnected Envorganisms

To understand this last kind of relation between relations, one needs to notice the fundamental similarity between codes and channels. A *code* in the Jakobson-Saussure framework is a set of type-type relations: signifiers (or signs) of one type are paired with signifieds (or objects) of another type. For a natural language, such as English, it takes an entire dictionary to fully specify the code: a set of mappings between words and concepts. And for a logic gate, such as NOT, there may be only two sign-object relations to specify: what voltage range counts as “true” and what voltage range counts as “false.” In contrast, a *channel* in the Jakobson-Saussure framework is a connection between the speaker and the addressee (or between the signer and the interpreter) such that signs expressed by the former (via processes that include instigation) may be interpreted by the latter (via processes that include sensation). Channels include synapses, air, and Ethernet cables—some of which are naturally occurring affordances and some of which

21. It is tempting to claim that scholars of social networks focus on relations (*f*)—either mathematically (and thus often without reference to the other kinds of relations) or sociologically (and thus typically taking into account only relations of type *e*). In this way, they usually leave out entirely relations *a–d* and hence the actual meaningful contents of the

interactions between the networked envorganisms. But let me leave this point for another essay.

are artificially designed instruments (relatively speaking).²² Note, then, the fundamental symmetry: just as codes connect signs and objects, channels connect signers and interpreters. Rather than focusing on what signs to send, we now focus on where to send them.²³

Now, while Saussure had very little to say about channels, he had a lot to say about codes. In particular, he made a famous set of distinctions that was grounded in his understanding of codes and grounding of his structuralist theory of language: selection versus combination, langue versus parole, synchrony versus diachrony, and arbitrary versus motivated. With two key caveats, each of these distinctions may be extended to think about channels, infrastructure, and networks more generally.

As for the first caveat, the point is not to just generalize Saussure's categories from codes to channels (which would simply give us a structuralism of the channel, thereby privileging langue over parole, synchrony over diachrony, and the arbitrary over the motivated). Rather, the point is to take his categories to be poles of a continuum and to understand social theory as requiring every range of positions within this continuum, and thus to focus on the motivated as much as the arbitrary, on practices as much as structures, on selection as much as combination, and on transformation as much as stasis.

As for the second caveat, our focus is not on a channel per se but on a network of channels linking an ensemble of envorgansisms. The problem with a word such as "network" is that its referent is often envisioned as a two-dimensional surface occupying a three-dimensional space (both like a "net" and somewhat like the Internet), where instead one should rather try to imagine an *N*-dimensional substance (itself chock full of brains and fangs) crammed into a four-dimensional space-time. With these caveats in mind, we may begin the generalization.

First, rather than think about selection (of paradigmatic alternatives within a code, e.g., whether one says *he*, *she*, or *it* or whether one says *was*, *is*, or *will be* or whether one says *happy*, *sad*, or *angry*), think about which channels (to which interpreters) are simultaneously accessible to a single signer (within a given network). And rather than think about combination (of such selections in linearly ordered syntagms, e.g., *she is angry*, *he was sad*, *it will be happy*, etc.), think about which channels may be sequentially accessed from a single signer. That is, operations such as selection and combination are at work in the domain of channels as much as in the domain of codes. And just as the "value" of a sign (qua

signifier-signified relation) for Saussure is dependent on its role in a grammar's code, the value of an envorganism is dependent on its role in a network of channels—where by "value" we mean how exactly, given this larger context, the features of its object or the interests of its agent should be understood (itself dependent on the frame at issue).

Second, just as the complementary notions of combination and selection may be extended from codes to channels, so too may the complementary notions of langue and parole (here understood in the wider sense of "structure" and "practice," respectively). For modern students of language as code, structure has two very different valences. On the one hand, it is pure potentiality: with a finite number of words and rules one can create an infinite number of different sentences. On the other hand, it is pure necessity: a grammar specifies how one should speak or what counts as an acceptable sentence. Practice is thereby subject to two different valences as well. On the one hand, it refers to any actual sentence said in a particular context—a singular entity usually called "an utterance." On the other hand, it refers to all of the ways in which such an utterance can fail to go according to plan: it may be ungrammatical for serendipitous reasons (a butterfly tickles our throat), or it may be ungrammatical for aesthetic or political reasons (a poet uses an adjective as a noun, a subcommunity inverts the meaning of *tu* and *vous*). Indeed, in this last sense, practice may be to structure as David is to Goliath or crime is to police. Poetic meter, from the structure of Petrarchan sonnets to the suite of Internet protocols, has both of these properties: *a finite domain of constraints leads to an infinite range of configurations, and any such configuration can both instantiate and undermine the set of constraints.*

To focus on the structure and practice of a network of channels interconnecting an ensemble of envorgansisms, then, is to foreground the tension between these valences. In certain cases, so long as the outputs, or instigations, of one envorganism match the inputs, or sensations, of another, the two can be combined. And meeting such constraints may involve a relatively simple matching of signals—of voltages (across logic gates), of codes (across speech communities), of neurotransmitters (across synapses), and so forth. Selection and combination of such simply matched channels may then give rise to configurations of unimaginable complexity. Think, for example, of the simplicity of train tracks understood as a small set of identically gauged segments (e.g., I's, C's, Y's, and X's) and the complexity of train tracks when such segments are interconnected. In short, the structure of channels refers to a relatively small set of principles or protocols that determine how envorgansisms may be interconnected (via processes such as combination and selection), thereby giving rise to a relatively large set of configurations, and the practice of channels refers to an actual configuration, itself usually an instantiation, and sometimes an undermining of the principles that gave rise to it.

Third, rather than thinking about synchrony (or stasis) in terms of the code that constitutes a grammar at a particular

22. Note, then, that channels may themselves be affordances and instruments, and so the network connecting the envorganism is itself composed of envorgansisms. Where one frames the boundary between channel and envorganism is usually grounded in a decision about relative salience or the agency of the units involved.

23. I highly qualify this simple symmetry between material translation (channel) and meaningful translation (code) and develop its repercussions (Kockelman 2011).

moment, think about the selected and combined channels and the governing principles and instantiated practices that interconnect an ensemble of envorganisms at a particular timescale. And rather than thinking about diachrony (or transformation) as changes in grammatical structure over historical time, think about the changes in the selection and combination and the structure and practice of channels that occur on various timescales: evolutionary, historical, biographical, interactional, and so forth. Temporally, such scales may range from eons to nanoseconds; spatially, they may be interstellar or subatomic. For example, these ensembles are not static: objects and agents may be born or die, may be introduced or taken away, may start up or break down at a moment's notice. Indeed, in more human terms, and given present concerns, a fundamental interpretant nowadays is connecting or disconnecting a channel (think Twitter and Facebook); that is, the fundamental mode of real-time instigation by human actors is selecting what (and whose) instigations one will sense and what (or who) will sense one's instigations.

Finally, we may turn to Saussure's distinction between the arbitrary and the motivated, itself going back to Aristotle's distinction between convention and nature. For Saussure, such a distinction was meant to describe the relation between a sign and an object: why was a particular sound pattern (e.g., the word "rat") paired with a particular concept (e.g., domestic vermin)? In this essay, in contrast, we have been focusing on motivation in the sense of selection: not how a sign stands for its particular object but why an agent produces a particular interpretant. Moreover, in Peircean terms, Saussure thought language was mainly symbolic (with such relations grounded in convention) and minimally iconic and indexical (with such relations grounded in similarity or contiguity, respectively). In contrast, we have been foregrounding the essential link between selection and significance, or "meaning" and "motivation," and we have been focused on a much wider set of selected and significant processes than natural languages.

With these caveats in mind, we may use the pairing between the arbitrary and the motivated in an expanded sense to think about the network of channels connecting an ensemble of envorganisms. In particular, the central move is this: while any envorganism is by definition caught up in relations of significance and selection, envorganisms may have their effects channeled out to other envorganisms at great distances of remove and any envorganism may have its causes channeled in from other envorganisms at great distances of remove, and these causes and effects—however large and lasting, splendid or devastating—may not have been selected for their significance. In some sense, then, the most interesting questions lie at the edge of (and often far beyond) processes of significance and selection. Sieving and serendipity are not just operative in natural selection, at the roots of the system; they are also operative in the mediating relations between any two interconnected envorganisms as some of the fruits. *Just*

as selection and significance (qua "the motivated") are at work, sieving and serendipity (qua "the arbitrary") are at play for every unit and at any scale.

Sieving and serendipity, especially when understood in relation to a network of interrelated envorganisms and as giving rise to complex emergent codelike patterns (such as "language" and "culture" as understood in the simple sense as relatively stable group-relative linkages between signs, objects, and interpretants), should be understood as playing key roles in several other traditions that I only touch on here. First, the relation between sieving and computer languages (and more generally, finite automata, context-free grammars, and Turing machines) is profound. When framed in their generality, the key issue underlying such processes is that of a filtering device that accepts certain strings (and thereby "recognizes" certain languages qua sets of strings) and rejects others (Sipser 1996). (And, to foreground the power of such a vision, note the infinitely wide range of things that can be represented by such strings [taking into account the frame of relevance and degree of resolution]: all media, DNA, and computer programs themselves.) To be sure, most computer programs in the stereotypic sense are selected (written and implemented) precisely for the effects of their sieving. However, there is much ongoing research on cellular automata and similar processes: complex, organized, and often useful patterns generated by sievelike processes involving large arrays of relatively simple agents that do not seem to have been selected for in any traditional sense. The field is enormous, but early highlights in theoretical biology include papers by Kauffman on self-organizing systems (1993; 1995), and in the field of anthropology, a recent highlight is Lansing's (2006) study on water temples in Bali. Ironically, in Mitchell's (2009) careful and accessible overview of this field of complexity studies, the question of meaning receives only a paragraph (184).²⁴ *The present essay's focus on meaning, or rather significance, is thereby meant to complement that tradition's focus on sieving and selection—to take up a similar set of questions from a very different starting point.*

There is a relation between sievelike processes and the research agenda carved out by the proponents and opponents of memes (Dawkins 1976; Hull 1988; Sterelny 1994; Sober 1992; and see Sterelny and Griffiths 1999 for a review), epidemiology-inspired scholars of language and culture (Atran 2002; Boyer 1994; Enfield 2003; Sperber 1996; inter alia), anthropologists interested in the relation between cultural evolution and genetic change (Boyd and Richerson 1985; 2005; Cavalli-Sforza and Feldman 1981; Tomasello 1999; inter alia), and linguistic anthropologists interested in the relation between the circulation of sign forms and the establishment

24. Indeed, she frames the question as "how does information acquire meaning?" whereas I see the process of "acquisition" running in the other direction—to wit, information turns on the mathematical, technical, and logical enclosure of meaning (Kockelman, "Information is the enclosure of meaning: comparing the theories of Shannon, Peirce, and MacKay," unpublished manuscript).

of dialects and registers (Agha 2003; Labov 1994, 2001). For example, Sperber makes the compelling argument that cognitive processes, themselves probably selected on other time-scales for other purposes (e.g., navigating the social and environmental affordances of the Pleistocene), may come to bias the kinds of representations (qua “beliefs” and “concepts”) that spread easily and stabilize widely, giving rise to the patterns many would call “culture.” In the framework offered here, such cognitive biases are just one kind of sieve among many. Indeed, it is worth making one relatively neo-Boasian (or neo-Saussurian) aside: *the representations we already have (qua sign-object relations, or “cultures,” “codes,” and “contexts”) and the relations we are already implicated in (qua signer-interpret relations, or “networks,” “channels,” and “infrastructures”) are perhaps the two most important sources of sieving (and selection) underlying the representations and relations we will come to have.*²⁵ This fact is perhaps the real barrier to any nonholistic reductionist understandings of the “evolution” or “epidemiology” of culture.

Indeed, given all the different ways in which significance and selection may be framed such that the universe is really a multiverse—each actor caught up in and each analyst oriented to a different web of relationality—we may say this: where we draw the boundary between the motivated and the arbitrary or how we frame the divide between what is selected and significant and what is sieved and serendipitous is itself grounded in processes of selection and significance and processes of sieving and serendipity.²⁶ To paraphrase Wallace Stevens, the aim, however unachievable, is to see nothing that isn’t there and the nothing that is.

Acknowledgments

I would like to thank three anonymous reviewers and the editor Mark Aldenderfer for their stimulating comments and encouragement. An early draft of some of the core ideas of this essay was written while I was a guest in the Language and Cognition Group at the Max Planck Institute for Psycholinguistics in Nijmegen, the Netherlands. I want to thank the members of this group and in particular Stephen Levinson and Nick Enfield for hosting me. Steve and Nick also invited

25. The term “representation” is being used in a very wide sense to mean public and private representations of the world (qua speech acts and mental states) as well as modes of residence in the world (qua affordances, instruments, actions, roles, and identities), as well as relatively fixed sign-object-interpretant relations more generally (whether these are framed as codes, contexts, or co-occurring texts). And one key reason that these have the sieving and selective effects they do is the modes of incorporation, realization, and contextualization that constitute them. For an account of the role of value (and “values”) in selection—qua human-specific modes of choice—see Kockelman (2010*d*).

26. This claim is related to but is not the same as an older claim: where we draw the boundary between nature and culture is itself grounded in culture—subject to various degrees of “strain” (Brandom 1979).

me to participate in a Wenner-Gren symposium titled “The Roots of Human Sociality” (Enfield and Levinson 2009). And several key conceptual threads of this argument emerged in conversations with Nick Enfield, to whom I dedicate this essay.

Comments

Vincent Colapietro

Department of Philosophy, Pennsylvania State University,
240 Sparks Building, University Park, Pennsylvania 16802,
U.S.A. (vxc5@psu.edu). 5 IV 11

Mundane Reservations

Why do I not feel more at home in Paul Kockelman’s account of our residence in the world (2006*b*), especially since I have such deep sympathy for his creative appropriation of Peircean semiotics? Why do I feel his attempt to represent our representations of the world leaves something out of account or, what is even more troubling, might not square with his own efforts to foreground our residence in the world (Kockelman 2006*b*)? Why do I find his endeavor in “biosemiosis, technocognition, and sociogenesis” to use the relation of relations to one another as the pivot around which everything turns to be such an intriguing and insightful exercise but ultimately an unsatisfactory and even misguided project? Perhaps I am not mistaken in taking myself to be representative of a certain class of his readers, somewhat sympathetic to the enterprise of grand theory but at the same time deeply suspicious of its relentless drive toward inclusive classifications and formal systematicity. Perhaps my failure to feel more at home in his account of our residence in the world and my misgivings or at least reservation about these other topics are not utterly idiosyncratic. If so, then my all too brief exploration of these matters might be illuminating to more than Kockelman (if it is indeed that) and me.

As a first stab at an answer, my impulse is to suggest that his pragmatist sensibility and phenomenological sensitivity are in these endeavors too frequently eclipsed by his formalist and taxonomic inclinations. As a second stab, it is to wonder (perhaps “worry” is the more honest term here) whether he appreciates the implications of his own insights, especially those regarding our residence in the world. Do not these insights carry implications for both the *form* and the *functions* of our practices of theorizing? Although I have struggled to resist doing so, I cannot vanquish the temptation to juxtapose Kockelman’s theoretical writings to Tim Ingold’s. The practices and experiences out of which our efforts to understand the various forms of human life emerge and by which these efforts are to be assessed have an all too allusive and hence elusive presence in Kockelman’s writings, whereas Ingold’s texts more effectively evoke a palpable sense of the mundane

context of our quotidian engagements. To use Ingold's term, humans are, in Kockelman's texts, "exhabitants" of the earth or, more accurately, too much so (see, e.g., Ingold 2007:7–11). It is one thing to insist schematically and formally that humans are beings in the world, and another to convey in an arresting and reorienting manner a sense of ourselves as just such beings. What I too often miss in Kockelman's writings is a more concrete sense of our inextricable entanglements and a more lively sense of the unfinished character of the natural processes and human practices in which human and allied actors are ineluctably caught up.

Theories are, to be sure, always more or less thin: they are maps, and not the terrain itself—outlines, and not the affairs the theorist is striving to render intelligible by means of outlines and diagrams. But some theories are more successful in evoking a keenly felt sense of experiential thickness, density, and texture and also of temporality, improvisation, and open-endedness. Kockelman is as appreciative as I am of James's emphasis not on "things but things *in the making*," not on antecedently fixed conditions but historically emergent factors. Even so, his Jamesian impulse to take the world to be truly a *multiverse* is, in some measure, thwarted by a Hegelian drive to gather up the irreducible heterogeneity of the actual world of our varied experience into a single comprehensive framework.

In "Notes toward a Politics of Location," Adrienne Rich asserts that "theory—the seeing of patterns, showing the forest as well as the trees—theory can be a dew that rises from the earth and collects in the rain cloud and returns to the earth over and over" (Rich 2001:65). Along with all other human practices, anthropological and other forms of theorizing are rooted in human entanglements with the mundane world so critical for eliciting and sustaining, redirecting and transforming, the heterogeneous array of human undertakings (including the most rarefied genres of theoretical discourse). But if theory, anthropological or otherwise, "doesn't smell of the earth, it isn't good for the earth" (Rich 2001:65). In my nostrils, Paul Kockelman's writings, including the most programmatic and schematic of them such as "biosemiosis, technocognition, and sociogenesis" smell of the earth. They give unmistakable evidence of having arisen, like morning dew, from this dwelling place, and also of returning, over and over again, like afternoon rain, to the earth. But they would be even better for the earth if they smelled more of their source.

Zoe Crossland

Department of Anthropology, Columbia University, MC 5523, 1200 Amsterdam Avenue, Room 452 Schermerhorn Extension, New York, New York 10032, U.S.A.
(zc2149@columbia.edu). 19 IV 11

Paul Kockelman's stimulating paper explores the relations between processes of selection and significance and in so do-

ing works to reframe relations between the subfields of anthropology. His paper touches on many thought-provoking issues, but I would like to use this comment to think about how his work might be useful for archaeologists. There are various points of intersection with archaeological concerns, but here I will focus on the discussion of context and agency. Kockelman's emphasis on framing as a question of scale and orientation situates the anthropologist firmly within the work of semiosis and provides ways to think about the disciplinary schisms that often prevent us from engaging thoughtfully and productively with one another. It also draws attention to the complexities of archaeological inference. Kockelman notes the importance of context for understanding both semiosis and agency—how in forming inferences a world of sedimented experience is drawn on and selected from. This question of context has been a key theoretical concern of archaeology since the 1980s, and the paper is helpful in starting to tease apart a concept that has been a bit of a black box for archaeologists.

In encouraging us to look further than the correlation between sign and object, Kockelman asserts the importance of the interpretant along Peircean lines but also makes a claim for another set of relations that revolve around selection rather than significance. As he notes, a particular sign (let us say a standing stone) could stand for a whole range of things (whether for men, for seeds, for power and authority, for blessing from the ancestors, or all of these). To understand which is indicated at any particular moment, he suggests that we need a double analytical move. On the one hand, we need to consider the relationship between the sign and its object and the particular interpretant that is elicited. If a stone was understood as a dead ancestor, was it then avoided, anointed with alcohol, wrapped in textiles, spoken of in hushed tones? On the other hand, we need to consider context, or "collateral experience," as Peirce put it. It is this collateral acquaintance with past sign relations that archaeologists have to build up precisely through the signs that we are trying to understand. This would be an impossible task were it not for the interconnected, networked, or entangled nature of semiosis. As Kockelman shows, this means that we can come at signs from multiple perspectives. Interpretants are certainly an important part of establishing context archaeologically: fragments of broken bottles at the base of a stone or hollow ways that trace a path of avoidance around certain landscape features both act as habitual interpretants of particular sign-object relations.

However, to understand why these interpretants are elicited rather than others, Kockelman suggests that we need to theorize selection more thoroughly. Selection revolves around agents and provides a way of thinking about the conditions under which these different sign-object relationships are foregrounded. Kockelman suggests that processes of selection and semiosis cannot be understood apart from one another; to understand why a stone represents a dead ancestor and is anointed with alcohol, one must also consider how the different semiotic possibilities were selected and understood by

those doing the anointing. This orients the problem of collateral experience around questions of agency, which Kockelman has explored elsewhere. I value the emphasis on the variability of agents, whether collectives, nonhuman or human, intraindividual or supraindividual. This is a useful counterpoint to the tendency to map agency onto people (or more recently, onto things). It is also liberating for archaeologists to acknowledge the agency of a group or community of selectors over time; we find it difficult to deal with agency on an individual level, and this has led to some anxiety among archaeological theorists. Kockelman provides us with a firm theoretical footing for looking at agency more broadly conceived. Having said this, I would like to hear more on why we need a concept of agent to think about processes of selection—despite Kockelman's efforts to dehomunculize the homunculus, the term does seem to obscure the relationships that are in operation. Some agents are themselves semiotic processes that sense and instigate, select and are selected; others operate as dumb sieves, in which case why use a term that forces these agentive processes to become agentive things and that retains connotations of free will, cognition, and human subjectivity? Kockelman's perspective intersects in interesting ways with the work of Bruno Latour and Michel Serres, and it would be helpful to hear his position on actants and actor-network theory. Peirce's concept of semiotic process offers more than the structuralist semiotic model that currently underpins (and arguably, undermines) ANT. Kockelman's work has the potential to make an important intervention into the debates around ANT and could provide a powerful means to engage archaeology's semiotic concerns with the burgeoning literature on materiality and networks. I look forward to further papers.

Marcel Danesi

Department of Anthropology, University of Toronto,
Toronto, Ontario M5S 1A1, Canada
(marcel.danesi@utoronto.ca). 1 IV 11

Attempts to amalgamate various strands of inquiry into the formal study of semiosis, defined as the innate ability to produce and comprehend signs, have led to several interesting developments within semiotics proper, including biosemiotics (Barbieri 2007; Sebeok and Danesi 2000), a branch that approaches the study of semiosis as an innate faculty in all living things, from plants to human beings. The interesting aspect of Kockelman's paper to a semiotician is that it puts forth an integrative model of semiosis that is applicable across species, even though Kockelman does not explicitly claim this to be the case.

I have no particular bone to pick with his model, which, at least as I read it, equates the production of meaning, which he calls *significance*, with symbolism and the coding of information and *selection* with the actual physical system or

channel that allows us to select from the flux of raw information only those structures inherent in it that have relevance and meaning to us. He calls the ability to enact such selections *technocognition*, if I read his use of this term correctly. I do have some suggestions, however, for expanding this very idea. By taking into account the McLuhian view of tools as bodily extensions (McLuhan 1964), Kockelman could then justify his use of technocognition as the process that guides such extensions, thus incorporating into his model the notion that selection and significance are interconnected phenomenologically. This implies, in effect, that the signifying resources we use to make "significant selections" from the world of information are extensions of our biological and psychological makeup. A tool such as the wheel extends our locomotive capacities; a tool such as the telescope extends vision; and so on. Being extensions of our bodies, McLuhan claimed that the actual tools we develop then take over the functions of biological evolution, so that we evolve through them. "Sociogenesis," to use Kockelman's term, is thus the product of such "artifactual evolution," as it can be called.

The other aspect of Kockelman's model that I believe needs elaboration is to differentiate semiosically between *information* and *significance*. In the communication sciences, much is made of the term "information," while the term "significance" is seen as too vague and "meaningless." The first to study communication as an information-delivery process was Claude Shannon, as Kockelman points out. All Shannon wanted to do with his model was to solve the problem of how best to encode raw information using notions from probability theory. He developed the key concept of information *entropy* as a measure for the randomness or uncertainty in a signal or message. For example, a ringing alarm system carries more information when it is "on" than when it is "off" because the latter is the "expected state" of the alarm system and the former its "alerting state." The information inherent in a signal, thus, is inversely proportional to its probability. The more probable a signal, the less information load it carries; the less likely, the more. Shannon used this notion to improve the efficiency of telecommunication systems. But Shannon's model tells us nothing about the meaning of the signal or the information it bears. Indeed, when we hear the alarm, we wonder what has gone wrong or what it means. Interpreting signals involves semiosis. *Information*, as its name suggests, is "form-as-raw-data." For this to become meaningful—that is, for it to convey something—it must be interpreted as something recognizable and usable. As Kockelman correctly points out, Shannon's model essentially depicts information transfer as a one-way process without the agency of the selector of the information. Kockelman's theory is one way of emphasizing the role that subjective experience and the active interpretation of information (significance) plays in semiosis. In effect, studying information in itself is useless unless we also study how we extract meaning from it.

In sum, I think that Kockelman's model is a first step in allowing us to understand how semiosis is linked to agency

and to what he calls technocognitive and sociogenetic processes. However, it needs some elaboration according to some of the ideas entertained here.

James D. Faubion

Department of Anthropology, MS 20, Rice University, P.O. Box 1892, Houston, Texas 77251-1892, U.S.A. (jdf@rice.edu). 19 III 11

Peirce meets systems theory in this wildly ambitious and often brilliant essay. I have recently delivered a polemic in favor of an anthropological return to programmatic inquiry (Faubion 2011), which the author turns out to have heeded pre-delivery. I thus cheer him on. In the course of that polemic, I distinguish among four prominent sorts of conceptual apparatuses: referential (which proceeds inductively from empirical tokens to abstract types); diagnostic (which is preoccupied with part-whole, text-context relations); tendential (which highlights intrasystemic tendencies); and model theoretic (which is concerned with the logic of a system as a totality). The author seems congenially disposed to all of these, but—at least in the essay under review and the Nietzschean caveat notwithstanding—plainly embraces the model theoretic as his apparatus of choice. Here, again, I approve. When well wrought and well deployed, model-theoretic apparatus can be singularly conceptually robust. Even the polemicist has to admit, however, that detractors are likely to doubt their reliability. To put much the same point differently, I need only twist slightly the words of system-theoretic fellow traveler Niklas Luhmann (1989): “such an apparatus can be a far-reaching, elegant and economical instrument” of elucidation and explanation, but “whether it is correct is an entirely different question” (35).

The author claims that his essay began as a “squib.” He offers his construction of a “general theory of meaning” as an “ideal type” and the ideal type as “that last refuge of the scoundrel,” indeed, as the uniform felicity of the illustrative examples provided attest. The monkeys always seem to recognize bears for precisely what they are. An even wilier dimension of the construct is its closure, its definability, its determinacy. Among the entailments of such closure—the same point can be made of Luhmann’s system theory, and in fact Luhmann insists on it—is that the “envorganism” is a creature fundamentally divided. It consists of an environment on the one hand and a system on the other. The causal interaction between the two must in every case be mediated—or “channeled,” as the author seems to prefer. Otherwise, the system itself would suffer a breach and the theoretical modeling of it would thus have to be systemically open. The elegance of semiosis would thus be bound to suffer. Not just ideal typology but genuine idealism enters the author’s model at this juncture. Nowhere is this more evident than in his parsing of Peirce’s notion of the immediate object as an object

“that signs represent (*and hence that exist because the sign brought some interpreter’s attention to [it]*)” (my emphasis). The idealism at issue does not sit easily with the author’s late salvo against the irreducibility of the contrast between natural and artificial selection.

As it turns out, however, this is a bit of a squib. If one tracks down the “evil twin” of the essay under review, one encounters an extended acknowledgment and analysis of a variety of circumstances in which the systematicity of semiosis is disrupted, goes afoul, crumbles into the asymmetrical seriality of unmitigated historicity (Kockelman 2010a). This is fine and well in the end, and hardly evil at all. The evil of the twin instead lies elsewhere. It may also cast its malignancy back on its putatively more virtuous sibling—unless the author can assure us of the contrary. The twin pronounces that “with Kripke and Putnam . . . we learn that all words are a little bit like proper names” (2010a:414). No, actually, we do not. Though he is not the first to do so, Kripke famously argues that proper names do not at all function like signs. They function ostensibly; they designate, they have a direct casual link to their designees, but they do not “stand for” them in the manner of the Kockelmanian sign. Now, one might seek to refute Kripke, prove the proper name to be a sign, and preserve one’s general theory of meaning intact. Alternatively, one might follow Kripke and resign oneself to banishing proper names from the general universe of semiosis. The twin makes no effort to refute Kripke but simply proceeds to treat the proper name as a sign (2010a:416). This looks very much like wanting to have one’s cake and eat it, too.

A final (mean-spirited) note. I very much doubt that the author’s pointing out that biologists, archaeologists, linguists, and interpretive anthropologists are engaged in the “humanistic” enterprise of the analysis of part-whole relations is going to lead to any peace treaties being signed in anything like the near future.

Stefan Helmreich

Anthropology, Massachusetts Institute of Technology, Room 16-267, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139, U.S.A. (sgh2@mit.edu). 27 II 11

Once upon a time, David Schneider called culture “a system of symbols and meanings” (1968:8). After the critiques of the 1980s and 1990s, however, anthropologists came to think of “culture” as less systemic, less whole. In the wake of post-structuralism, they also came to think of “meaning” as elusive—if not as an ideological placeholder for universalist metaphysics.

Against this history, Kockelman offers “a general theory of meaning.” This time out, however, it is not “culture” that grounds meaning but rather an expanded sense of the “biological”—the biological not as a foundational or fixed “na-

ture” to “culture” but as an organic assemblage of apparatuses of selection and signification: the biosemiotic.

Biosemiotics has been much in the philosophical and anthropological literature lately, from Giorgio Agamben’s (2002) retrieval of biologist Jakob von Uexküll’s early twentieth-century notion of the *Umwelt* (a being’s sensorial world), to Eduardo Kohn’s 2007 use of *Umwelten* to speak of human-dog relations for the Amazonian Runa, to Jussi Parikka’s *Insect Media* (2010), to Thierry Bardini’s *Junkware* (2011). What those works have in common is concern with the unstable mix of commensurability and incommensurability—the multiplicity—that characterizes human/nonhuman agencies, sensoria, and relations. Insofar as Kockelman employs the notion of the “multiverse,” his theory is in dialogue with this work. By and large, though, Kockelman takes a different tack, seeking a unifying material semiotics of relationality. His multiverse is epistemological, and not ontological.

At the center of Kockelman’s analysis is “relations between relations”—and there are, he writes, many species of these, some structural (Saussure, Marx), some processual (Pierce), and some that fuse these forms (Veblen). In such fusions, relations between relations produce values that generate derivative values that come to stand for the “original” relations, which are then sieved into future relations. That notion of derivation recalls Jane Guyer’s arguments in *Marginal Gains* (2004) about the production of value in Atlantic African exchange; relations and value are always already derivative (see also Lépinay 2011). To put this in the language of evolutionary biology, adaptations always mix with what Stephen Jay Gould and Richard Lewontin (1979) called “exaptations,” ancillary developments of affordances not strictly selected for. All these are connections consistent, I think, with Kockelman’s project.

But, one might also make connections that crinkle the neatness of Kockelman’s model. If Kockelman argues that the key unit in anthropology might be “a relation between two kinds of relations between relations,” he does not do so in dialogue with a major contemporary anthropological thinker on relation: Marilyn Strathern. Her work *The Relation: Issues in Complexity and Scale* (1995) offers critical takes on “relation” as well as “complexity” and “scale,” which, she argues, are reifications with social histories (see also Tsing 2000 on “scale”). Kockelman’s claim that his theory of meaning “foregrounds the environment-organism relation at any level of complexity and with respect to any kind of life form” can be complicated by treating “relation” as a thickly historical term of art.

Each term in the claim might benefit from other worrying, too. As for the environment-organism relation, in *The Mirage of a Space between Nature and Nurture* (2010), Evelyn Fox Keller suggests that attempts to overcome the organism-environment divide often simply reify those poles. As for any level of complexity, beyond historicizing “complexity” itself, one might ask what sort of complexity is at issue; physicist Seth Lloyd (2001) catalogued dozens of measures of complexity. With respect to any kind of life form, do we know

what “life” is or why it takes a “form”? This conjuncture of life and form—which has origins in the German *Lebensform*—is more historical than ontological (Helmreich and Roosth 2010).

In *Trying Leviathan* (Burnett 2007), the historian of science D. Graham Burnett looks at philosopher of biology John Dupré’s (1999) argument that a whale might be considered a fish if one takes seriously ordinary folk taxonomy (of the kind championed by Melville in *Moby-Dick*’s “Cetology” chapter; Melville 2001 [1851]). But Burnett argues that the excommunication of whales from fishes is not a philosophical matter but a historical one. What is called for is not generalization but specification—or, otherwise put, “situated knowledge” (Haraway 1991; feminist critiques of universalism would be intriguing to think with next to Kockelman’s model).

The “diagrammatic generality” sought by Kockelman may be just that, a generality that attaches to the world only if one takes “environment organism,” “level of complexity,” and “life form” as categories that can be extracted from their historical emergence. The model, offered to bring different practitioners into conversation, is, as Kockelman rightly says, an ideal type. But it is also an ideal type that can be examined as a social fact emergent from relations between the relation between history and epistemology, relations we might think through—to join Kockelman in paging back to our disciplinary forebears—using the analytical sieve of Boasian historical particularism.

Olivier Morin and Christophe Heintz

Institut Jean-Nicod, Pavillon Jardin, 29 rue d’Ulm, 75005 Paris; France (olivier@cognitionandculture.net)/Central European University, Department of Cognitive Science, Nador u. 9, 1051 Budapest, Hungary. 7 IV 11

The Specificity of Human Communication Eludes Semiotic Theories

Paul Kockelman’s ambitious paper connects social and cultural anthropology with evolutionary theory on the basis of two assumptions: first, humans are evolved organisms; second, culture itself evolves. These two assumptions have been the starting point of much work in anthropology, connecting the natural sciences with the study of human culture. One reason why mainstream anthropologists (especially when influenced by the interpretive tradition) tend not to be interested in such approaches is the widespread impression that naturalistic accounts of culture do not deal with the meaning of public symbols or put excessive restrictions on talk of meaning and symbols.

There have been, however, many interesting proposals to naturalize the study of signs and their meaning. Kockelman’s

could be described as drawing on two theoretical traditions: the semiotic study of natural signs (Peirce 1868) and the selectionist account of signals proposed by Ruth Millikan (1984), among others. We feel the pull of both approaches, but we fundamentally disagree with the way they account for human communication.

Kockelman borrows from semioticians the intuition that some signals can represent features of the world merely by virtue of standing in some relation with it and with an observer. Thus, the visual shape of a bear signals the presence of that bear to observers. No intentionality is required on behalf of the bear. Indeed, a stone may “signal” its presence in the same way.

Such natural signs, Kockelman argues, may come to serve communicative functions through a process of selection. Like Millikan, he argues that linguistic devices (words, syntactic forms, inflections, etc.) become stable in a community because of the regular patterns of correspondence between the use of the linguistic device and the responses of hearers. In particular, when linguistic devices are words, these regular patterns constitute the words’ conventional meanings. Both human and nonhuman signals are subject to various processes of selection: most nonhuman animal signals were selected as part of the organisms’ biological evolution, while most human signals were selected during cultural history. But both are selective processes through which items with meaning emerge. Consider, for instance, the calls of vervet monkeys: these calls, one type for each one of their major predators, may have been selected because they serve to warn other monkeys.

In this way, one can get meaning from causal relations combined with selection. In Kockelman’s view, these two basic mechanisms (occasional refinements notwithstanding) suffice to give us a complete account of human communication: “Human-specific cognitive processes and linguistic practices are just particularly complex modes of significance and selection.”

We disagree. Human signals have at least one property that other animal communication systems lack. Human signals cannot be explained by significance and selection alone. Focusing on these processes is enlightening when trying to understand nonhuman communication (from vervet call to bee dance) but will lead us no further.

According to Gricean theories of communication (Csibra and Gergely 2009; Grice 1989; Sperber and Wilson 1995 [1986]; Tomasello 2008), human communication relies on the interpretation of communicative intentions in a way that no other communication system does. When one is decoding vervet alarm calls, one does not need to pay any attention to the communicative intentions of monkeys. We can learn all we need to know about the meaning of vervet calls by observing their causes and their history. Knowing that a caller intends to be heard does not tell us anything we did not know about the meaning of his calls. His intentions do not figure.

Compare with human pointing. If A points at some region in space, it would, most of the time, be very hard for B to

figure out what object or process A wishes to draw B’s attention to without making assumptions about A’s intentions, beliefs, and beliefs about B’s beliefs. A’s intentions are not just necessary to the production of her pointing gesture. They are crucial for its interpretation, too: B can make sense of the signal only by being aware of A’s communicative intention. In other words, understanding communicated information is not for humans just a process of decoding strings of signifiers; it is an inferential process that starts with attributing communicative intentions to the communicator and ends with a conclusion about what the communicator meant or wanted to communicate. Human communication is based on the expression and recognition of communicative intentions. This (and not necessarily some greater “complexity”) might be the main root of the flexibility and richness of human communication.

Paul Kockelman dismisses Gricean theories for being overly preoccupied with psychology and not concerned enough with the public aspects of communication. However, the empirical study of overt interactions is an important aspect of the Gricean tradition (Brown and Levinson 1987; Sperber and Noveck 2004); this approach is quite compatible with the strong interest many anthropologists take in the history of public systems of signs.

Gary Tomlinson

Department of Music and Whitney Humanities Center,
Yale University, New Haven, Connecticut 06511, U.S.A.
(gary.tomlinson@yale.edu). 22 III 11

We are all wary of reinventions of the wheel, but Kockelman reminds us that sometimes reinventing builds better machines. He extends recent evolutionary thinking along several lines.

Semiosis. Kockelman contributes to a resurgence of Peircean semiotics (an earlier instance, to which I will return, is Deacon 1997) involving three shifts of emphasis: the turn from the structure of signs to the process of signification, highlighting the *interpretant*; the focus on *indexicality* rather than symbolism, highlighting contiguity, context, causality, and relation; and the analysis of nested *hierarchies* of semiotic processes (understated in Kockelman’s essay, but see his discussion of fig. 9). Kockelman first exploits these shifts with figure 4: Peirce’s emphasis on the interpretant entails the agent sensing a sign; insofar as agents not only sense but also react, then, selection—interpretant as instigation—is implicit in signification. The triangle of figure 4 is already, covertly, the diamond of figure 6.

Coevolution. Kockelman’s central relation of relations, selection to signification, embraces a vast range of organization in part because the dizzying transposability of its terms (agents are objects, objects agents; signs are interpretants, interpretants signs, etc.) models the corelations constitutive of the

biome. Coevolutionary theories in the tradition of Gibson, Boyd, and Richerson and niche-constructive approaches (Sterelny 2003; Weber and Depew 2003) are founded on such correlations, working along feedback loops and feed-forward lines; Kockelman saturates them with signification. His *env-organism* is the playful avatar of coevolution. Its messages are: affordances are agents, agents affordances; the bond of the one to the other is semiotic; and discerning either is a question of framing and scale.

Technology. Another transposition: tools are signs, signs tools. Kockelman's linking of significance and selection asserts the immanent semiosis of technology—and reminds archeologists that hominin industries have *never not* been modes of storing and transmitting information.

Continuity. Kockelman's theory does not evade uniquely human aspects of biosemiosis and technocognition—fundamentally, the symbol and advanced mindreading (“theory of mind”). The capacity for joint attention is crucial to both (Tomasello 1999, 2008), and figure 7 suggests how it starts from the transposability of interpretant and sign in less elaborate communicative scenes. This linking of nonhuman and human is exemplary: Kockelman's approach again and again builds bridges across our customary chasms (nature/artifice, mind/body, thought/affect, etc.).

Emergence. The widening of the argument to sieving and serendipity links significance and selection to processes extending far beyond the biome. Kockelman discerns Deleuzian *abstract machines* (De Landa 1997, 2011; Deleuze and Guattari 1987): patterns in the emergent organization of flows of information (in the biome and its sociocultural outgrowths) and of matter/energy (in the multiverse as a whole). Figures 6–9 present schematics for these machines, each one building from the last to describe distinct semioselektive interactions.

What is the value of abstract machines in our analysis? First, they avoid transcendentalism and teleology. (Nietzsche glimpsed them in his will to power.) They are not opposed to matter, like Platonic ideas, instead describing immanent trajectories; to render them nonimmanent would be like attributing an idealized design to sodium transfer across a cell membrane. They generalize the dynamic patterns of matter/energy and information giving rise to complex assemblages, collectivities momentarily stable (at whatever scale), later dissolved into further flows.

In their generalization, abstract machines adduce sweeping commonalities behind the emergence of complexity of all sorts—their second methodological advantage. Kockelman demonstrates how a single machine can eventuate in a limitless range of (related) assemblages. Differences among these assemblages arise from the play in particular circumstances of the machines immanent to them; discerning the machines uncovers robust continuities of process. These carry broad evolutionary and historical implications, as a miniature case in point will suggest.

The final emergence of human modernity is today the most vexed question in hominin evolution. It has settled all too

often into a debate over the emergence of symbolism and its exemplary manifestation, language. This privileging of (linguistic) symbolism has encouraged bad habits: reductive proposals of single-cause selection for complex behaviors; assertions of radical discontinuities at odds with archeological and paleontological evidence; hypotheses of miraculous, symbolism-generating mutations; and even a certain “black-box” mystification of symbolism itself.

The best accounts, instead, have begun to introduce into evolutionary discussions the indexical entailments of symbolism and our deepening understandings of emergent self-organization (Deacon 1997, 2003). Kockelman's abstract machines point toward further work along these lines. This will connect ideas of emergent complexity (at scales ranging from neural nets to human populations) to the post-neo-Darwinian coevolutionary consensus mentioned above. It will avoid symbolo- and linguocentrism, revealing diachronic continuities between modern language and earlier communicative strategies. And, along the synchronic axis, it will uncover, around the Middle/Upper Paleolithic border, the relations of nascent language to several distinct capacities and behaviors of modern humans that are not narrowly symbolic: musicking, “offline” imagining of things beyond sense perception, and the transcendentalizing of social roles and institutions. In doing this, it will carry home Kockelman's lesson that human signification is tied to the broadest informational flows of the biome in ways our focus on symbolism has obscured.

Reply

Life Frames and Frames of Life: A Theory of Things, Including Media and Dreams

I want to thank the commentators for their extraordinary interpretants. I am sympathetic to almost all of their concerns, and only wish I had the space to do them justice here.

To start at the end, I am extremely grateful to Gary Tomlinson. His comments constitute perhaps the most sympathetic, careful, and expansive reading I can imagine. For example, he both tracks and synthesizes all of the different kinds of relations between relations outlined in the text (à la sec. 7 and fig. 9), and not just the two highlighted in the abstract (significance and selection). He foregrounds the way framing (sec. 4) may always creatively refigure and thereby potentially obviate the relations presupposed by any particular frame (and thus the reifications such relations are otherwise subject to). He effortlessly moves across a range of scales—phylogenetic, historical, interactional—showing important sites of intersection and intrascale. And he clearly and creatively ar-

ticulates a wide range of hidden connections, possible entailments, and conceptual allies.

Stefan Helmreich begins by masterfully summarizing a set of works with which this work may be put in conversation—for reasons of contrasting commitments (e.g., Agamben 2004 [2002]; Strathern 1995) as much as common cause (e.g., Gould and Lewontin 1979; Guyer 2004) as much as complicating and crinkling (e.g., Haraway 1991; Keller 2010). And he finishes by articulating what is arguably the dominant frame in both cultural and linguistic anthropology.

Putting this framing in its full generality goes something like this: (1) just as the social formations studied by anthropologists are historically emergent and particular, (2) so are anthropologists' epistemological formulations of those formations; (3) in part, this is because they too constitute a social formation; (4) in part, this is because both social formations are usually mediated, however unwittingly, by other social formations and epistemological formulations, which are themselves historically emergent and particular, at various degrees of remove; and (5) only critical theorists working at the level of, for example, Foucault or Marx are really ever witty enough to metaformulate such metaformations. (Okay, maybe Helmreich did not say all this, but he was getting at something like items 1–3, and I bet he would agree to 4 and maybe even accept 5.)

As both a linguistic anthropologist and an arch-Boasian (if only in certain measures and during certain months), I can surely sympathize. Indeed, not only is this often my preferred frame for undertaking analysis, it is also my preferred frame for analyzing my preference in frames. In particular, the claim at the end of section 4 is as follows: whenever we frame an event (entity, relation, process, etc.) as the outcome of significance and selection as much as sieving and serendipity, our framing of the event is itself the outcome of significance and selection as much as sieving and serendipity (not to mention all of the other relations between relations detailed in this essay). In this way, both the framing of the event (entity, process, relation, etc.) and the event so framed are historically emergent and particular and hence should be studied *in tandem* and *as such*.

Such moves hold for forms of life as much as life forms, not to mention that particular form of life that postulates life forms and that particular life form—us (and those, like chickens, with whom we are inextricably entangled)—that exist only as distinct forms of life.

Note, then, that my notion of framing is happily, and precisely, the “thickly historical term of art” that Helmreich rightfully calls for (but seems to overlook). Frames enclose as they disclose, reify as they reveal—and hence their reflexive centrality to this project (Kockelman 1999, 2007b). I hope this way of framing framing invites scholars to inquire into the aesthetics of such processes as much as their pragmatics (not to mention their epistemology and ontology). Thus, it is imperative that we substitute the word “frame” for “form” in the preceding paragraph. (Serendipitously, a recent acquaint-

tance of mine, Eben Kirksey, himself a coeditor with Stefan Helmreich of an important edited volume in cultural anthropology [2010], is, I would argue, our discipline's foremost curator of such frames.)

That said, I actually pointed to Nietzsche rather than Boas (and in particular, to genealogy rather than history, with its emphasis on descent rather than origins) as the most direct way to reframe the claims of this essay so as to be more compatible with certain commitments in cultural and linguistic anthropology. And James Faubion, in a very generous gesture, followed that point to another essay of mine that was written as a complement to this one: “Enemies, Parasites, and Noise: How to Take Up Residence in a System without Becoming a Term in It” (2010a). (See Coetzee's *Life and Times of Michael K* for an explanation of this subtitle; and see Kafka's *Trial* or *Castle* for an inverse icon of this explanation; i.e., how to become a term in a system without taking up residence in it.)

In particular, Faubion goes out of his way to read carefully that essay as well as this one and thereby defend this essay from possible misreadings—such as an overemphasis on closure. Moreover, he summarizes an important stance that he has detailed elsewhere (2011) regarding the utility and limits of various kinds of epistemological formulations and how the position advanced here relates to that one. Finally, on a pessimistic final note, he points out that rapprochement between the various subdisciplines of anthropology is unlikely. Fair enough, but I am with Gramsci on this one: pessimism of the intellect (I agree, they will never get it) and optimism of the will (but let us keep trying to give it to them).

In addition to directing our attention to some classic works in biosemiosis and the ways they relate to the present essay, Marcel Danesi foregrounds the relation between meaning and media as well as the relation between meaning and information. As he notes, these are large topics of central concern to many scholars and could be productively approached through the analytic framing offered here. I thank him for this invitation to say a few words about them.

This essay is precisely a theory of media in the wide sense (as that which mediates). In particular, any relation in figure 9 is such a site of mediation. In this way, this essay incorporates and extends more narrow senses of media (e.g., technological and/or aesthetic forms of mediation—à la film, radio, print, etc.). Indeed, if one takes selection (on any scale) to constitute function, and if one takes framing (of any scale) to constitute aesthetics, then the distinction between a wide and a narrow definition of media actually disappears. Most theories of “media,” as the very term suggests, are thus really theories of a handful of reified products of mediation.

All life forms—including that life form that exists only as forms of life—are simultaneously forms of mediation and media in formation (and maybe even vice versa, if only increasingly so).

None of this is to say that the narrow sense of media is not interesting. If I may invoke McLuhan for a moment and

limit my attention to the relations in figure 6, note the following. If a quali-sign is whatever could be sensed by a semiotic agent (and thus possibly stand for an object to that agent), a quali-interpretant is whatever could be instigated by a semiotic agent (and hence be created by a sign so far as it stands for an object). And a quali-object is whatever could organize the quali-signs (or sensations) and quali-interpretants (or instigations) of a semiotic agent: whatever could be a significant feature in the context of its selecting interests. From this standpoint, a key function of *media* in the narrow sense (from telescopes and guns to gloves and sunglasses, from telephones and the Internet to calculators and computers) is precisely to extend (as well as diminish, buffer, and mask) the sensory and instigatory capabilities of semiotic agents (as well as their communicative and cognitive abilities more generally). (Note, then, that earplugs, blindfolds, wet suits, skateboards, and handcuffs are media as much as gramophones, film, and typewriters.) They transform the quali-signs and quali-interpretants of semiotic agents and hence the quali-objects of semiotic agents—and hence the semiotic agents per se insofar as the features of such objects are so tightly coupled to the interests of such agents.

While Danesi's second important question also deserves an essay in itself, I am afraid I have only enough space for a slogan: *information is the enclosure of meaning* (where meaning is itself but one facet of mediation).

Zoe Crossland makes a very strong case for the relevance of significance and selection (and sieving and serendipity) to archeology and the study of materiality and networks more generally. And she offers a harsh critique of ANT as working on a structuralist model of semiosis. Her own work (Crossland 2009, 2010) is exemplary of several of the commitments of this essay and stands at the forefront of efforts to theorize materiality through the lens of mediation.

I myself am a big fan of much of the work by Serres, Callon, and Latour, and I have tried to show some of the ways this project resonates with theirs while, nonetheless, having different roots and ultimately bearing different fruits. In particular, the essay mentioned above (Kockelman 2010a) goes to what I think is the heart of the connection between Serres and Peirce on the one hand and ANT and this project on the other. And two other essays—"Agency: The Relation between Meaning, Power, and Knowledge" (Kockelman 2007a) and "Enclosure and Disclosure" (Kockelman 2007b)—track some of these connections as well. For these reasons, I am not going to take up here Crossland's invitation to reflect on ANT and the study of science and technology more generally.

As for the term "agent," I certainly understand where Crossland is coming from, and hence I understand why some theorists have coined new terms or unmoored old terms from canonical meanings. My sense is that defining one's term carefully in relation to a field of other carefully defined terms is the best way to stave off possible misinterpretations. And so I want to emphasize with Crossland that the way the term "agent" is defined and implemented in this essay should en-

sure that properties such as free will, subjectivity, cognition, and so forth are *not* presumed.

Rather, "agency" is a wide term defined in relation to objects on the one hand and signs and interpretants on the other; where any bundling of all of these, qua envorganism, gets its value only in relation to a world or *-verse* of other envorganisms; and where all of these relations, so far as they are the projection of a particular framing, are themselves already subject to the demands of enclosure. Figure 9 is an attempt to frame all of this at once.

Moreover, such relations between relations are fundamentally rooted in "selection"—a term that is meant to range over a very wide set of processes, some of which look quite a lot like classic notions of free will (qua intentional actors selecting instruments and actions on interactional timescales with potentially huge amounts of freedom and foresight); some of which look like sieving in combination with serendipity; some of which look like the circumspection and association, or the *umsehen* and *umgehen*, of Dasein-like entities; and some which do not look like any of these at all.

The agents (or envorganisms) in question are fundamentally widely distributed, multidimensional, and by degrees notions—only sometimes coinciding, under certain framings, with stereotypically agentive entities—such as animals, people, instruments, environments, cultures, and life forms. In particular, our attempts to designate "agents" are usually only quixotic efforts to enclose *agency*, which really only ever exists, as it were, in the wild, outside of any frame, in ways that are as murky, fleeting, and distant as the modes of mediation that constitute it. That said, the temptation to move from agency to agents or mediation to (im)mediators will always be great, for they allow one to treat the agent at issue as a *unit of accountability* (Kockelman 2007a, 2007c) in all of its extended senses—not only that which is responsible but also that which is worthy of an account, a locus of selection, and potentially quantifiable.

Vincent Colapietro's incredible writings played a large role in piquing my interest in and shaping my understanding of Peirce. And his specific remarks as to the relative ethnographic rootedness of my analysis in this essay are fair and dovetail in certain respects with those of Helmreich. So, to show the way my concepts are empirically rooted and ethnographically imagined, I need to go to another text, written in another register, and itself the benevolent triplet of this one: "A Mayan Ontology of Poultry: Selfhood, Affect, Animals, and Ethnography" (Kockelman 2011). This essay foregrounds several of the relations between relations discussed in this text as they unfold on historical and interactional scales. In this way, I hope it provides what Colapietro beautifully characterizes as "a more concrete sense of our inextricable entanglements and a more lively sense of the unfinished character of the natural processes and human practices in which human and allied actors are ineluctably caught up."

Finally, in contrast to the foregoing respondents, some of the comments by Olivier Morin and Christophe Heintz read

relatively carelessly and thereby miss most of this essay's arguments. The last part of section 3 is precisely a reading of Grice and ostensive-inferential communication more generally. In particular, it explicitly frames Grice's claims through the categories of Peirce and thereby synthesizes two of the most powerful approaches to meaning of the last century. Indeed, the only way I can understand how their comments went so far awry is to assume that they read this essay only in light of what they were expecting to find and then stopped reading at the end of section 2. A pity, really, because this essay is, in part, meant to leverage both kinds of approaches and thereby bring together both sets of practitioners. Serious scholars working in a neo-Gricean tradition (Levinson, Sperber, and Wilson; Tomasello; inter alia) will find a lot of common ground.

So let me turn lemons into lemonade. In particular, the aforementioned section of this essay is in some sense a generalization of Grice-like ideas where the dynamic object (or "communicative intention") in question need not only be evinced in human agents on interactional timescales. For example, one way to playfully reread the Freudian oeuvre is to reframe repressed wishes as a kind of dynamic object; such a dynamic object relates to a dream (parapraxis, neurosis, etc.) as cause to effect, where the dream itself has an immediate object (whatever it most transparently points to—e.g., the manifest dream content), and this object itself constitutes a sign of a more mediate object (the latent dream content)—which can be inferred only by reference to the dynamic object (repressed wish) that set the whole process in motion.

More generally, the immediate object of any sign can itself constitute a sign of a more mediate object that is itself only easily attended to (by an interpreting agent) by reference to the dynamic object (or original cause) of the initial sign. In this wide framing, "ostensive-inferential communication" of the Gricean sort is very similar to "psychoanalysis" of the Freudian sort—a fact that is destined to be repressed by neo-Griceans. Such a rich account of interpretation, suitably re-framed, is perhaps Freud's most prescient and lasting contribution.

—Paul Kockelman

References Cited

- Agamben, Giorgio. 2004 (2002). *The open: man and animal*. Kevin Attell, trans. Stanford, CA: Stanford University Press. [SH]
- Agha, Asif. 2003. The social life of cultural value. *Language and Communication* 23(3):231–273.
- Anscombe, G. E. M. 1959. *Intentions*. Oxford: Blackwell.
- Aristotle. 2001. *Nicomachean ethics*. In *The basic works of Aristotle*. Richard McKeon, ed. Pp. 935–1112. New York: Modern Library.
- Atran, Scott. 2002. *In gods we trust: the evolutionary landscape of religion*. Oxford: Oxford University Press.
- Austin, J. L. 2003 (1955). *How to do things with words*. Cambridge, MA: Harvard University Press.
- Bakhtin, Mikhail. 1986. The problem of speech genres. In *Speech genres and other late essays*. Pp. 112–145. Austin: University of Texas Press.
- Barbieri, Marcello, ed. 2007. *Introduction to biosemiotics: the new biological synthesis*. Dordrecht, Netherlands: Springer. [MD]
- Bardini, Thierry. 2011. *Junkware*. Minneapolis: University of Minnesota Press. [SH]
- Boyd, R., and P. Richerson. 1985. *Culture and the evolutionary process*. Chicago: University of Chicago Press.
- . 2005. *Not by genes alone: how culture transformed human evolution*. Chicago: University of Chicago Press.
- Boyer, Pascal. 1994. *The naturalness of religious ideas*. Berkeley: University of California Press.
- Brandom, Robert. 1979. Freedom and constraint by norms. *American Philosophical Quarterly* 16:187–196.
- . 1994. *Making it explicit: reasoning, representing, and discursive commitment*. Cambridge, MA: Harvard University Press.
- Brown, Penelope, and Stephen C. Levinson. 1987. *Politeness: some universals in language usage*. Cambridge: Cambridge University Press. [OM, CH]
- Burnett, D. Graham. 2007. *Trying leviathan: the nineteenth-century New York court case that put the whale on trial and challenged the order of nature*. Princeton, NJ: Princeton University Press. [SH]
- Cavalli-Sforza, L., and M. Feldman. 1981. *Cultural transmission and evolution: a quantitative approach*. Princeton, NJ: Princeton University Press.
- Cheney, Dorothy L., and Robert M. Seyfarth. 1990. *How monkeys see the world: inside the mind of another species*. Chicago: University of Chicago Press.
- Clifford, James, and George E. Marcus, eds. 1986. *Writing culture: the poetics and politics of ethnography*. Berkeley: University of California Press.
- Colapietro, Vincent M. 1989. *Peirce's approach to the self: a semiotic perspective on human subjectivity*. Albany: State University of New York Press.
- Crossland, Z. 2009. Of clues and signs: the dead body and its evidential traces. *American Anthropologist* 111(1):69–80.
- . 2010. Materiality and embodiment. In *The Oxford handbook of material culture studies*. D. Hicks and M. Beaudry, eds. Pp. 386–405. Oxford: Oxford University Press.
- Csibra, Gergely, and György Gergely. 2009. Natural pedagogy. *Trends in Cognitive Sciences* 13:148–153. [OM, CH]
- Darwin, Charles. 1965 (1872). *The expression of the emotions in man and animals*. Chicago: University of Chicago Press.
- . 1981 (1871). *The descent of man, and selection in relation to sex*. Princeton, NJ: Princeton University Press.
- Davidson, Donald. 1984. *Actions, reasons, and causes*. New York: Oxford University Press.
- Dawkins, Richard. 1976. *The selfish gene*. Oxford: Oxford University Press.
- Deacon, Terrence. 1997. *The symbolic species: the co-evolution of language and the human brain*. London: Penguin. [GT]
- . 2003. The hierarchic logic of emergence: untangling the interdependence of evolution and self-organization. In *Evolution and learning: the Baldwin effect reconsidered*. Bruce H. Weber and David J. Depew, eds. Pp. 273–308. Cambridge, MA: MIT Press. [GT]
- De Landa, Manuel. 1997. *A thousand years of nonlinear history*. New York: Zone. [GT]
- . 2011. *Philosophy and simulation: the emergence of synthetic reason*. London: Continuum. [GT]
- Deleuze, Gilles, and Félix Guattari. 1987. *A thousand plateaus: capitalism and schizophrenia*. Brian Massumi, trans. Minneapolis: University of Minnesota Press. [GT]
- Dretske, F. 1981. *Knowledge and the flow of information*. Cambridge, MA: MIT Press.

- Dupré, John. 1999. Are whales fish? In *Folkbiology*. Douglas L. Medin and Scott Atran, eds. Pp. 461–476. Cambridge, MA: MIT Press. [SH]
- Ekman, Paul. 2006. *Darwin and facial expressions*. Cambridge: Cambridge University Press.
- Enfield, N. J. 2003. *Linguistic epidemiology*. London: Routledge.
- . 2009. *The anatomy of meaning: speech, gesture, and composite utterances*. Cambridge: Cambridge University Press.
- Enfield, N. J., and Stephen Levinson, eds. 2009. *Roots of human sociality: culture, cognition, and interaction*. New York: Berg.
- Evans-Pritchard, E. E. 1969 (1940). *The Nuer: a description of the modes of livelihood and political institutions of a Nilotic people*. Oxford: Oxford University Press.
- Faubion, J. D. 2011. *An anthropology of ethics*. Cambridge: Cambridge University Press. [JDF]
- Frege, Gottlob. 1955. *The foundations of arithmetic*. Princeton, NJ: Princeton University Press.
- Gibson, James J. 1986. *The ecological approach to visual perception*. Boston: Houghton Mifflin.
- Goffman, Erving. 1981. Replies and responses. In *Forms of talk*. Pp. 5–42. Pennsylvania: University of Pennsylvania Press.
- . 1983. The interaction order. *American Sociological Review* 48(1):1–17.
- Gould, Stephen Jay, and Richard C. Lewontin. 1979. The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme. *Proceedings of the Royal Society of London B: Biological Sciences* 205:581–598. [SH]
- Grice, Paul. 1989a. The causal theory of perception. In *Studies in the ways of words*. Pp. 224–247. Cambridge, MA: Harvard University Press.
- . 1989b. Logic and conversation. In *Studies in the ways of words*. Pp. 22–40. Cambridge, MA: Harvard University Press.
- . 1989c. *Studies in the way of words*. Cambridge, MA: Cambridge University Press. [OM/CH]
- . 1989d. Utterer's meaning and intentions. In *Studies in the ways of words*. Pp. 86–116. Cambridge, MA: Harvard University Press.
- Guyer, Jane. 2004. *Marginal gains: monetary transactions in Atlantic Africa*. Chicago: University of Chicago Press. [SH]
- Halliday, M. A. K., and Ruqaiya Hasan. 1976. *Cohesion in English*. London: Longman.
- Haraway, Donna. 1991. Situated knowledges: the science question in feminism and the privilege of partial perspective. In *Simians, cyborgs, and women: the reinvention of nature*. Pp. 183–202. New York: Routledge. [SH]
- Heidegger, Martin. 1996 (1927). *Being and time*. Albany: State University of New York Press.
- Helmreich, Stefan, and Sophia Roosth. 2010. Life forms: a keyword entry. *Representations* 112:27–53. [SH]
- Hull, D. 1988. *Science as process*. Chicago: University of Chicago Press.
- Ingold, Tim. 2007. Earth, sky, wind, and weather. *Journal of the Royal Anthropological Institute* 13(suppl.):S19–S38. [VC]
- Jakobson, Roman. 1990. Shifters and verbal categories. In *Roman Jakobson: on language*. L. R. Waugh and M. Monville-Burston, eds. Pp. 386–392. Cambridge, MA: Harvard University Press.
- Kauffman, Stuart. 1993. *Origins of order: self-organization and selection in evolution*. Oxford: Oxford University Press.
- . 1995. *At home in the universe: the search for the laws of self-organization and complexity*. Oxford: Oxford University Press.
- Keller, Evelyn Fox. 2010. *The mirage of a space between nature and nurture*. Durham, NC: Duke University Press. [SH]
- Kockelman, Paul. 1999. Poetic function and logical form, ideal languages and forms of life. *Chicago Anthropology Exchange* 29:34–50.
- . 2005. The semiotic stance. *Semiotica* 157:233–304.
- . 2006a. Representations of the world: memories, perceptions, beliefs, intentions, and plans. *Semiotica* 162(1):73–125.
- . 2006b. Residence in the world: affordances, instruments, actions, roles, and identities. *Semiotica* 162(1):19–71.
- . 2006c. A semiotic ontology of the commodity. *Journal of Linguistic Anthropology* 16(1):76–102.
- . 2007a. Agency: the relation between meaning, power, and knowledge. *Current Anthropology* 48(3):375–401.
- . 2007b. Enclosure and disclosure. *Public Culture* 19(2):303–305.
- . 2007c. From status to contract revisited: value, temporality, circulation, and subjectivity. *Anthropological Theory* 7(2):151–176.
- . 2010a. Enemies, parasites, and noise: how to take up residence in a system without becoming a term in it. *Journal of Linguistic Anthropology* 20(2):406–421.
- . 2010b. *Language, culture, and mind: natural constructions and social kinds*. Cambridge: Cambridge University Press.
- . 2010c. Meaning, motivation, and mind: some conditions and consequences for the flexibility and intersubjectivity of cognitive processes. *New Ideas in Psychology* 30:1–15.
- . 2010d. Value is life under an interpretation: existential commitments, instrumental reasons, and disorienting metaphors. *Anthropological Theory* 10(1–2):149–162.
- . 2011. A Mayan ontology of poultry: selfhood, affect, animals, and ethnography. *Language in Society* 40:1–28.
- Kohn, Eduardo. 2007. How dogs dream: Amazonian natures and the politics of transspecies engagement. *American Ethnologist* 34(1):3–24. [SH]
- Labov, William. 1994. *Principles of linguistic change: internal factors*. New York: Blackwell.
- . 2001. *Principles of linguistic change: social factors*. New York: Blackwell.
- Lansing, Stephen. 2006. *Perfect order: recognizing complexity in Bali*. Princeton, NJ: Princeton University Press.
- Lépinay, Vincent. 2011. *Codes of finance: engineering derivatives in a global bank*. Princeton, NJ: Princeton University Press. [SH]
- Lloyd, Seth. 2001. Measures of complexity: a nonexhaustive list. *IEEE Control Systems Magazine*, August. [SH]
- Lucy, John, ed. 1993. *Reflexive language: reported speech and meta-pragmatics*. Cambridge: Cambridge University Press.
- Luhmann, Niklas. 1989. *Ecological communication*. John Bednarz Jr., trans. Chicago: University of Chicago Press. [JDF]
- Marx, Karl. 1967 (1867). *Capital*, vol. 1. New York: International.
- McLuhan, Marshall. 1964. *Understanding media: the extensions of man*. London: Routledge & Kegan Paul. [MD]
- Mead, George Herbert. 1934. *Mind, self, and society*. Chicago: University of Chicago Press.
- Melville, Herman. 2001 (1851). *Moby-Dick*. Harrison Hayford, Hershel Parker, and G. Thomas Tanselle, eds. Evanston, IL: Northwestern University Press. [SH]
- Millikan, Ruth G. 1984. *Language, thought, and other biological categories*. Cambridge, MA: MIT Press. [OM, CH]
- . 2004. *Varieties of meaning*. Cambridge, MA: MIT Press.
- Mitchell, Melanie. 2009. *Complexity: a guided tour*. Oxford: Oxford University Press.
- Nietzsche, Friedrich. 1989 (1887). *The genealogy of morals and ecce homo*. New York: Vintage.
- Oyama, Susan, Paul E. Griffiths, and Russell D. Gray, eds. 2001. *Cycles of contingency: developmental systems and evolution*. Cambridge, MA: MIT Press.
- Parikka, Jussi. 2010. *Insect media: an archeology of animals and technology*. Minneapolis: University of Minnesota Press. [SH]
- Peirce, Charles S. 1868. On a new list of categories. *Proceedings of the American Academy of Arts and Sciences* 7:287–298. [OM, CH]
- . 1955. Logic as semiotic: the theory of signs. In *Philosophical writings of Peirce*. Justus Buchler, ed. Pp. 98–119. New York: Dover.

- . 1992 (1868). On a new list of categories. In *The essential Peirce*, vol. 1. Nathan Houser and Christian Kloesel, eds. Pp. 1–10. Bloomington: Indiana University Press.
- Rich, Adrienne. 2001. *Arts of the possible*. New York: Norton. [VC]
- Saussure, F. 1983 (1916). *Course in general linguistics*. La Salle, IL: Open Court.
- Schneider, David M. 1968. *American kinship: a cultural account*. Chicago: University of Chicago Press. [SH]
- Searle, John R. 1983. *Intentionality: an essay in the philosophy of mind*. Cambridge: Cambridge University Press.
- Sebeok, Thomas A., and Marcel Danesi. 2000. *The forms of meaning: modeling systems theory and semiotics*. Berlin: de Gruyter. [MD]
- Serres, Michel. 2007 (1980). *The parasite*. Minneapolis: University of Minnesota Press.
- Shannon, Claude. 1949. Communication theory of secrecy systems. Declassified document.
- Shannon, Claude, and Warren Weaver. 1963 (1949). *The mathematical theory of communication*. Urbana: University of Illinois Press.
- Sipser, Michael. 1996. *Introduction to the theory of computation*. Boston: PWS.
- Sober, E. 1992. Models of cultural evolution. In *Trees of life: essays in the philosophy of biology*. P. E. Griffiths, ed. Pp. 1–17. Dordrecht, Netherlands: Kluwer.
- Sperber, Dan. 1996. *Explaining culture: a naturalistic approach*. Oxford: Blackwell.
- Sperber, Dan, and Ira Noveck. 2004. *Experimental pragmatics*. London: Palgrave. [OM, CH]
- Sperber, Dan, and Deidre Wilson. 1995 (1986). *Relevance: communication and cognition*. 2nd edition. Oxford: Wiley Blackwell.
- Sterelny, Kim. 1994. Science and selection. *Biology and Philosophy* 9: 45–62.
- . 2003. *Thought in a hostile world: the evolution of human cognition*. Oxford: Blackwell. [GT]
- Sterelny, Kim, and Paul E. Griffiths. 1999. *Sex and death*. Chicago: University of Chicago Press.
- Strathern, Marilyn. 1995. *The relation: issues in complexity and scale*. Chicago: University of Chicago Press. [SH]
- Strawson, P. F. 1971 (1954). Intention and convention in speech acts. In *Readings in the philosophy of language*. J. Rosenberg and C. Travis, eds. Pp. 599–614. Englewood Cliffs, NJ: Prentice-Hall.
- Tomasello, Michael. 1999. *The cultural origins of human cognition*. Cambridge: Cambridge University Press.
- . 2008. *Origins of human communication*. Cambridge, MA: MIT Press.
- Tsing, Anna. 2000. The global situation. *Cultural Anthropology* 15(3): 327–360. [SH]
- Veblen, Thorstein. 1971 (1899). *The theory of the leisure class*. New York: Free Press.
- von Uexküll, Jakob. 1926. *Theoretical biology*. London: Kegan, Paul.
- Vygotsky, L. S. 1978. *Mind and society: the development of higher psychological processes*. Michael Cole, Vera John-Steiner, Sylvia Scribner, and Ellen Souberman, eds. Pp. 19–37. Cambridge: Harvard University Press.
- Weber, Bruce H., and David J. Depew, eds. 2003. *Evolution and learning: the Baldwin effect reconsidered*. Cambridge, MA: MIT Press. [GT]
- Weber, Max. 1949. *The methodology of the social sciences*. New York: Free Press.
- . 1978. *Economy and society*, vol. 1. Berkeley: University of California Press.