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COLLOQUIA

Grading, gradients, degradation, grace

Part 2: Phenomenology, materiality, and cosmology

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Part 1 of this article, which appeared in the last edition of this journal, focused on intensity and causality through the lens of social conventions and communicative practices. This part focuses on related themes from the standpoint of phenomenology, cosmology, and materiality. The central ethnographic object is still landslides in Highland Guatemala, and the ways speakers of Q'eqchi' (Maya), from a small village in the cloud forest, relate to such events. And so we will continue to analyze the aftermath of one such landslide, taking up precisely where part 1 left off. More generally, though less explicitly, this article continues our articulation of four key terms for the Anthropocene (and, as should now be clear, for almost Everycene): "gradients" (the way qualities vary in their intensity over space and time, and the ways such variations relate to causal processes), "grading" (the ways agents assess and alter such intensities, and experience and intervene in causal processes), "degradation" (the ways highly valuable variations in qualitative intensities are lowered or lost), and "grace" (the way agents work to maintain gradients, care for those whose lives have been degraded, and value those agents who work and care in such ways).

Keywords: time machine, solar power, heat engine, thermodynamic anthropology, meaning, entropy, gift, god

Part 1 of this article showed how gradients give rise to force fields, how force fields give rise to flows, and how a significant chunk of "field-work" turns on figuring (out) such force fields and flows. It is important to realize that force fields, through the flows they condition, also give rise to gradients, gradients which are phenomenologically embodied as much as physically embedded. In particular, not just every terrain, but every tool, medium, sign, substance, era, agent, collectivity, and world

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exhibits a field of forces. To interact with such entities requires we understand their force fields. And to understand such force fields is, in effect, to understand the way they enable and constrain the relation between our instigations (or actions) and our sensations (or perceptions).

The first three sections of what follows will ethnographically unpack these points, which bring together the two kinds of grounds that were analyzed in part 1: grounds of comparison and grounds of causation; and hence forces and flows as much as dimensions and degrees. The conclusion will take up grace, insofar as it cosmologically binds together speakers of Q'eqchi' (Maya), the mountainous terrain that surrounds their village, and the divine (and sublime) origins of space-time.

A brief afterword reviews the core terms of this two-part article from the standpoint of heat flows (as opposed to landslides). It reframes a few universal thermodynamic variables as (soon to be, if not already) global sociocultural values: energy, entropy, work, and temperature. And it details some of the key features of our own nineteenth-century "causemology" in regard to the origins (and destination) of the Anthropocene (and the discipline of anthropology).

Channeling intensity

In the days following the mudslide, the mayor's house was used by village women as a place to prepare food to feed the working men. To this end, they had enlisted village boys to collect dry branches so that they would have a steady source of fuel for the hearth fire. At one point a lone boy dragged part of a tree trunk through the front door, almost 10 inches in diameter. When the mayor's wife saw it, she said:

> *ay dios at-in-yuwa'*
> Interj god A(2s)-E(1s)-father[1]
> "oh god, you are my father!" (or, more idiomatically, "oh my goodness!")

She and the other women stared at the log, until one woman finally repurposed it as a *k'ub'* (one of several large stones that are placed around a hearth fire). And over the rest of the day it served not just to hold up the griddle, but also as a source of fuel—the women slowly pushing it toward the center of the fire until it was finally consumed.

This interjection was the morphologically longest member of a set of three frequently used interjections (*ay* < *ay dios* < *ay dios atinyuwa'*), which all incorporate the Spanish loan interjection *ay*. As shown in this example, a very frequent function of these interjections was to indicate marked intensities, typically a marked degree of a significant dimension of a recently revealed entity or event. Such interjections not only indexed a marked degree of a salient dimension, they also functioned to direct the attention of others to the object (dimension or degree) in question, often with the effect of enlisting their help or inviting their commentary. In short, you could use this interjection to grab others' attention, and thereby direct them

1. See part 1 of this article for transcription conventions.

to whatever grabbed your attention—thereby creating intersubjective awareness of something "grabby" in experience.[2]

In this example, the dimension was left implicit. In other examples of usage, however, the dimension in question, and its marked degree, could be made explicit. For example, when a five-year-old boy asked his mother for a tortilla to soak up the rest of his broth, his mother handed him a whole tortilla, and he said:

> *ay, mas nim*
> Interj very big
> "goodness, that's very big!"

The woman then retracted her hand, tore off half the tortilla for herself, and gave her son the remainder. Here the boy used the morphologically shortest member of the set. His usage alerted his mother to his sense of the markedness of the magnitude in question; and, to remedy the situation, she simply reduced the degree of the dimension by half, so to speak. Frequently salient dimensions that were made explicit in this way included: price (*terto*), size (*nim*), weight (*aal*), quantity (*naab'al*), and goodness (*us*). But any gradable adjective would do, as would state-change predicates (achievements) that turned on similar predicates. For example, after putting up with her misbehaving kids long enough, a woman said:

> *ay dios, mas x-in-titz'*
> Interj god very Perf-A(1s)-become_exasperated
> "my goodness, I have become very fed up!"

As will be seen below, when we discuss speakers' projections of causality onto interjections, such an event would probably be framed as follows: the child's misbehavior causes the parent's state change (from less than very fed up to very fed up), and the parent's state change itself (especially the degree of the final state) causes the (re) action of uttering the interjection. Note the relation, highlighted by Sapir ([1944] 1985), between movement (change), affect (exasperation), and grade (intensity).

As evinced in these examples, in most of the tokens I collected, the adjective or achievement in question was modified by the particle *mas* (< Spanish *más*), which in Q'eqchi' means "very" (Spanish *muy*) or "much/many" (Spanish *mucho*), as opposed to "more" (Spanish *más*). There is some evidence that, just as saying something is "big" means that it is bigger than the typical member of the class with which it is being compared, to say something is "very big" is to say it is bigger than the typically big members of that class. Phrased differently, and very tendentiously, to call something "big" is to say it is bigger than average; whereas to call something "very big" is to say that it is bigger than one standard deviation above average. While not equivalent, to be sure, grading and statistics are

2. Recall that Kant, when theorizing the sublime in his *Critique of Judgment*, was precisely interested in entities that seemed beyond comparison, or "great." Nowadays we use other words than great to indicate what (we think) is somehow extreme: superdiversity, big data, hyperobjects, ultrarich, and the like. Somewhat hilariously, if not pathetically, the "greater" the degree predicated by the modifier, the more grabby the theory. (Recall that infinity—and even "bigger" notions—can be both clearly communicated, and brilliantly cognized, with just a few teeny-weeny symbols.) From this perspective, a "hyperobject" is just an object infused with more hype than other objects.

arguably linked to each other in weird and wily ways: each can radically influence our understandings of the other. That said, most dimensions of experience (for most comparison classes) are probably not so easily "normalized."[3] For example, the boy and the mother, in our example above, clearly did not agree on what counted as a "very big" tortilla (but the mother was willing to accommodate the boy's assessment). In any case, usage of this function of these interjections correlated (so far as the lexical evidence attests) with very marked degrees, not just marked degrees.

Another relevant characteristic of these interjections is that, as a form class, they constitute an intensity cline: the relative "morphological length" of the interjection uttered (*ay* < *ay dios* < *ay dios atinyuwa*') maps onto the relative degree of the dimension in question, or perhaps even onto the relative affectedness of the speaker by that degree (see fig. 1).

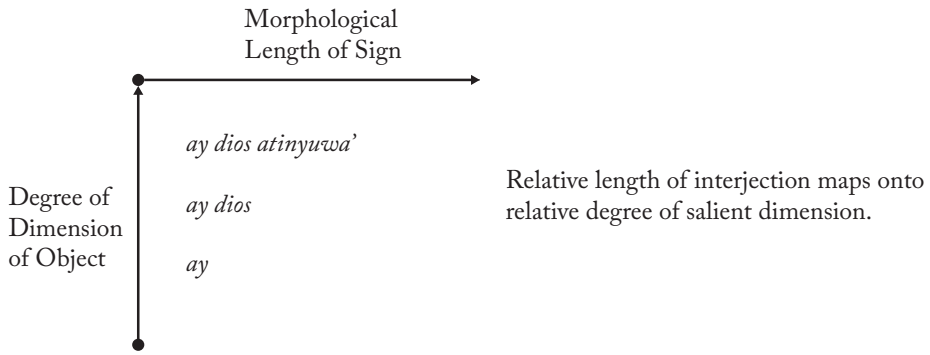

Figure 1: Intensity and iconicity

This is a form of "diagrammatic iconicity," as opposed to imagistic iconicity, that is pervasive throughout language (Peirce 1955; Friedrich 1979; Kockelman 1999, 2010a): it is not that a sign has a quality in common with its object; it is that the relation between signs has a quality in common with the relation between objects. Recall our discussion of reduplication. Such an intensity cline is relatively discrete and should be compared with a range of more canonical intensity clines from language studies which are relatively continuous in well-known ways (Labov 1984): pitch, amplitude, rate, and so forth.[4] Needless to say, any of the three forms just discussed may also have its degrees changed along any one of these continuous dimensions, more or less easily, or consciously. For example,

3. Indeed, key dimensions that are nonnormal are income and connectivity (Taleb 2010), both of which are key modalities of power, or agency. So it may be that grading practices around such dimensions are very different from grading practices around more easily normalized dimensions. Or it may be that grading practices are out of touch with the graded processes. This question is worth a study in itself.

4. Crucially, there seems to be a decoupling between the morphological intensity of the interjection used, and the predicated intensity introduced via an adjectival phrase. And so one might argue that the former indicated the degree of the speaker's affectedness (by some experience), whereas the latter indicated the degree of the experienced dimension (causing such affectedness).

one may utter an interjection more or less loudly, a variation that probably correlates with a range of other dimensions: proximity to addressees (or overhearers), publicness of speech event, size of speaker, amount of background noise, and so forth.[5]

Let us now return to our discussion of causal grounds. In the following example we have a speaker describing the conditions under which one might utter the interjection (*ay*):

> *naq x-Ø-aa-yok aa-wib' ay chan-k-at x-b'aan aa-rahilal*
> Comp Perf-A(3s)-E(2s)-cut E(2s)-Rflx Interj say-Pres-A(2s) E(3s)-RN E(2s)-pain
> "when you have cut yourself, you go 'ay' because of your pain"

As may be seen, the speaker is describing an enchaining of causal processes: *when* one cuts oneself, one experiences pain; and *because of* one's pain, one utters the interjection. Such a construction may be compared with the causal constructions described in part 1 of this article. Note, for example, the use of a when-particle instead of an if-particle to mark the antecedent clause. And note the use of a "because" construction in the consequent clause, which is often used in replies to *why*-questions. As may also be seen from this example, interjections were typically characterized as nonintentional signs; and thus as relatively direct affective reactions to experience, rather than as communicative signs about experience. Moreover, speakers typically characterized interjections involving *ay* as if they indexed physical pain, even though very few tokens of usage seemed to correlate with such obviously somatic events. Finally, for many speakers, such interjections indexed the age and gender of the speaker—indicating that they were the sort of person who was easily affected by intense experiences or painful events (Kockelman 2003).

Crucially, in a tradition that runs from Aristotle to Jakobson (1990a), interjections are often treated as exemplary of the "expressive function" (calling attention to the speaker's reaction to an event), rather than the "referential function" (calling attention to the event per se). As seen, however, with the application of an adjectival phrase, interjections can be used to "point to" and "predicate features about" various objects and events (so to speak). Their most frequent function, however, was relatively "phatic" (Jakobson 1990a; Kockelman 2003, 2010b), and thus foregrounded the communicative medium or "channel," understood as something like the psychological connection and physical contact between a speaker and an addressee. By noticing something in such an exaggerated way, a speaker could topicalize that something, call another's attention to it, and simultaneously take the floor: using the interjection to recruit another into a certain role within a discursive interaction, and thereby establish a channel. Moreover, in their most frequent function, they didn't directly index an object or event exhibiting a marked degree of some dimension; rather, they indexed a sign (said by another speaker) that referred to, or predicated a feature about, such an object or event. For example, if someone were talking about

5. And, of course, one may even hear another's interjection as more or less loud, depending on one's mood, social relation to the speaker, habituation to a certain voice, and so forth. As will be shown in the discussion of grabbiness, all perception is apperception.

the high price of a machete they saw in town, another person could say, *ay dios, mas terto*, or "goodness, how very expensive." Such usages, then, were metalinguistic (indexing a relatively immediate sign whose relatively distal object, qua referent, was a marked degree of some salient dimension) as well as phatic (functioning as back-channel cues). In effect, such uses did not just let another know that one was listening to them, they also let another know that one was absorbed in, or affected by, the relatively high degree of whatever dimension they had just described.[6]

* * *

In part 1 of this article we focused on various linguistic constructions that make explicit comparative and causal grounds. Such constructions can involve linguistic signs whose referenced objects are entities and events, and their dimensions and relations: "this entity is larger than that entity"; "if this event occurs, then that event will occur"; and so forth. We paid particular attention to constructions that interrelate both grounds: "when it rains a lot, we don't sleep very well." We also saw that the entities and events referred to by such signs may themselves be signs: in perceiving the relative intensity of one event, we infer the relative intensity of another event. We saw that such interrelations may ground action as much as inference: I manipulate the intensity of one event, in order to manipulate the intensity of another event. And we saw that such comparative and causal grounds typically remain in the background: we are always evincing such grounds through our residence in the world, even if we don't always announce such grounds through our representations of the world.

We now want to focus on these issues more fully by theorizing situations in which signs, objects, and interpretants: (a) are relatively continuous, as opposed to discrete, phenomena; (b) correlate with each other, not just as continuous phenomena, but also as immediately coupled phenomena; and (c) as coupled and continuous phenomena potentially constitute the object-signs of metasigns (which could make them relatively explicit in the foregoing kinds of ways). As we just saw, interjections evince all these dimensions to some degree(!): the correlation between object and sign, or sign and interpretant, is relatively immediate (as opposed to displaced); as the object varies in intensity, so may the sign (and perhaps even the interpretant); they are object-signs and metasigns as much as signs. In some sense, they lie halfway between representations of the world and the modes of residence in the world to which we now turn (Kockelman 2007).[7]

6. They are also radically poetic (Kockelman 2003, 2016a, 2016b), but I don't pursue that function here. Note, though, that Jakobson's classic definition of poetry resonates with Hume's classic account of causality, both of which resonate with practices of grading: the repetition of tokens of common types, the habitual grounds of experience and inference, and the (a)metricality of the world more generally. In the spirit of Bahktin, causality, like metricality, is inherently chronomodotopic—both mediating of, and mediated by, understandings of time, space, and possibility.

7. Needless to say, all this is opposed to the idea—once quaint, but now cultish—that affect, phenomenology, and the like are somehow beyond semiotics, or prior to semiosis. They are no more (and no less) beyond it than anything else in the world.

Experiential grounds

Whenever we interact with the world, we are simultaneously sensing and instigating, perceiving and acting, feeling and moving, interpreting and signifying. At any moment, in any place, through different sensory modalities, one perceives a huge range of different dimensions of different degrees, and hence not so much quantified qualities as "quantiafied qualia" (Kockelman 2016a). And as one moves and acts, these intensities can change: certain dimensions may no longer be sensible; others may become newly sensible; others stay sensible, but fade or grow in degree. Noises get louder or softer, smells get more or less pronounced, objects seem to move more or less slowly, or occlude more or less of a background. Every time we tilt our head or turn a key, take a step or take a sip, grab a handle or hold onto a hand, we experience a change in the intensities (quantia, or degrees) of various dimensions: more or less pain, heat, resistance, softness, illumination, noisiness, warmth, and so forth.

In some sense, then, the world (in our relation to it) *channels* our instigations into sensations just as we (in our relation to the world) *channel* our sensations into instigations. Some of these modes of channeling are basic facts about perception that have long been studied: for example, as I move closer to an object, it takes up more of my optical field. Others are particular facts about complicated mechanisms: if I push this key on the typewriter with more or less force, I will hear a particular clack that is more or less loud, feel more or less of a resistance against my fingertip, and see the letter "b" appear more or less darkly.

As scientists and philosophers of perception have long argued (Gibson 1979; Neisser 1988; Palmer 1999; O'Regan and Noë 2001; O'Regen 2010; inter alia), we make sense of the perceived world by attending to these relatively regular relations between our instigations and our sensations, understanding how the former affect the latter. As Gibson (1979) might have put it, to perceive the world (and one's place in it), one must understand *the relatively invariant way variations covary in one's sensorimotor interactions*. That is, sensations are correlated with instigations, and these correlations are often relatively invariant in a particular environment and to a particular agent: as one varies in its quantia of particular qualia, or in its degrees of various dimensions, so does the other, and in relatively regular ways. In short, not only do physical gradients constitute force fields, but force fields themselves may be experienced as phenomenological gradients, or as "experiential grounds."

* * *

We will now retheorize such observations from a semiotic stance (Kockelman 2005). Suppose that some dimension (like temperature, altitude, concentration, or price) varies as a function of some other dimension (like position, time, or item). In particular, changes in the degree of one dimension correlate with changes in the degree of the other dimension (see fig. 2).

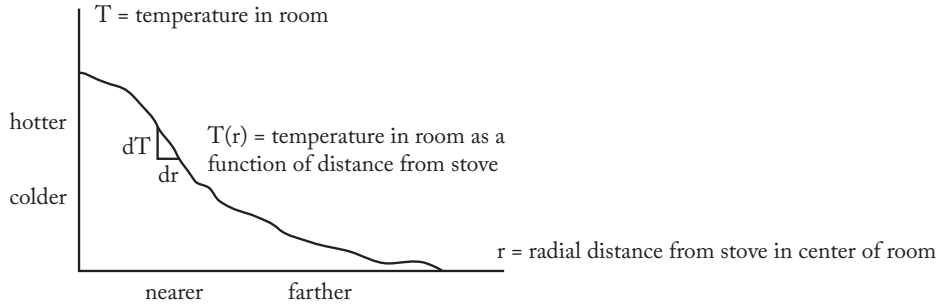

Figure 2: Correlation of degrees of dimensions

For example, the closer one gets to the hearth fire, the warmer one becomes. The steeper the slope, the more arduous the climb. The heavier the rain, the more we worry (and the less we sleep). The harder one steps on the brakes, the faster the car decelerates. And so forth. Note, then, the entwining of various dimensions through both if/then and more/less relations, and hence through both causal and comparative grounds.

Let us assume that the agent can "move" along at least one dimension (and thereby change its degree of that dimension), and "sense" its movements along both dimensions (and thereby sense its changes in degrees of those dimensions). Or, the agent can move something along one dimension, and sense that something's movements along both dimensions. For example, I move myself closer to or farther from the fire, and not only feel myself closer or farther, but also feel myself hotter or colder. And I can move something closer to or farther from the fire, and not only sense that it is closer or farther, but also sense that it is hotter or colder.

Such an agent can learn of the position and movement of the entity along one dimension by knowing the position and movement of the entity along the other dimension (and perhaps vice versa). That is, the *T*–*r* (temperature–radial distance) relation can constitute a sign–object or an object–sign relation. And such an agent can indirectly manipulate the position and movement of the entity along one dimension by directly manipulating the position and movement of the entity along the other correlative dimension. That is, the *r*–*T* relation can constitute a means–ends (or ends–means) relation. In short, *T*(*r*) is a ground, and not just a semiotic ground, nor just a causal and comparative ground, but *a ground of experience and agency*, a ground of sensorimotor interaction.

Crucially, one and the same dimension can be used as sign and interpretant, as something sensed and something instigated. I perceive where I am, and I change where I am; and I perceive changes in where I am as I change where I am. I perceive how hot I am, and I change how hot I am (by changing where I am); and I perceive changes in how hot I am as I change where I am. In this regard, one variable (say, *T*, or its relative degree) can constitute a sign; a change in that variable (say, *dT*) can constitute an object (understood as a goal of an action, as much as the correlate of a sign); and a change in the coupled variable (say, *dr*) can constitute an interpretant. For example, sensing how hot it is (where I am), I move in order to change how hot it is.

To a certain extent, then, we are simply within the cause–effect, sign–object, means–ends world described in part 1 of this article. The difference here is that the cause and effect are not discrete events, but rather continuously gradable degrees along immediately correlated dimensions; and hence, so are the sign and object, as well as the means (interpretant) and the end (object). There are three kinds of (ideal-typic) semiotic processes, whereby signs stand for objects and give rise to interpretants (see fig. 3).

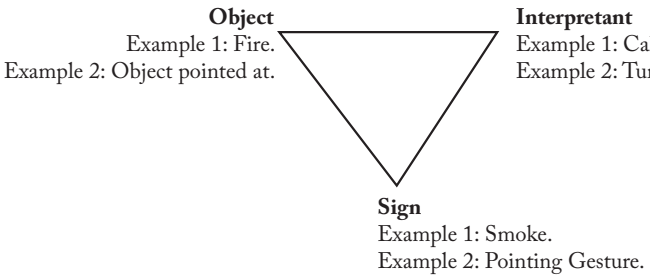

Figure 3a: Semiotic process whose components are (framed as) relatively discrete events

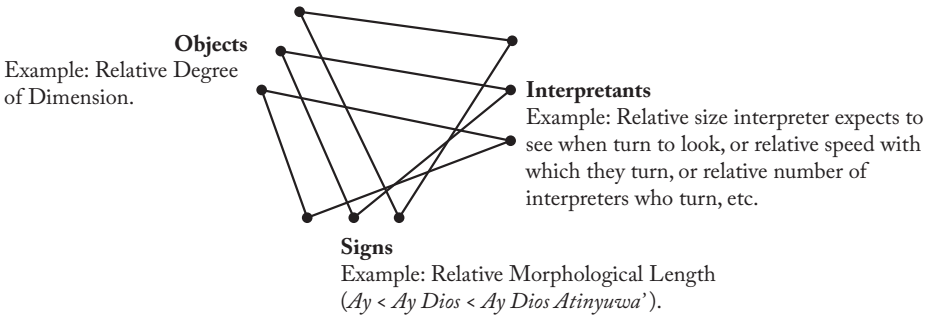

Figure 3b: Semiotic process whose components are (framed as) discontinuously graduated events

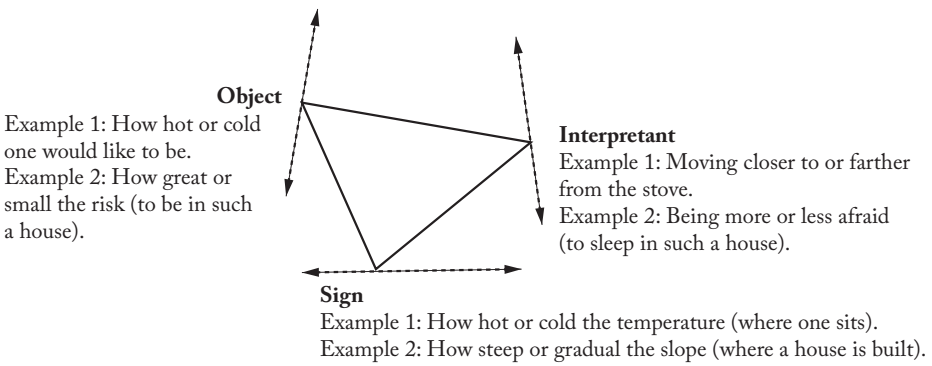

Figure 3c: Semiotic process whose components are (framed as) continuously graduated events

Figure 3a shows examples of such processes when the components in question are (framed as) relatively discrete events. *Figure 3b* shows examples of such processes

when the components are (framed as) discretely graduated events, as per our interjection example. And *Figure 3c* shows examples of such processes when the components in question are (framed as) continuously graduated. As may be seen, the object is often a value (or directly correlated with such a value), and the interpretant is a behavior that serves to increase or decrease that value. In some sense, then, each of the three components of a semiotic process may be framed as a function,[8] with relatively continuously covarying domains and ranges, themselves highly sensitive to context- and culture-specific parameters (all the while being besieged by parasites and unsettled by perturbations, *and essentially so*, as per our extended discussion of such issues in part 1).

Crucially again, because the two dimensions are so closely coupled, as one moves (*dr*), one directly changes one's temperature (*dT*), and one can directly sense that change. In effect, one is getting (relatively) continuous and instantaneous feedback in regard to the efficacy of one's actions through that very action. Moreover, one is also getting relatively instantaneous feedback as to the usefulness (or truthfulness) of the ground through that very action (and its invocation of such a ground). A key value is feedback, or rather "feel back/touch forward," a kind of phatic function with respect to both phenomenology and physics, namely, the degree to which the world tells you, more or less immediately and transparently, what effect your behavior just had on it. In some sense, it tells you it was listening, and that it understood (or didn't) what you were trying to say. Indeed, it doesn't just tell you that it was suitably impressed by what you said, but also that it speaks your language.[9]

* * *

It is worth exploring some of the entailments (and caveats) of the foregoing claims. To begin, it should be remembered that such a ground can, to some degree, be figured. That is, an agent can "pull into consciousness" or "put into communication" these relations. They can be aware of them, think about them, and talk about them, to some degree; and not just while they are engaged in them or experiencing them, but also "at a distance" (as it were). That is, the entirety of the *T*–*r* relation can constitute the object (sign, or interpretant) of another semiotic process.[10] Phrased another way, one can have—to a certain degree, along various dimensions—representational agency over one's residential agency.

8. That is, $O = O$ (degree), $S = S(O)$, and $I = I(S)$. In other words, O is a function of degrees, S is a function of O, and I is a function of S.

9. Moreover, just as many agents are radically distributed, many modes of sensation and instigation are nonimmediate and sloppily coupled, many assumptions about invariant relations are incorrect, and so forth (Kockelman 2017).

10. That is, we don't just experience such relations (through sensation and instigation), we also communicate them (through signification and interpretation): they can become the topic and focus of conversation (and of mediatization more generally). Moreover, just as our experience of such relations mediates our communication about them, our communication about such relations mediates our experience of them. Finally, not only are communication and experience mediated by such relations, but such relationality—the very fact of dimensions being coupled to dimensions—is mediated by communication and experience.

Such an agent can learn of the correlation through the organization of its sensorimotor interactions (in moving around the room, one notices how degrees in temperature vary with distance from the stove); and it can organize its sensorimotor interactions in reference to the correlation (I move closer to the stove in order to be warmer). And it could have been informed about the correlation by some other agent who directly experienced it (or was itself informed about it, and so forth). To some degree, it may be simultaneously caught up in all these processes. In any case, such relations tend to be agent- and environment-specific, as well as collectivity- and context-specific.

An understanding of such a relation and such value-organized behavior (in light of such a relation) can be enminded (in beliefs), encoded or entextualized (in utterances, laws, protocols, etc.), embodied (in habits, practices), embedded (in tools, infrastructure), engenomed (in a species), and so forth. In particular, objects, like environments, enable and constrain $T(r)$-like relations. And many environments are filled with signs of such relations: thermometers, odometers, price tags, safety rails, grip-tape, and the like. Recall our discussion of landslide risk assessments in part 1 of this article.

We have been assuming that such a correlation is relatively stable (given the qualities of some environment) and relative understandable (given the capacities of some agent). For example, a function like temperature versus distance (from hearth fire), or $T(r)$, is reliably evinced and easily intuited, at least in a certain context, to a certain consciousness, and to a certain approximation. It should be emphasized, however, that many such relations are singularities rather than replicas, and thus difficult to understand (nonlinear, discontinuous, parameter-sensitive, chaotic, etc.) rather than easy.[11] Moreover, all the hedges about parasitic forces and framing, as introduced in part 1 of this article, apply here as well.

There can be all sorts of couplings between the existence of the correlation (as a fact about an environment) and an understanding of the correlation (as a fact about an agent), with all sorts of performative dynamics in these couplings: understanding of such a relation may follow from, or lead to, the existence of such a relation; or lead to its going out of existence; and so forth. Such facts, of course, make certain distinctions, such as where to draw the line between agent and environment, or individual agent and collectivity of agents, highly frame-dependent, contentious, and reflexively consequential.[12]

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11. Indeed, even if the overall phenomenon is outside of the understanding and experience of some agent, there is often a small swatch that it is sensitive to via a good-enough approximation: *a locally linear way to relate to a function that is radically nonlinear (nonlocally)*. Recall from part 1 of this essay that experience can itself be regraded: we may zoom in on any dimension such that what looks linear becomes nonlinear (or vice versa), or what looks continuous becomes discrete (or vice versa), and so forth.

12. Crucially, a function like $T(r)$ is never really $T(r)$, but rather $T(r, t, A, W, C, P, O, I,$ "$T(r)$," etc.). That is, a variable like temperature may look (locally) like it is a function of r, but it is also a function of time, of agent, of world, of collectivity, of politics, of others, of imaginaries, and so forth. Indeed, as can be seen by the quoted embedding of $T(r)$ into itself, the range–domain relation is often itself a function of how the range–-domain relation is understood.

Signs, as much as environments per se, exhibit such relations. In some sense, a sign is a force field, channeling roots into fruits, or objects into interpretants. As I change my signs, the world (of interpreters) changes its interpretants.

All animals, and probably all life-forms more generally, are attendant to such relations to some degree—recall Benjamin's (1968) account of the secret heliotropism of flowers.[13] Simply by moving toward the light, away from the cold, closer to the source of a smell, or farther from the stench, an organism is typically moving toward or away from the source of some sensation; a sensation whose intensity increases or decreases as that organism moves toward or away from it. And so an organism can assess how far it is from something, and which way to move to get even closer or farther, simply by assessing a gradient in the marked sense. This is because most entities that are sources of sensations (food and smell, light and sight, temperature and feeling) create energy gradients around them. Fire, for instance, radiates light, heat, and odor. And, setting aside such crucial issues as wind and walls, and infrastructure more generally (as that which channels fields, fluxes, and flows), that light, heat, and odor are most intense near the fire, equally intense along any circle around the fire, and diminish in intensity as a function of one's distance from the fire.[14] An organism can orient to any, or all three, of these gradients in sensory intensity, by changing its trajectory.

(Indeed, algorithms, as much as organisms, chase gradients. So called "deep learning," for example, involves an optimization process called gradient descent. And economists have been chasing gradients for years, as well as insisting that the rest of us chase them too [Kockelman 2010c]. To be sure, as I discuss in detail elsewhere [Kockelman 2011], gradients also chase organisms, which are sieved on the basis of their ability to attend to, act on, and alter, gradients.)

Just as most signs turn on sources of energy which are too faint to be used as energy sources per se (Swenson 1997), most signs are best understood as gradient flows rather than discrete units. Their significance is their changing intensity; and we interpret them, in large part, by covarying our trajectories. Looking back

13. The full quote is illuminating: "As flowers turn toward the sun, by dint of a secret heliotropism, the past strives to turn toward that sun which is rising in the sky of history" (1968: 255). I'll leave it to my comrades to unpack the implications.

14. One common stereotype of infrastructure is that it is "materiality that enables the movement of materiality." This is unfortunate, as even the most trivial forms of infrastructure (roads, wires, channels, etc.) don't fit such a stereotype. Rather, they constrain movement as much as enable it (e.g., a pipe tells water where not to go, as much as where to go). They enable and constrain the movement of "nonmaterial" entities (people, signs, ideas, affect, intentionalities, etc.) as much as material entities. (Indeed, the distinction between "materiality" and "nonmateriality" is ridiculous—infrastructure, rather, plays a key role mediating local understandings of where materiality ends and nonmateriality begins.) Finally, movement (translation across space) is not essential: translation across time (preservation) and translation across possibility (realization) and translation across form (metamorphosis) are just as important. Refrigerators and graves are modes of infrastructure, as are imaginaries. Indeed, the ground itself—as a quintessential *ground*—is one of the foundational modes of infrastructure (Kockelman 2012).

to our invocation of the Anthropocene, as well as forward to our discussion of heat engines, one would do well to reframe much of semiotics (which has spent way too much energy studying discrete signs of the stereotypic sort), taking as a canonical semiotic process that game we used to play as children: *you're getting warmer . . .*

Material grounds

If the foregoing points are true, then our residence in the world is organized by comparative and causal grounds as much as our representations of the world. In particular, one is evincing a sensitivity to comparative and causal grounds whenever one is attending to the relative degree of some dimension (or intensity of some quality); insofar as one's behavior takes that degree into account; and insofar as that intensity (or a change in it) either directly constitutes, or indirectly correlates with, a value.

Indeed, what's often crucial are not just modes of behavior, but also traces of such behavior in the form of tools, artwork, infrastructure, built environments, and the like. This is because agents incorporate substances into their creations (tools, goods, idols, artwork) as a function of the degrees of the dimensions embodied in those substances, insofar as such gradated dimensions enable or constrain cause–effect, sign–object, or means–ends relations: for example, their relative degree of malleability, durability, density, heft, conductance, specific heat, color, rareness, luster, traction, or price. The "objective world" around us evinces not just our past assessments of causal and comparative grounds, but also those of our ancestors and other life-forms. While this fact is often foregrounded in the most objective sense (e.g., as the use-value component of a commodity, which is itself a combination of quantity and quality: *three bushels of wheat*, *two bolts of cloth*, and the like), it is a much wider phenomenon, as we will now see.

* * *

While most objects are radically multidimensional *in potentia*, only a few of these dimensions come to the fore in any particular activity. Recall our opening example of the impractically large log, and the way it was simultaneously repurposed as hearthstone and firewood. On the one hand, it was high enough (and stable enough) to serve as one of several large stones that would hold up a grill. On the other hand, it very slowly got shorter, as it was consumed by the flames, while its biochemical energy was converted into thermal energy, which itself caused tortillas to change—by degrees—from "raw" to "cooked."[15] And all the while the women

15. Elsewhere, I take up the notion of *(not) enoughness* among speakers of Q'eqchi' (Kockelman 2016a: 113–15). Also important are notions of *(not) too muchness*. Crucially, such notions are semantically parallel to the temporal notions encoded in adverbs like *already*, *not yet*, *still*, *no longer* (Kockelman 2010a: 92). Every more crucially, all these categories can cooccur with each other in Q'eqchi', much like they can in English: *no longer enough*; *still too much*; and the like. That is, not only is temporality gradable, but our gradations of other dimensions altogether are temporal.

cooking attended to these changing degrees along various dimensions—not only setting down raw cornmeal patties and picking up cooked tortillas at regular intervals (judging doneness by touch, rather than sight: a sufficiently cooked tortilla doesn't stick to one's fingers when patted), but also slowly pushing in the log toward the center of the flame, such that it provided a relatively even source of heat. Note, then, the manifold relations not just between dimensions and degrees, but also between sensation and instigation, energy and entropy, work and temperature, time and space, ontology and transformation, experience and affordance, feedback and flow.

For Aristotle (2001a), and many other philosophers, substances were identified through their qualities, if not identical to them. From some of its qualities, I infer it's fire; and having inferred it's fire, I predict it has further qualities that would be in keeping with its "fieriness" (given my ontology). Such an understanding of substance (and things more generally), as that which stands beneath, or bundles together, qualities, isn't particularly compelling.[16] At the very least, as was shown in part 1 of this article, Aristotle's qualities should be understood as semantically significant dimensions of experience in sufficient degrees, such that they can be predicated of the referents from which they seem to emanate (under certain conditions), by agents committed to particular ontologies (themselves highly frame-dependent).[17] A "substance" doesn't have the "quality" of *hotness* per se; rather, a referent has a high-enough degree along a certain dimension to count as "hot" to a speaker normatively attendant to certain dimensions in certain degrees.[18]

Finally, it should be emphasized that epistemic, as much as ontological, relations are organized by various dimensions, or scales: elsewhere (Kockelman 2010a) I discuss the epistemic scale (greater or lesser strengths of certainty), and relate it to evidential scales (better or worse sources of evidence) and ethical scales (better or worse behavior, more or less obligatory or permissible actions), as all of these unfold on interactional time-scales.

16. For superb, Peirce-inspired approaches to qualia, and materiality more generally, see Manning (2012) and Harkness (2015); and for a careful and inspired account of dicentization, through Peirce and far beyond, see Ball (2014).

17. Not just seemingly high-level ontological distinctions like substance versus quality, but also seemingly low-level ontological distinctions like person versus thing, redness versus whiteness, great dane versus chihuahua, walking versus crawling, goo versus muck, troll versus noob, and so forth.

18. Following Gibson (1979), people usually talk about affordances as possibilities for action that are latent in an environment and open to an organism (given its capacities, drives, goals, and so forth). It should be emphasized that such possibilities are not "qualities," but, rather, salient dimensions in significant degrees (which, again, stand at that latent/open intersection). For example, different regions in one and the same rock face may be more or less steep, crumbly, wet, pockmarked, or traveled; and thereby make different kinds of actions more or less possible—climbing, mining, sliding, hiding, or photographing. We attend to the intensity of a quality as much as to the quality per se—for it is not so much the presence of salient qualities, or dimensions, as it is their presence in significant quantities, or degrees, that enables or constrains our

But more importantly, most qualities are not really single dimensions (above certain thresholded degrees). Something doesn't have a specific heat, conductance, or resistance per se. Rather, when put to certain by-degrees, dimension-specific tests, that something responds in certain by-degrees, dimension-specific ways. Qualities, and qualia while we're at it, do not just depend on comparative grounds; they also depend on causal grounds. That is, insofar as something has a certain dimension to a certain degree, it enables and constrains certain trade-offs between degrees of other dimensions. (Recall our discussion of the relatively invariant covariance of variations.[19]) Some of these dimensions are lab-specific; but most are really experience-specific. To say a slide is slippery, or sticky, is to subject it to certain dimension- and degree-specific tests insofar as it responds in dimension- and degree-specific ways. For example, how do I know that some slide is too slippery? I slid down too fast for my own comfort. How do I know that another slide is not slippery enough? Because I slid down too slow for my own enjoyment. One literally puts some body (such as a slide) to the test by seeing how it channels the potential dimensions and degrees of another body—including, "the body." Such tests involves dimensions and degrees as much as forces and flows, and hence both comparative and causal grounds (see Kockelman 2016b).

* * *

In regard to speakers of Q'eqchi', several of our examples turned on cultural practices surrounding corn at the stages of sowing and growing: for example, taboos around planting, reactions to milpa-induced landslides, and the like. It should be emphasized, however, that dekerneled corncobs (*b'ajlaq*), and hence post-consumption corncobs, were also caught up in a wide range of practices. In part, some might argue that this was because such corncobs were no longer caught up in moral taboos or nutritional needs, and so could be repurposed to any imagined end; and, in part, this was because such slowly degrading corncobs were so prevalent, handy, and durable. More generally, they incorporated (or, from them, seemed to emanate) a range of locally salient dimensions, in sufficient degrees, that they were able to serve as causes for a variety of effects, means for a variety of ends, and signs of a variety of objects.

Because of their shape, for example, they were often used by children as toy vehicles—typically buses, but also cars, ships, and airplanes. (Such a usage was even lexicalized: the compound construction *b'ajlaq ch'iich'*, literally "corncob metallic/machete," could be used to refer to bicycles and buses; just like the compound construction *ulul ch'iich'*, or "brains metallic," could be used to refer to computers; and so on for other nonindigenous metallic objects.) Those with kernels still on them,

actions (or renders the entity or event perceptible in the first place). Moreover, given our discussion of invariance, such dimensions (and degrees) not only stand at the intersection of the organism and its environment, they also stand at the intersection of the organism's sensations and instigations. Elsewhere (Kockelman 2006, 2011), I rework such claims from an explicitly social and semiotic stance.

19. That is, many key ontological distinctions emerge, endure, and fade away because of such relative invariance.

but otherwise too dry or rotten to eat, could be used to dekernel other corncobs—that is, one could use the harder, still-intact kernels of one corncob to remove the softer kernels of another corncob, all the while protecting one's hands. They functioned as relatively harmless projectiles—not just in children's games, but also to shoo dogs and chickens. They were gnawed on by hungry dogs and often eaten by pigs. They could even be burned as fuel in a pitch—usually to create smoke that would be wafted across wet corncobs, or roof-thatch, that were otherwise in danger of rotting. And they could be used as insulators—in particular, as pot-holders to prevent a person from burning his or her hands while they lifted a pot or griddle off the cooking fire.

Corncobs could be used for all these purposes, could afford such a wide range of actions, precisely because they had particular dimensions (or qualities) in peculiar degrees (or intensities): from relatively low specific heat to a relatively handy diameter, from a relatively soft exterior to a relatively dense core. Such dimensions were not, of course, values "in themselves," but rather values that incorporated, complemented, and helped create the dimensions and degrees of other entities and agents (Kockelman 2015). In particular, rather than think about them as instruments that could be wielded insofar as they served functions (which they were designed and built to have), it is better to think of them as affordances (Kockelman 2006, 2013) that could be heeded insofar as they provided purchase (given the capacities and characteristics of people and things, or all the agents and entities more generally, that they mediated between).[20] As we saw above, for example, a corncob could "stand between" a man's hand and a dog's head, a pig's senses and its stomach, a child's imagination and a key mode of transportation, a woman's hand and a hot pot.

We might thereby amend Uexküll's (1982) famous claim: Just like a spider's web is fly-like as much as spider-like, *in terms of its dimensions and degrees, as much as its forces and flows*, a dekernealed corncob is hand-like as much as pot-like (and hot-like), imagination-like as much as transportation-like, snout-like as much as stomach-like, and so forth.[21]

Indeed, a key affordance of corncobs was their cylindrical symmetry, with its slowly tapering radius, such that they served as a wedge, or lever, that simplest (and most sublime and widespread) of the simple machines (see fig. 4).

In particular, dekerneled corncobs were frequently used to plug holes in the walls of houses, to hold open doors, to create space between stacked planks of wood, and to level beds, desks, and workbenches.

20. As I argue at length elsewhere (Kockelman 2006), such affordances also enable and constrain instruments, actions, roles, and identities (qua ethical and moral values).

21. To a comparative and causal public, or to a consciousness or collectivity attendant not just to certain degrees and dimensions, but also to certain forces and flows. (Spider webs, and other traps, are simply one kind of sieving device among many—and hence constitute banks and rivers as much as bridges and t[r]olls. What gets through, or stands "perpendicular to," is just as important as what gets caught.)

An axial displacement (Δ axial) "translates" into a radial displacement (Δ radial), such that a force exerted in the axial direction is applied in the radial direction, where the slope (gradient) of the corncob determines the "trade off." In particular,

Δ axial × force axial = Δ radial × force radial, so that:

Δ radial / Δ axial = force axial / force radial = 2 × slope.

Phrased another way, an agent can exert a relatively small force over a relatively long distance (in the axial direction), and the corncob will translate this work (= force × distance) into a relatively large force exerted over a relatively small distance (in the radial direction).

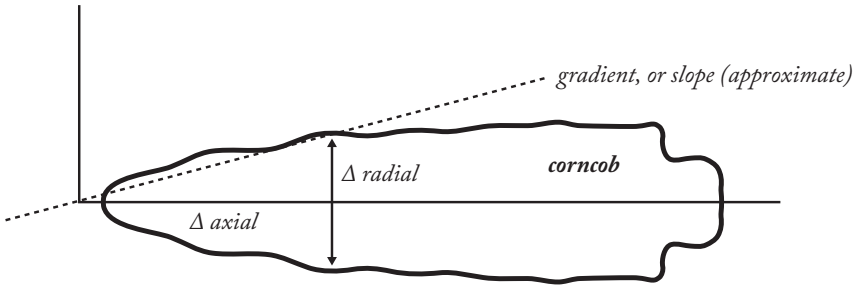

Figure 4: Corncob, like machete blade (or mountain face), as wedge

Now one might not think a corncob has much to do with gradients, but this key affordance of corncobs has a very similar physics to hillsides (not to mention machetes).[22] In particular, a force applied in the axial direction translates into a force applied in the radial direction. And, depending on the tapering of the corncob (or the sharpness of the machete, or the grade of a hillside), there is a trade-off between the amount of force exerted and the distance pushed (by the agent doing the wedging), and the amount of force applied to, and the distance moved by, the entity being wedged. In the case of corncobs, these facts, combined with their relatively soft exterior and hard interior, mean that they hold up under wedging, and stay put once wedged.

For some readers, all this should be reminiscent of Aristotle's (2001b) discussion of justice, and Marx's ([1867] 1967) discussion of value: not a relation between people mediated by a relation between things, but a relation between forces mediated by a relation between distances (mediating between a person and a thing, and hence mediating between people [and their things]).

Note, then, how we make sense of instruments and interfaces and infrastructure, and perhaps even signs and ideas and imaginaries: by understanding how

22. Compare two trails between the same two contour lines. All things being equal, if you want a short walk, it's going to be a steep slope; if you want a gradual slope, it's going to be a long walk. (All things, of course, are not equal: typically, by taking the longer route, one suffers friction, and other parasitic forces—and hence does extra work. Equivalently, in letting something slide down the longer path, rather than the shorter path, one degrades the quality of energy: from potential energy and [macroscopically] kinetic energy to thermal energy, or heat.)

they change the ratios and dimensions of our experience, of our sensation–instigation relations, through both more/less and if/then relations, and hence both comparative and causal grounds. To really understand an instrument, including semiotic instruments like media and speech acts, as well as social instruments like the division of labor, requires that we understand (inter alia) the kinds of trade-offs (or *mutual sacrifices*) such an instrument allows, trade-offs that interrelate degrees of various dimensions, from what we do to what we induce or effect, from what we experience to how we react or affect, from what we see or hear to what we interject.

* * *

O'Regen (2010) has been at the forefront of recent attempts to understand conscious experience in sensorimotor terms. He argues that to understand consciousness, we need to take seriously the fact that our sensory systems are "grabby." As he defines it:

> Grabbiness is the fact that sensory systems in humans and animals are hard-wired in such a way as to be able to peremptorily interfere with cognitive processing and automatically cause an orienting response. When there is a sudden flash or loud noise, hard-wired detectors in the nervous system detect these "transients," and automatically orient attention towards the source of interruption. Pungent smells and persistent pains are detected by specialized detectors that incontrovertibly monopolize our attention and cause avoidance reactions. (2010: 17)

O'Regen's claims are very interesting and useful. But for our purposes, several complementary claims are in order, based on the foregoing analysis of causal and comparative grounds. Firstly, entities and events grab our attention not just because of a bunch of species-specific, hard-wired detectors, but because those entities and events are at odds with our grounds. We have those events which are not expected or intended by an agent given that agent's understanding of the ground (as a set of forces pertinent to a particular terrain which lead to event-sequencings of particular sorts, as oriented to in the inferences and actions of those agents aware of them). For example, when I push this button, the door does not shut (but it should). And we have those events or entities which have the wrong dimension or the wrong degree (of some dimension) for an agent given that agent's understanding of the ground (as a set of ontological assumptions regarding what kinds of entities there are in the world, what qualities those entities typically have, and what intensities those qualities usually possess). For example, this object is too heavy (given my expectations). Note, then, that many entities and events grab our attention because they conflict with such grounds, and so easily stand out as figures.

Secondly, as should be clear from the preceding arguments and examples, both kinds of grounds are just as likely to be "subjective" (or relatively individual-specific) and "intersubjective" (or relatively collectivity-specific) as they are "objective" or "universal" (or relatively species-, or taxon-specific). That is, expectations about event-sequencing, or about the dimensions and degrees pertinent to particular entities, are largely a function of what environments one has grown up in, whom one has talked to, what stories one has heard, what sensorimotor experiences one has had, what media one has accessed, and so forth. They are a function of particular

environments, particular organisms, and particular collections of organisms, and their mediated relations among themselves and with the world. To be sure, such grounds are also a function of relatively fixed, species-specific sensory systems, and the environments such systems evolved in; but that is only one small part of the story.

Thirdly, just because an entity or event is at odds with our grounds does not mean it must grab our attention. There are any number of ways of dealing with ungrounded experiences, anomalous events, or parasitic forces more generally. Douglas ([1966] 2002), in a different register and on a different topic, handled many of these: reinterpretation, control, avoidance, symbolization, and so forth. And, more generally, the literature on how humans take up "anomalies" is enormous—from Heidegger to Kuhn, just to name two. For example, we may simply not notice that which would be anomalous because our grounds are not attuned to them. A lot of forces are not easily sensed or instigated in the first place; and so a lot of event-sequencing is not oriented to in our inferential thinking or instrumental acting. This may simply be due to the fact that the distinctive dimensions and degrees of the event-sequencings they condition are outside of our ken (without particular media): too faint, too far, too fragile, too rare, or too rarified for our scales of experience. Or we may simply overlook, or even out, the ways they are at odd with our grounds, assimilating their rough edges and unlikely outcomes. We may not have adequate predicates to describe the world (or their conceptual structure is not up to the task); or our sense of intensity, of gradation, may be out of scale. That is, the world is conceptually-symbolically insubordinate (and discursively-interactionally insubordinate,) as much as it is insubordinate in sensorimotor terms.

More generally, certain phenomena are simply difficult to figure in the first place without a range of auxiliary beliefs (such as theories) or particular equipment (such as technologies), and so difficult to build up representations of, or interventions in. Indeed, perhaps the phenomenon in question is just not predictable: the world is full of outliers, black swans, serendipity, singularities, parasites, abnormalities, and the like. Finally, to return to Douglas, instead of minimizing the distinctiveness of particular events or event-sequencings, we may treat them as figurations (tropes, omens, encounters, symbols, etc.), rather than as figures, or even as figments of our own or another's imagination. As our extended example of landslides should attest, the world, in our wranglings with it, is just as slippery as it is grabby.

Grace

The term "grace" has a variety of meanings in English, many of which have been touched on in this article: divine and unmerited assistance (think "free gift"), fluidity of movement (gracefulness), the capacity to bring honor, value, or renown upon a person, institution or occasion (to grace), and a brief speech act that gives thanks (to say grace).[23] Of particular interest is the ways that grace relates to the other key

23. As Hobbes put it, in his extended discussion of the performativity of speech acts in relation to contract: "When the transferring of right is not mutual, but one of the parties transferreth in hope to gain thereby friendship or service from another (or from his

terms of this article (grading, gradients, and degradation), and to comparative and causal grounds more generally.[24] To conclude this article, I want to discuss related issues from the standpoint of Q'eqchi'-specific practices and beliefs.[25]

Let's focus on the last sense of grace—a small prayer, or giving thanks. As we noted in part 1 of this article, the usual way to thank someone in Q'eqchi' is simply to say *b'aantyox*, or "because (of) God." Such a construction turns on the relational noun *-b'aan*, which is also used to mark demoted agents in passive constructions (the house was destroyed *by* the mudslide), to head *because*-clauses (often as answers to *why*-questions), and, as a nonrelational noun, to denote medicine. It was the (unmarked) agentive marker par excellence—indicating the source of causation, as much as the target of benefaction.

While the Q'eqchi' have a range of distinctly Catholic prayers that can be used to give thanks to god (as well as to directly petition him for assistance), they also have several genres of prayer that they use to address the various *Tzuultaq'a*, or "earth deities," that surround their homes in the mountainous regions of Alta Verapaz, usually in the context of cave sacrifices and similar ceremonies. As we saw, the word *Tzuultaq'a* is composed of two morphemes, *tzuul* "hill" and *taq'a* "*valley*," and thus makes reference to the highest and lowest points in a landscape. As Wilson noted, these deities can be male or female and, as such, have distinctive qualities and causal powers:

> Male tzuultaq'as have sharper contours, more dramatic peaks, and, frequently, a white cliff face. From their caves, male tzuultaq'as throw lightning bolts, blast out thunder, and shake the ground to cause earthquakes. Female tzuultaq'as are no less destructive than males, but they devastate through deluges and landslides. (1995: 54)

Elsewhere (Kockelman 2010a), I work through an early twentieth-century Q'eqchi' myth that describes how Moon, the daughter of a male *Tzuultaq'a* (portrayed in the myth as the only *Tzuultaq'a*), eloped with the Sun, and how her father's subsequent

friends), or in hope to gain the reputation of charity or magnanimity, or to deliver his mind from the pain of compassion, or in hope of reward in heaven, this is not contract, but Gift, Free-Gift, Grace, which words signify the same thing" ([1668] 1994: 82).

24. We have already noted the many ways that the four key categories of this article fold back in on themselves. For example, grace and degradation, as relatively complex dimensions, can themselves be graded: some person or action can be judged more or less graceful; some resource can be more or less degraded; some situation can be more or less degrading. We have claimed that determining relative degrees of degradation is crucial because this metadimension applies to so many other key dimensions—the degree to which some resource (in the form of a gradient) still exists, or not, and so can still be relied on, cared for, safely kept, used, exploited, and so forth. And we have put forth the idea that the first and second senses of grace are often best understood in terms of degradation—in particular, a kind of ethical and practical caring for those whose lives have been degraded, or who live amongst degradation.

25. See Sivaramakrishnan (2015) for a particularly important account of the relation between morality, affect, religion, landscape, and nature. While his focus is on the ethics of nature in India, the network of relations considered there is highly relevant in this context as well.

revenge on the unfortunate couple (themselves portrayed as the original parents of us all) came to structure the entirety of the cosmos: not just space and time, but ontology and ontogeny, quality and quantity, substance and form, relation and reference, gender and power. In some sense, then, *Tzuultaq'a*—and his intense desire to hold onto his wayward daughter, while fighting off her wily companion, such that she could continue "to care" (*ch'oolanink*)[26] for him—was the original and ultimate cause of it all.[27]

The prayers, or modes of grace, that Q'eqchi' speakers use to address the various *Tzuultaq'a* that surround their communities can be quite varied in content, depending on the needs and preoccupations of the one saying the prayer. But they very often begin and end with some variant of that longest interjection (*ay dios atinyuwa'*, or "oh god, you are my father"). Here is one example taken from Estrada Monroy (1990: 25–26; and see Burkitt [1902] and Wilson [1995: 323-24] for similar examples):

> *at-in-tyox at-loq'-l-aj-tzuul-taq'a*
> A(2s)-E(1s)-god A(2s)-precious-Dm-SD-hill-valley
> "you (are) my god, you (are) my precious hill-valley"

As may be seen, in the prayer, but not in the interjection, the word "god" (*tyox* < Spanish *dios*) is assimilated to Q'eqchi' phonology—the /d/ undergoing devoicing, and the /s/ undergoing palatization. As may also be seen, there is an upgrading of *tzuultaq'a* via the predicate *loq'laj* "precious," similar to the upgrading of *iglesya* "church" through the predicate *santil* "saintly" that we analyzed in part 1 of this article. Note that there is not just a lexical parallelism, via the compound construction (*tzuul-taq'a*), but also a phrasal parallelism, via the two clauses: "[you are my god], [you are my precious [hill]-[valley]]."

Another frequent variant of these prayers swaps out the second part "you are my precious hill-valley," and replaces it with another instance of parallelism, this one turning on kinship relations, and having the same syllable count and closely related syntax:

> *at-in-tyox at-in-na' at-in-yuwa'*
> A(2s)-E(1s)-god A(2s)-E(1s)-mother A(2s)-E(1s)-father
> "you (are) my god, you (are) my mother, you (are) my father"

---

26. The verb "to care" (*ch'oolanink*) is derived from the noun *ch'ool-ej*, an inalienable possession that refers to one's heart. As discussed elsewhere (Kockelman 2010a: ch. 2), this category includes most kinship relations, many body parts, and words like shadow, name, and community. Note, then, that a key part(!) of Q'eqchi' ontology is an extended partonomy, one that involves part–whole relations (my hand) as much as node–network relations (my brother).

27. None of this is to say that geology is theology for the Q'eqchi'; but there are certainly less tenable hypotheses that one might entertain. Both disciplines are devoted to figuring out the trade-offs, or sacrifices, that "ground" being; and both owe their origins, arguably, to the most grabby of earthly experiences, themselves often due to the sudden and severe degradation of some energy gradient: landslides, earthquakes, lightning bolts, and the like.

These prayers usually continue by indicating the speaker's relation to the landscape, this time not by using inalienable possessions that turn on kinship relations, but by using inalienable possessions that turn on body parts, and related items, usually in the form of relational nouns (Kockelman 2010a: ch. 2). They thereby locate the speaker relative to the landscape, or in relation to the body of the *Tzuultaq'a*. Here is an example of such a spatial locating, such a deictic grounding:

(a) *k'a'jo' r-us-il wan-k-Ø arin sa' l-aa saq-oo-naq pek . . .*
Part E(3s)-good-Nom exist-Pres-A(3s) here inside Dm-E(2s) white-become-Part rock
"how much goodness there is here inside your whitened cave . . ."

(b) *. . . r-ub'el l-aa mu ch-aaw-e ch-aaw-u*
E(3s)-beneath Dm-E(2s) shadow Prep-E(2s)-mouth Prep-E(2s)-face
". . . beneath your shadow, before your mouth, before your face"

Note, in reference to part 1 of this article, the use of the same construction (*chiru*) that is used to indicate comparisons ("in the face of," "in confrontation with," "in comparison to"). Here the speaker is being placed in front of the *Tzuultaq'a*, and not just before his face (or gaze), but also before his mouth (or voice); and not just before these body parts, but also beneath his shadow.[28]

Note how thoroughly we are within Aristotle's category of relation, suitably transformed, as opposed to his categories of quality (or substance): inalienable possessions and the relational nouns and adpositions (into which they so often derive). Relation was the key category that structured Aristotle's understanding of both comparison and causality. As I have discussed elsewhere (Kockelman 2015), this category was itself a key source of inspiration for Heidegger's notion of "references" (*die Verweisungen*) as opposed to "representations" (a distinction which centered his discussion of worldliness, and subsequent literature on "embodiment" and "embeddedness"). And they are closely related to Jakobson's (1990b) notion of "in reference to" as opposed to "refers to" (which grounded his discussion of shifters).

Finally, in examples of this genre encountered by Wilson (1995), the interjection *ay* is present, there is explicit thanking of the *Tzuultaq'a*, and there is apologizing (using the other key agentive relational noun, *-maak*, itself negatively valenced as per its lexical meaning of "sin").[29]

(a) *Ay Tiox Ay Tzuul-taq'a ex in-na' in-yuwa'*,
Interj god Interj hill-valley A(2p) E(1s)-mother E(1s)-father
"ay God, ay Tzuultaq'a, you (plr) are my mother, my father"

28. The construction *k'ajo' adjective-Nom* functions as a secondary interjection: it takes an adjective (or nonverbal predicate), nominalizes it (e.g., *us* "good" → *us-il* "good-ness"), and then indicates that there is a markedly large degree of this dimension: *k'ajo' rusil* "how much goodness." And, like primary interjections, it usually has the illocutionary force of an exclamation.

29. Quite appropriately, I think, Wilson himself translates the interjections as apostrophes: "O God."

(b) *arin wan-k-in r-ub'el aaw-oq, r-ub'el aaw-uq' at wa'* .
here exist-Pres-A(1s) E(3s)-beneath E(2s)-feet E(3s)-beneath E(2s)-hands A(2s) ?
"here I am beneath your feet, your hands"

(c) *Ch-Ø-aa-kuy taxaq in-maak*.
Opt-A(3s)-E(2s)-endure Opt E(1s)-sin
"(if only you would) forgive my sins"

(d) *B'antiox aaw-e x-in-ru x-in-chal jarub' chi tzuul, jarub' chi taq'a, jarub' chi leeg, chi kutan*.
thanks E(2s)-Dat Perf-A(1s)-be_able Perf-A(1s)-come how_many Prep hill how_many Prep valley how_many Prep night (?) Prep day
"(it is) thanks to you (that) I have been able to cross so many hills, so many valleys, so many nights, so many days"

In some sense, then, every intense interjection is a radically profaned and truncated prayer—something uttered when in the face of (confronted by, compared to) something larger than oneself, and yet a part of oneself. Moreover, every interjection of this sort might even be seen as an attempt to grab a god's attention, to establish a channel with it. A markedly intense experience "causes" you to establish a channel with that ultimate cause. In any case, there is a locally motivated relation between gradients (high and low), degradation (landslides), and grace (prayers to the earth god, the highest and lowest places in a landscape, the source of landslides and everything else under the sun [and moon]). We grace it with our prayers and sacrifices; it graces us with its presence—and sometimes with its presents. *Or else* . . .

(That said, one cannot help point out the irony of a *Tzuultaq'a* causing landslides—precisely a leveling out of low and high grades, almost a negating, or simultaneously an upgrading and a degrading, of the *Tzuultaq'a* itself.)

But, lest we get carried away, it should be emphasized that in the aftermath of the landslide I heard no causal explanations of this kind. (Though, given such well-attested ethnographic and historical details, I assume such beliefs were in "the background," at least among elders.) As we saw in part 1 of this article, villagers I spoke to usually referenced causes like heavy rains, steep slopes, and overplanting. Moreover, I witnessed no otherworldly petitions of this sort. (Though I heard quite a few interjections, among members of the younger age grades, of the *oh-my-#!@%-god* variety.) Rather, the family whose house was destroyed, along with the mayor who organized the labor pool, individually thanked each and every person who—in that *massive sign* of solidarity and sympathy—came to dig out the pieces of their old house and build them a new one. This time on more stable, though perhaps no less shifting, grounds.

You're getting warmer: Carnot knowledge (and power)

Let me offer one last relevant example of gradients and degradation—in part, to illustrate the key terms in this article's title; in part, to show their relevance to the core concerns of anthropology and the Anthropocene, at least at their origins; and,

in part, to sketch the key features of one *countercosmology*. Such a nineteenth-century "causemology" not only succeeded in reframing space and time, intensity and causality, quality and relation, it also introduced four interrelated dimensions which are (soon to be) global cultural values as much as universal thermodynamic variables: energy, entropy, work, and temperature.

Temperature exhibits gradients: we may note its increase or decrease in passing from one point, or moment, to another. It is thus a quality (or dimension) that varies in quantity (or degree) depending on context. We grade temperature not only when we explicitly measure it (*the thermometer says it's 34 degrees Celsius*), but also when we implicitly compare the temperature of one place or period with another (*it's hot here [in comparison to there]*, *it's hotter now [than it was then]*).

Whenever there is a spatial gradient in temperature, and an appropriate conduit or channel across the space, heat can flow from the hotter regions to the colder regions, a process which will eventually bring all points to the same temperature. That is, a temperature gradient causes a flow of heat which eventually cancels out the temperature gradation which caused it. This is an example of degradation—the loss of a gradient, resulting in the homogeneity of grade: *it's as warm here as it is there*.

Heat engines exploit such facts by taking in temperature gradients and turning out *work* (understood as the application of a force through a distance—say, lifting a mass, compressing a spring, accelerating a car, climbing a hill, or driving a wedge). Conversely, a refrigerator takes in work (or energy) and turns out a temperature gradient. And so just as gradients can be exploited to do work, work can be used to establish gradients. Indeed, we often use the energy released, or work performed, in leveling one gradient to establish another:[30] for example, using a heat engine to pump water into a cistern.

Crucially, in taking in heat from a higher temperature region and putting out heat into a lower temperature region, such an engine eventually makes both regions the same temperature—such that no more work can be done. While an ideal engine can be reversed, such that the same amount of work done *by* the engine can be done *on* the engine, and thereby return the two regions to their original temperatures, no heat engines are actually ideal. And so while energy is always conserved, as per the first law of thermodynamics, useful energy—and hence energy one can readily direct to desirable ends—is lost. This is another way to understand the second law

30. See note 16 of part 1 of this article for key caveats, extensions, and speculations. Schrödinger (1944), for example, argued that organisms are particularly good at capturing negative entropy (which he also referred to as "orderliness" and "free energy"). This is how they compensate for the entropy they create by living, and thereby maintain themselves at relatively low entropy levels. Indeed, he referred to this capacity to capture free energy, or relatively nondegraded energy, as the "organism's astonishing gift" (ibid.: 75). By capturing such fluxes, they keep themselves "alive," which is to say they keep themselves from coming to equilibrium with their environments, and thereby maintain a graded difference between themselves and their environments. In short, local order increases so far as global order decreases. And key gradients are not just those that vary across environments, but also those that separate organisms from their environments.

of thermodynamics, the idea that entropy is always increasing—or, equivalently, that energy is always degrading.[31]

Degradation is a key way to figure such loss, a loss that is inherently irreversible, a loss that grounds the inexorable directionality of time. What does it mean to live in such a world? Grace—to live, live well, and struggle so that all can live and live well, despite degradation. As if there was a point beyond life itself and its ceaseless cessation. Hope in the face of nope.

* * *

Needless to say, the fact that these four dimensions (energy, work, entropy, temperature) are universal variables and global values does not mean they are the same everywhere, just locally salient everywhere (and globally significant). They must then be studied, in their local salience (and global significance), through all the techniques offered in parts 1 and 2 of this article—in particular, through "fieldwork" as it was theorized in part 1, as one key component of fieldwork (in its more traditional sense).

* * *

The French engineer Sadi Carnot was one of the first to understand heat engines in regard to both their abstract potential and their historical particularity. As he saw it (Carnot [1824] 1897), such engines were radically open, insofar as they could replace all other sources of power (animals, rivers, wind, etc.). They were radically portable, insofar as they could be used to produce power at any time, in any place, on any scale (so long as one can produce a heat gradient there, which is as easy as burning coal). Like the other "mechanical arts," their key factors of production were iron and coal. But unlike the other mechanical arts, heat engines were recursively central to acquiring more iron and coal—through mining practices, in particular. Moreover, when employed in the form of steam engines on ships and trains, Carnot argued that such devices enabled communication, "the penetration of savage lands," the introduction of civilization, and the shortening of distance. (All the changes, incidentally, that McLuhan ([1964] 1994) would later argue, albeit with a relatively negative valence, that "media" helped to introduce.) Indeed, the steamship that Marlowe took upriver in *Heart of darkness* ([1899] 2007) was precisely such a vehicle. And Conrad's story, itself the foil for so much anthropological thought (at least since the 1960s), is filled with images of thermodynamic degradation amidst capitalist exploitation and colonial expansion: boilers, rusty rails, detonations, decaying machinery, puffs of smoke, and noise.

After making these claims, Carnot asked himself whether the motive power of heat was unbounded. And he compelled himself to think about this question in a completely general way ("independent of any particular agent"), and thus without regard to the specific details of the technology employed. He understood that you cannot get work out of heat, no matter how hot the source, unless there is something cold: a temperature differential is essential. He thought that, in addition to a

31. As should be clear from the examples offered in this article, not all gradients are good, and not all degradation is bad. That is, just as grading practices are relatively frame-dependent, so are evaluation practices (in regard to such grades).

heat source (say, a boiler) and sink, you need an "intermediary substance," something that changes size with temperature, such that it can push or pull, and thereby do work. And he argued that the motive power of such a device does not depend on the nature of this intermediate substance, but only on the temperature difference between the source (a region at a hotter temperature, *Th*) and the sink (a region at a colder temperature, *Tc*). He calculated the maximum efficiency of such an engine, equal to the work done (as output) divided by the heat absorbed (as input), showing it to be equal to (*Th* – *Tc*)/*Th*. In other words, so long as you have a temperature gradient, you have a source of power. In short, in offering his theory of thermodynamic mediation, Carnot described both the physical nature and the cultural ramifications of one of the most powerful and portable "agents" in world history.

Such a vision of temperature gradients, as generative of work and civilization, was the inverse imaginary of degradation and death, or the end of time, that was highlighted in 1854 by the German physicist Helmholz (quoted in Sethna 2006: 81; and see Thomson 1862), who suggested that all forms of energy would degrade into heat, and all temperatures would become equal, such that everything existing would "be condemned to a state of eternal rest." This idea was later foregrounded by H. G. Wells in *The time machine*, when he imagined what the state of the earth would be in the distant future, when all readily available gradients had been tapped:

> The sun, red and very large, halted motionless upon the horizon, a vast dome . . . glowing with a dull heat. . . . The earth had come to rest with one face to the sun, even as in our own time the moon faces the earth. . . . There were no breakers and no waves, for not a breadth of wind was stirring. Only a slight oily swell rose and fell like a gentle breathing, and showed that the eternal sea was still moving and living . . . the life of the old earth ebb[s] away . . . . ([1895] 2005: 66–67)

According to such nineteenth-century cosmologies, then, the heat engine was the original time machine—taking us all, ever faster, into this future.

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Graduer, gradation, dégradation, grâce. Deuxième partie : Phénoménologie, matérialité et cosmologie

Résumé : La première partie de cet article, publiée dans le dernier volume de cette revue, était tout particulièrement centrée sur l'intensité et la causalité étudiées du point de vue des conventions sociales et des pratiques de communication. Cette nouvelle partie porte sur des thèmes associés abordés du point de vue de la phénoménologie, de la cosmologie, et des études de la matérialité. L'objet ethnographique central est toujours les effondrements de terrain dans les plateaux du Guatemala et la manière dont les habitants d'un village de la Forêt de nuage, qui parlent le Q'eqchi (Maya), vivent de tels évènements. Nous continuerons donc d'analyser les conséquences des effondrements, en reprenant là où s'achevait la première partie. Plus généralement, bien que moins explicitement, cet article continue notre exposition de quatre termes centraux pour l'anthropocène (et comme cela devrait maintenant être clair, ils sont sans doute Omnicènes): la "gradation" (la manière dont l'intensité des qualités varie dans le temps et l'espace), "graduer" (la manière dont les agents évaluent et altèrent ces intensités, vivent et interviennent dans ces processus causaux), la "dégradation" (comment des variations en intensité qualitative très significatives sont amoindries ou perdues), et la "grâce" (la manière dont les agents tâchent de prendre soin de ceux dont la vie a été dégradée, et valorisent les agents qui travaillent et se dédient à cette tâche).

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