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CHAPTER TEN

Modeling, Ontology, and Wild Thought: Toward an Anthropology of the Artificially Intelligent

Willard McCarty

I come back to ostranenyi, how we freshen things that have become banal, rather than banalize things that have become revolutionary.
—Jerome Bruner (1988)

Raw and Strange

“We shape our tools and thereafter they shape us” is a good place to begin (Culkin 1967: 54). Whether it is true of all tools at all times, John Culkin’s principle fits the reciprocity between the remarkable adaptability of the digital machine and our own.¹ It suggests how we come to respond to intelligently designed interfaces as if they were “intuitive” by nature, not seeing the characteristics of the machine behind them.

1. In most instances, by “digital machine” I mean the kind we use daily, but sometimes all devices conforming to von Neumann’s architecture ([1945] 1993). Thanks to the common design, much of what I have to say applies to all of them. Context should make clear which is intended when clarity is needed.

In Michael Polanyi's terms, with exposure to the machine we become increasingly able to "attend from" it to the work at hand, thinking with rather than about it (1983). More so than with earlier tools, engineering behind the scenes makes less and less common the phenomenological "breakdown" that would otherwise cause us to "attend to" the mechanics, and so be reminded of those characteristics. For this reason, digital appliances are or quickly tend to become part of the furniture, their digitality imperceptible.

Here I want to come back to the primary consequences of design responsible for those unseen characteristics: the radical translation that the machine requires and the combinatorial "blind thought" (Leibniz's *cogitatio caeca*) that follows. These bear centrally on the anthropological question of intelligence that I explore in this essay.

Anthropology and Computing

Anthropologists were among the earliest to take an interest in computing. Their engagement with it began in conversations at Stanford in 1960–61. These led the next year to an international conference whose aim, Dell Hymes wrote, was to place the virtues and prospects of the computer "not in speculative isolation, but in real relation" to the anthropological disciplines (1965). But the stage had already been set by the early 1940s with the multidisciplinary and hugely influential field Norbert Wiener named "cybernetics" (1948a), from which the sciences of cognition and computing have inherited a great deal. Wiener took the name from the Greek *kūbernētēs* ("steersman"), invoking the embodied kinesthetic intelligence of a skilled person interacting with what James Gibson would later call its "affordances" ([1977] 1986). Wiener had worked with this kind of intelligence in the feedback mechanisms of anti-aircraft fire-control systems during World War II (Galison 1994).

Theoretically, Wiener wrote, cybernetics aimed "to find the common elements in the functioning of automatic machines and of the human nervous system," or what he called "control and communication" when done by machines and "thinking" when performed by humans (Wiener 1948b: 14). From their nascent theorizing, the early cyberneticists proposed to fashion these elements into a far-reaching, radically interdisciplinary science. Anthropologists Gregory Bateson and Margaret Mead were keen, seeing in cybernetics, as Mead later wrote, the prospect of "a form of cross-disciplinary thought which made it possible for members

of many disciplines to communicate with each other easily in a language which all could understand” (Mead 1968: 2).² Cybernetics, in other words, appeared to offer fulfillment of the age-old quest for a universal language that would overcome the distortions and inhibitions of our lapsarian tongues (Eco [1993] 1995; cf. Steiner [1975] 1992). Artificial intelligence (AI) research pursues this quest in its search for a perfect programming language (Blackwell 2017).

What is AI from the “relations everywhere” perspective of social anthropology (Strathern 2005: 37)? In simplest terms, it is an engineering project that reifies personality in interactive, relational machinery; in consequence, it estranges and defamiliarizes that which it models. To borrow Philippe Descola’s words from his commentary on Eduardo Kohn’s *How Forests Think* (2013), AI is “the project of repopulating the . . . sciences with nonhuman beings”—or, in an echo of the related Artificial Life project, of creating the human *in silico*. AI thus joins the larger shift of focus “toward the interactions of humans with (and between) animals, plants, physical processes, artifacts, images, and other forms of beings” (Descola 2014: 268). Thus, Alfred Gell: “The entire historical tendency of anthropology has been towards a radical defamiliarization and relativization of the notion of ‘persons.’ Since the outset of the discipline, anthropology has been signally preoccupied with a series of problems to do with ostensibly peculiar relations between persons and ‘things’ which somehow ‘appear as,’ or do duty as, persons” ([1998] 2013: 9). As an art, working in material forms, AI becomes in Polish artist Bruno Schulz’s words, “a probe sunk into the nameless” murk of human potential, *in statu nascendi*, premoral, barely conceptual, rapidly changing, and potentially revelatory (Schulz [1935] 1998: 369–70; McCarty 2009).

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2. Mead and Bateson were present at the earliest gathering in 1942, then participated as core members of the yearly Macy Conferences on Cybernetics from 1946 to 1953, the first of which included a session on “Anthropology and how computers might learn how to learn” (Heims 1991: 14–17 and *passim*; Mead 1968). Bateson’s dialogue with Wiener proved highly fruitful (Heims 1977; Ramage 2009). For Bateson’s connection of his early anthropological work with cybernetics, see “Epilogue 1958” (Bateson [1936] 1958: esp. 287ff.) and “Foreword” (Bateson [1972] 1987). Other prominent anthropologists took up cybernetic theory; see, for example, Talcott Parsons and Lévi-Strauss (Geoghegan 2011) and the index to Geertz ([1973] 1993). Pickering (2010: chap. 2) argues that ontology was central to cybernetics.

In computer science from the 1950s into the early 1980s, recognition of the machine as such a “person”—an “acting and interacting other”—was established; work began on identifying and implementing the “human factors” it needed to have (Suchman 1998: 5). Serious theorizing followed mid-decade with three landmark studies that drew *inter alia* on phenomenology, neurobiology, anthropology, and social science to conceptualize human-machine interaction (Koschmann 2003). The most influential of these, Lucy Suchman’s *Plans and Situated Actions* (1987), gave its name to research of this kind. Her work from that book onward, with its focus on the relationality of machine and human rather than their convergence, is central to my topic (Duguid 2012).

Mimesis and Alterity

Within the analogical frame of human-machine relations, my emphasis falls in this essay almost exclusively on differences between the two. The mimetic agenda of technological research, its progressive success in fitting digital circuitry to the appliances of modern life, and our own readiness to accept them argue effectively enough for similarities.

Let us suppose, then, an artificial intelligence with which, or with whom, we communicate in a probing and critical conversation. Let us assume this AI is fully realized, not in our terms but in its own. (While it is premature to say what exactly the intelligence at play might be and what it means to reason in the context of AI, we can look to the differences between how we reason biologically and how the machine acts in taking full advantage of its digital circuitry. I will return to this question later.) Let us assume further that in relation to ourselves it is neither servant nor master, neither simply inferior nor superior but different, a new kind of being, though with ancient ancestry (Riskin 2016). Undiscouraged by Wittgenstein’s lion (2009: 235, §327), let us assume we converse with it in an effort to learn and understand what this “probe sunk into the nameless” has to tell us. Let us think of it and ourselves as situated on opposite sides of a Galisonian “trading zone” (Gorman 2010) or separated by a beach we would cross with Greg Dening (2004), then attempt to strike up a conversation. How would we proceed? What might we learn and understand?

The structure I propose closely resembles two well-known scenarios: Alan Turing’s “imitation game,” which he devised to attract attention to artificial intelligence (Whitby 1996; Gandy 1996: 124); and ELIZA,

Joseph Weizenbaum's simulation of a psychoanalyst's responses to the user as patient (1976: 1–16). My proposal differs: I assume realization of that which Turing invited others to explore, and I want to focus specifically on a full-frontal encounter that preserves critical distance. In other words, in parallel with recent work in ethology (Cheney and Seyfarth 2007; de Waal 2016; Godfrey-Smith 2017), I want to pluralize intelligence. I want to raise it not as a criterion to be met but a question to be asked, so that we may meet creatures unlike ourselves with some possibility of understanding them in their terms rather than bending them to ours—without moving the goalposts to preserve human separateness (Darwin 1871: 47). Again, an analogical investigation is called for, using the similarities so easily spotted and differences we must work to identify to strike sparks off each other.

The computer scientist Peter Wegner has said of Alan Turing's original design, from which the machine we have is derived, that it is "autistic in precluding interaction" beyond itself (Wegner 1998: 318; cf. Blackwell 2010; Zuboff 1988: 86). This autism was overcome with the machine's first implementation, but it continues in our conception, application, and deployment of the machine *insofar as we think of or configure it as isolated*, as merely taking input and delivering results. One consequence is the tendency to conceive the artificial kinds of intelligence as utterly alien (that is, *nothing* whatsoever to do with us) rather than other (enigmatically and unresolvably both like and unlike us). A former colleague, an ex-pat who had lived in a European country for decades, once remarked to me that the longer he lived there, the better he knew its people and the stranger they became. He was a misanthrope, but he had a valuable point about what depths lie beneath superficial similarities. His is the sense of relatedness I would apply to the machine.

Ontology and Modeling in Computer Science

Anthropology, we are told, has taken an "ontological turn" (Salmond 2014) that radically pluralizes the conventionally singular if incompletely accessible account of "what there is" (Quine 1948) familiar to us from the natural sciences. The core anthropological idea is that we cannot rightly speak of a single ontology about which there are multiple perspectives but must recognize multiple, problematically related ontologies. This raises the question of whether ontological pluralization has anything to do with the practice in computer science of resolving a

domain of interest into a more or less adequate “ontology,” hence different “ontologies” for different domains and conceptions of them.³

The term *ontology* came to be used in computer science about forty years ago to denote a particular formal description or many of them. An ontology in the computational sense is thus indeterminate, one of an indefinite number, each one shaped by choice, interpretation, and the affordances of the computer-language into which problem and source material are encoded. This “ontology” is basis for an interpretative “model.” These two words can and often do overlap in meaning, but in the sense used here an ontology is to a model as a map is to an itinerary.⁴ A model may achieve a stable form and be accepted as a standard research tool (as usual for mathematical models, for example, in economics), but since the late twentieth century, technological improvements have made composing and changing software on the fly ever easier. This has foregrounded the dynamic, exploratory process of “modeling,” hence the computer itself as a modeling machine with which *serio ludere* (“seriously to play”). Programmers will recognize this playfulness in what they often do.

It seems plausible if not obvious that the computer would simultaneously influence and reflect how we conceive and engineer the world we live in. Furthermore, it seems plausible that although the modeling machine is largely a tool of the established order, a net effect of its use over the last many decades would have been not only to work against the status quo but, as it were, to liquefy it, or come to express and accelerate its liquefaction. Argument for the place of our “machine for doing thinking” (Mahoney 2011: 87) in such a shift of emphasis from the stable, well defined, and uniform to the mutable, transgressive, and diverse is beyond my scope here, but I suggest it has played and is playing a part. One rather crude bit of evidence is the surge in occurrences of “model” and its inflected forms in English from circa 1950 to the present alongside an equally dramatic surge in occurrences of “ontology.”⁵

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3. Efforts at designing a comprehensive ontology in computer science proved impractical from the beginning, were largely ignored, and have more or less been abandoned (Smith 2004: 159).
 4. This is a highly simplified version of the relationship between “ontology” and “model.” For model in the human sciences, see Flanders and Jannidis (2018); for ontology in computer science, see Gruber (2009; cf. 1995), and in digital humanities, see Eide and Smith Ore (2018).
 5. The Google Ngram Viewer (<https://books.google.com/ngrams>) may be used to show this—with caution: word-frequency is a very blunt instrument

Less dramatic though also less problematic evidence comes from the transformations computing has wrought within the physical and life sciences (Gramelsberger 2011; cf. Keller 2003). Again, however, my concern is with possible relations between the digital machine on the one hand and anthropological interests on the other. My argument will be that the machine and the ontological turn in these disciplines are complementary. What underlies both, draws them together, or associates them is a teasing question I cannot answer and suspect is best left as is. The digital machine has become the great (and quite amoral) engine of civilization since its implementation mid-twentieth century, but the rapidity of its diversification and strength of its appeal suggest a technological response to something else—a *Zeitgeist*? Robin Gandy’s “something in the air which different people catch” (1995: 53)?

I have noted the relative youth of the term *ontology* in computer science: it was, in fact, not poached from philosophy until circa 1980 and not formalized until the 1990s. Nevertheless, the ontological question was from the very beginning implicit in the design of the stored-program computer (the kind we have). Hence the ease with which “ontology” slipped noiselessly into the discourse of computer science.⁶ But as it did so, it changed from denoting a philosophical account of “what there is” to a practical inventory in a schema. Ontological disagreements have divided philosophers since the Presocratics (or earlier, and elsewhere), but the computational redefinition pluralized ontology in a different sense by substituting an indefinitely large and proliferating number of engineered objects for an ultimate referent: metaphysically, not different conceptions of *the* world but different (“toy”) worlds. Ontology in this sense became part of how computing redefines whatever research

for probing ideas or concepts; mistakes in OCR affect accuracy; and “metaphysics” is sometimes used as a synonym for “ontology.” Since “model” is highly polysemous, searching for “model of” and “model for” will reduce false positives (although the shape of the curve for “model” alone is the same). To compare the shapes of the graphs and so rates of change in usage, scaling is recommended: none for “model,” a factor of 4 for the other model-words, 80 for ontologies et al., 20 for “ontology” and “ontological.” The rough point is that something quite dramatic happened circa 1945–50.

6. For early examples see Kosslyn (1978) and especially McCarthy (1980). See also Alexander et al. (1986). Formal definition came with Gruber (1995; cf. Sowa 2000: 51–131; Zúñiga 2001).

questions it embraces, at least those in the human sciences: as a locus of indeterminate approximations that sum to a statistical result.

“Ontology” was first pluralized in Anglo-American philosophy of the mid- to late 1940s by Willard van Orman Quine.⁷ Quine understood the digital machine theoretically, from its mathematical origins in the work of Turing and others, the design of logic circuitry for actual machines (in which he participated), and the challenges of programming as “mechanical brains come to be adapted to purposes farther and farther beyond mere arithmetical calculation” ([1960] 1966: 40; 1955). He concludes, “the utterly pure theory of mathematical proof and the utterly technological theory of machine computation are thus at bottom one, and the basic insights of each are henceforth insights of the other.” While it is true that he regarded physical science as providing best access to knowledge of “what there is,” in his work on language he argued that our individual accounts of it are indeterminate and incommensurable ([1960] 2013: chap. 1 and 2). Quine’s ontology remains a matter of different takes on a singular world, but by ruling out the possibility of resolving them, his hugely influential position undermined ontological singularity just at the point at which the computing machine began its own subversive work.

Quine famously made his point by analogy to an anthropological linguist attempting to produce a definitive translation of an imagined native’s utterance, arguing that although the natural sciences give us the most reliable account, only incompatible versions of the one ontology are possible. Subsequently his influence on anthropology seems to have been slight, but the connection his work made between the digital machine and social anthropology is suggestive.⁸

Forests

The connection between the anthropological experience of the disturbingly different human and of the disturbingly different machine made by

7. For the state of ontology at the end of WWII see Feibleman (1949). Serious attention to ontology and its proximity to the digital computer happened earlier in Germany (see Heidegger [1927] 2001: §3; Steiner 1978: 79–80; see also Zuse 1993: chap. 3). Heidegger’s work became known in Anglophone computer science with Dreyfus (1972) and important in that discipline thanks to Winograd and Flores (1987).

8. <http://openanthcoop.ning.com/m/group/discussion?id=3404290%3ATopic%3A52720>. Accessed November 29, 2018.

humans may be suggested by positioning ourselves with Charles Darwin, in the moment when he first set eyes on a “Savage,” as he called him, a “naked Fuegian his long hair blowing about, his face besmeared with paint . . . [with] an expression . . . inconceivably wild.” Gillian Beer quotes these words from Darwin’s correspondence then comments, “Here no relation, in the sense of a message or narrative, can be established. The other is ‘inconceivably wild.’ But that which is inconceivable is also here a mirror image” (Beer 1996: 23, 25).

Beer’s catoptric metaphor, informed by the long tradition of revelatory, perilously existential mirroring from Greco-Roman times onward (McCarty 1989), fits our anthropomorphic machine. My interest here is not so much in the question of the human that this mirroring provokes, rather more in the possibilities opened up by meeting my AI-as-maybe on level ground. Donald MacKay once commented that attributing intelligence to machines “would not primarily be a matter of using evidence and knowledge, but a matter of having the nerve” (Gandy 1996: 136). Indeed, that nerve will out; it has been driving very well-funded efforts to realize the imaginative possibilities of computing (bad and good) for decades. So I think it not exaggerated to insist that we bring to light the reasoning we are doing in concert with this Heraclitean machine, whose containing mathematics shapes a torrent of proliferating changes into the future.

The historian of computing Michael Mahoney tellingly asked how we get back into the driver’s seat of this machine in its proliferating manifestations and interpretations of them. He saw us standing “before the daunting complexity of a subject that has grown exponentially in size and variety, looking not so much like an uncharted ocean as like a trackless jungle. We pace on the edge, pondering where to cut in” (2011: 23). I know exactly what he meant and am likewise daunted by the spreading, metamorphosing, interpenetrating forms of “the” computer and the many takes on them and their effects. But I wonder if the *tracklessness* of that jungle is not a matter of *perspective*. What might it look like to an artificial native? What might *we* look like? Imagine the “semantic stretch” necessary in both directions (Lloyd 2007: 65).

Machines Are (Not) Us

To answer those questions of stretch we need history, specifically the history of how we came to accept (and act on) the notion that this digital

native will one day be more rather than differently intelligent. David Hanson, founder of Hanson Robotics, has observed, “people get used to the robots very quickly . . . within minutes” (Guizzo 2010). Even if features of a robot make “getting used to” difficult, one may find oneself drawn in, wanting the robot to be alive.⁹ Again, what was once spectacular, spooky, or curious, if successfully engineered, becomes part of the furniture. How has this happened in the case of AI?

Consider the neatly unbroken sequence from Turing’s foundational paper of 1936 onward. In that paper Turing, in response to one of David Hilbert’s mathematical challenges, proved that there can be no purely algorithmic procedure for deciding whether mathematical statements are universally valid, thus helping to rescue mathematics from a sentence of terminal exhaustion.¹⁰ To do this he invented an abstract machine that allowed him to show in principle what such a procedure could not do. He began with a metaphor: “We may compare a man in the process of computing a real number to a machine which is only capable of a finite number of conditions $q_1, q_2, \dots, q_n, \dots$ ” (Turing 1936: 231; Wittgenstein 1980: 1096). His machine imitated the mathematician but reduced him to a discrete logical form. A few years later neuropsychologist Warren McCulloch and mathematician Walter Pitts used Turing’s abstract machine to design a computational schematic for the human brain (McCulloch and Pitts [1943] 1988). Two years after that John von Neumann used the McCulloch-Pitts schematic and its neurological vocabulary to describe the architecture of the digital machine more or less as we have it now ([1945] 1993). Eventually—I pass over a complex history—a “computational theory of mind” settled into the cognitive sciences and became a standard account if not *the* standard account (Rescorla 2016). Development of neuromorphic chips, hence brain-based robots, has been underway since then (Hof 2014). Thus the coevolutionary human-machine

9. See, for example, Alice at https://www.youtube.com/watch?v=G0NLHVJoI_E, an experiment in producing facial expressions.

10. G. H. Hardy wrote, “Suppose, for example, that we could find a finite system of rules which enabled us to say whether any given formula was demonstrable or not. This system would embody a theorem of metamathematics. There is of course no such theorem, and this is very fortunate, since if there were we should have a mechanical set of rules for the solution of all mathematical problems, and our activities as mathematicians would come to an end” (1929: 16).

“looping effect” (Hacking 1995: 21; McCarty 2015: 297–98): from inventor to the invention that bears his imprint; from the invention to a new human self-image or life-style; from the self-reconfigured human builders to a new machine; and so on.

Work on neuromorphic chips and the ongoing research in both computational biology (simulation of life *in silico*) and biological computing (computation done with biological materials) bears out von Neumann’s view of artificial intelligence: always simultaneously an engineering and a mathematical problem (1958). He had argued in 1949 that to conceive of automata purely in the abstract was to throw “half of the problem”—the physical half—“out of the window, and it may be the more important half” (1966: 77). Among other things, von Neumann’s suspicion and the prehistory of the computational model of mind underscore the importance of the biological turn in computing (Keller 2002, 2003) and the embodied and socially situated mind in the cognitive sciences (Wilson and Foglia 2017).

The Machinery

The machine we have is a composite of hardware and of software that progresses stepwise in layers, from the circuitry that creates and maintains the crisp binary signals so often assumed to be simply a given, to the ever friendlier, “intuitive” interface that trains as much as reflects the user’s intuition. The low-level details can be left to electrical and software engineers, but this logic survives through all the layers of abstraction and has much to do with how its resources are applied and how we are affected (Evens 2015). Furthermore, at all steps at which a scholarly problem and the resources on which it draws are defined and encoded, binary logic is the gatekeeper and disciplinarian. For this reason, *a scholarly understanding of the digital machine begins (but does not end!) with these terms of reductive translation.* Those who use the machine as an instrument of critical reasoning need to have the sensitivity of the princess who feels the hard pea under those many mattresses and cannot sleep because of it.

In the reception history of computing in the human sciences, that sensitivity was greatest in the early period, when the small minority of scholars involved were attempting to sort out what in principle the machine was for. In 1976, the great pioneer Fr. Roberto Busa asked, “Why can the computer do so little?”; he dismissed the damaging notion that

the machine should be “aimed towards less human effort, or for doing things faster and with less labour,” insisting on the greater efforts the computer made possible. Fourteen years earlier, the Cambridge linguist and philosopher Margaret Masterman wrote that the potential of the computer “is so great as to make of it the telescope of the mind” (1962: 39), arguing that to treat it as the “purely menial tool” that others had described was a great mistake. Four years later, the American literary critic Louis Milic argued, “The true nature of the machine is unknown to us,” that “its intelligence and ours must be made complementary,” and so implied the crucial question of what we take intelligence to be (1966: 4). “Thinking in a new way is not an easy accomplishment. It means,” he said, “*reorientation of all the coordinates of our existence*” (1966: 5, my emphasis)—that is, a cosmological reconfiguration. He called his brief article, “The next step.” I don’t think we’ve taken that step yet. Several factors, including assimilation of the machine as an appliance of daily life, have dulled us to its fundamentally different, algorithmic way of reasoning—once again, to the hard pea under those mattresses.

The historian of science David Gooding put it like this:

To digitalize is to represent features of the world, including relationships between them, in a manner that establishes and fixes unambiguous meaning. . . . It is a method designed to achieve two things: to preserve the invariance of tokens in a symbol manipulation system and to make the value of the tokens unambiguous. (2003: 279 and 283n33)

Hence my two axioms of digitization: that everything to be encoded in software, both source material and operations to be done on it, must be rendered with the *complete consistency* and with the *absolute explicitness* demanded by all-or-nothing digital logic. The severity of these axioms makes it difficult to see how the machine has anything to offer beyond clerical assistance, however fast, however accurate. The machine’s price of admission may seem entirely too high, offering as reward only some light on whatever cannot satisfy those axioms. It is true that the escapees do help us ask how we know what we know if we cannot spell it out digitally, hence a valuable *via negativa*. But this is cold comfort if that is all that is possible. Indeed, this *via negativa* does not, in fact, require use of the machinery at all.

Digitization, however, is only the first of three stages. Overall, these stages comprise the iterative and exploratory process I have called “modeling.” They are illustrated by the diagram in Figure 9.

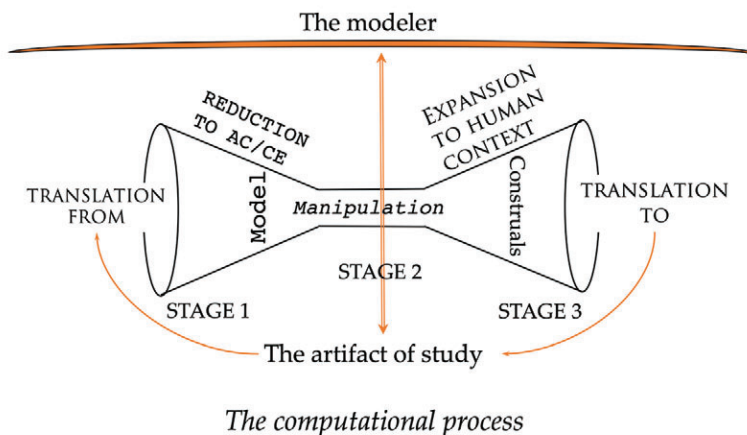


Figure 9. Three stages of the computational process (after David Gooding, “Varying the Cognitive Span” [2003], fig. 13.4).

Although in practice these stages can take place rapidly with little demarcation, I will describe them in a clearly distinct sequence. Again, the first and third involve the machine primarily in the abstract, as a set of requirements and as the source of results to be considered. Only the second stage involves the machine directly.

We may think of operations in this middle stage as “mechanical”—that is, not human—but since the machine is a human artifact, it is more productive to ask after the model of thought-processing the machine instantiates—its hardwired “theory of mind,” if you will. In the nineteenth century, Charles Babbage’s friend Lady Ada Lovelace, commenting on his Analytical Engine, wrote that the machine “can do [only] whatever we *know how to order it to perform*” (Lovelace 1843: 722). In other words, her human correlate was a perfectly obedient servant. In the mid-twentieth century, her long-lived dictum resurfaced in numerous statements to the effect that the digital computer was no more than a “fast moron” (e.g., Soule 1956: 173–74; Andree 1958: 2, 106). IBM supposedly made “fast moron” and similar phrases doctrine, promulgating this doctrine via sales staff in order to salve public fears of artificial intelligence following

the successes of the machine at the game of checkers and the ramping up of publicity required to sell the very expensive “giant brain” (McCorduck 1979: 159). The mantra certainly became a stubbornly persistent meme.

But such is *not* the machine they had nor the one we have (the one von Neumann helped to design), nor the one for which he and Herman Goldstine sketched the basics of programming in a very early paper on that subject, “Planning and coding of problems for an electronic computing instrument” (1947). They pointed out that the difference in design (which in effect transcends Lady Lovelace’s dictum) is the provision allowing a running program, conditional on the outcome of previous operations, to deviate from the linear sequence of instructions or to rewrite those instructions on the fly. They explained—note these words well—that coding “is not a static process of translation, but rather *the technique of providing a dynamic background to control the automatic evolution of a meaning*” as the machine follows unspecified routes in unspecified ways in order to accomplish specified tasks (Goldstine and von Neumann 1947: 2; my emphasis; Campbell-Kelly 2011). Thus Herbert Simon: “This statement—that computers can only do what they are programmed to do—is intuitively obvious, indubitably true, and supports none of the implications that are commonly drawn from it” (Simon [1960] 1977: 67; Feigenbaum and Feldman 1963: 3–4). The idea of “machine” behind it is, as Marvin Minsky remarked, “precomputational” (McCorduck 1979: 71).

The high level of complications that result from the design of the stored-program computer, Goldstine and von Neumann went on to note, are “not hypothetical or exceptional . . . they are indeed the norm”; the power of the machine “is essentially due to them, i.e. to the extensive combinatorial possibilities which they indicate” (1947: 2). In essence, as von Neumann suggested four years later, machines “of the digital, all-or-nothing type” work by combining and recombining the data under given constraints until coherent patterns emerge (von Neumann 1951: 16). By design they are combinatorial. Hence, in a nutshell, the core benefit they confer is their *recombinatorial potential*, which does not offer the enquirer closure on truth but generation of unforeseen or unforeseeable possibilities for consideration. Thus, the mathematician Martin Gardner: “When ideas are combined in all possible ways, the new combinations start the mind thinking along novel channels and one is led to discover fresh truths and arguments” (Gardner 1958: 17). That is essentially what Ada Lovelace went on presciently to write after laying down her dictum: that the Engine’s power of “mechanical combinations” would throw new

light on “the relations and nature of many subjects,” leading to more profound investigation of them (1843: 721, 723). In his 1950 paper, Turing quoted her, noting in agreement with Douglas Hartree that she had left open the possibility of an intelligent machine; all that was lacking was memory and speed (1950: 450).

While it is true that interpretative significance does not survive digitization, that the machine sorts only configurations of bits from which this significance has been stripped, meaning stays with the enquirer and, after the Leibnizian *cogitatio caeca* in hardware, is reattributed to the resorted output at the end (Picon 2008: 223).

Hence the emphasis falls on Gardner’s “new . . . novel . . . fresh,” which deserves further, stronger emphasis—and considerably more attention than I have space for here. The best, most highly developed example for AI is the rapidly evolving AlphaGo system, designed to play the ancient board-game known as *go* in Japanese, *weiqi* in Chinese (Papineau and Black 2001; Fairbairn 2007). AlphaGo’s victories are impressive,¹¹ especially given the antiquity and complexity of the game and the discipline required to master it. The significance for AI, however, is that in the 2017 (AlphaGo Zero) version, it acquired its skill by playing against itself repeatedly, starting off as *tabula rasa* with no historical knowledge of play beyond the basic rules (Silver, Schrittwieser, and Simonyan 2017), and that in doing so it deployed legal moves that no human player had thought to make in the approximately 2500-year history of the game. Ambitions for the latest algorithm, AlphaZero, are stronger yet: to achieve “superhuman performance in many challenging domains” (Silver, Hubert, and Schrittwieser 2017).

For the question of intelligence that I raise here, these developments are unquestionably important. What they import, however, is not so much a superhuman intelligence but a clearly different kind. However dependent on the rigidly defined rules and structure of this and other games, these developments in AI serve as an existence-proof that, in the lineage of Turing’s provocation, draws attention to possibilities of intelligence in the built world, in conversation with us.

Permit me a few wild thoughts. For the future, AlphaGo and progeny raise the question of what happens as the precisely defined limits of the game-board fall away and expand, as the application of explicit and consistent rules relaxes into the playing of roles. For the present they direct

11. For the history, see https://en.wikipedia.org/wiki/AlphaGo#AlphaGo_Zero_and_AlphaZero.

us to look toward exploratory experimental work with the machines we have for the conversation happening there, right now. Anthropologically, as the history of board games suggests, they point toward manipulatory ethnomathematical and divinatory practices, which likewise use combinatorial techniques to direct the client toward something other (a subject for another time). It is, in other words, a question of what the AI *does* in concert with us.

Incommensurability?

Back to Darwin's naked Fuegian, inconceivably other but simultaneously a mirror image. On the one hand, the Fuegian cannot have been incommensurable, since that would make any kind of comparison impossible. On the other hand, Eduardo Viveiros de Castro has pointed out, to grant commensurability or guarantee it by presuming continuity short-circuits "the challenge . . . to construct a commensurability (i.e., a reciprocal measurability)" between the kinds (2010: 330). The crucial thing is not to ignore the challenge, however we construe it.

For scholarship, the disciplinary marches—Thomas Kuhn's Gestalt switch (1977), Beer's open (but hazardous) fields of cultural encounter (1996; cf. 2006), Denning's beaches of the mind (2004), Strathern's commons and borderlands (2004), Galison's trading zone (Gorman 2010)—provide preparatory examples close to hand. What these scholars have *not* done is the reason I cite them: they have not underestimated the difficulty or breezily assume an ontologically neutral standing point from which each discipline can be viewed objectively, its ways and means poached at will without error or partiality (McCarty 2016). This error is comparable to Viveiros de Castro's "modern cosmological vulgate": the multiculturalist supposition of "a single world or nature . . . around which different partial cultural views orbit" (2010: 329). Look closely, he argues, and the one nature it supposes turns out to be this cosmology naturalized. Michel Foucault's invocation of Jeremy Bentham's panopticon, with its "sentiment of an invisible omniscience," gives us a fitting image for it.¹² G. E. R. Lloyd's corrective statement, "there is no

12. Foucault, "Panopticism" (Foucault [1975] 1995: 195–228; plate 3 shows Bentham's design). See also Bentham (1843: 235–48). The quoted phrase is often attributed to an anonymous architect; see Lyon (2006); Nugent (2011).

theory-free way of accessing an answer to the question of what the world comprises” (2010: 210), throws us back to the question of the relation of theory to the digital machine. I will return to it, but for now I want to focus on the temporal dimension.

Ontologizing

Lloyd continues: “We just have to make the best use we can of such bridgeheads of intelligibility as will enable us to begin to make sense of others.” Are these bridgeheads *ontologies*—that is, formal specifications or ethnographies? I don’t think this is the best way to conceive of them, and not the most productive, at least for my consideration of a machine that is nothing but a paperweight if not “doing thinking” *with* us.

Lloyd avoids the closure and abstraction a formal ontology would require. Amiria and Anne Salmond note in their commentary on his “History and human nature” (2010) that these bridgeheads “are not ‘out there’ conveniently to hand, waiting to be discovered, but are rather cultivated over years, often generations” (Salmond and Salmond 2010: 304). *They are processes in time*. In “Historical ontology” Ian Hacking avoids closure by bringing ontology to life in time, allowing it to denote the implicitly changeable and changing “whatever we individuate and allow ourselves to talk about.” He points, for example, to new ways of “constituting ourselves *as so and so*” by discovering “possible ways to be a person”—other ways of being human that arise, surge in popularity, then decline and lose their appeal (2002: 1–2; cf. 1995). Viveiros de Castro repeatedly refers to his anthropological project as experimental, with a perpetual revolution intended; *Cannibal Metaphysics*, he says, is “a beginner’s guide” to another, endlessly imagined book ([2009] 2014: 39). Thus, Denning: “we write culture in the present participle” (2002: 23). Participles “soften the essentializing quality of nouns with the being and acting quality of the verb” better to express the truth of our experience in a world that is “processural, unfinished” (1993: 84).

What, then, *is* the world in processual experience or representation? The latter—representation—is Quinean, implying a reality out there that in practice can only be severally, separately, incommensurably, approximately represented. With Denning’s participle in mind, I have been converging on a suggestion of an ongoing, participatory, asymptotic *ontologizing* that, like Emanuel Schegloff’s verbal/nonverbal communication (1982), is normally a commensurating activity—a bridgehead

cooperatively under construction from both sides. Note that I have left the world alone. Lloyd has offered a *multidimensional* world but has avoided limiting the number of dimensions, and he has allowed for semantic stretch in how we talk about them. I think his multidimensionality and my ontologizing are complementary.

Back to our face-to-face encounter with that AI. What we are talking about when we talk about AI, then, is not a catoptric sign, a reflection of ourselves, but an emergent manifestation of ourselves differently constituted.

Toward an Anthropology of the Artificially Intelligent?

Why, then, anthropology and AI?

To date, computer scientists have taken an interest in anthropology mostly to inform the design of software better to suit people who use and are affected by it. Anthropologists have tended to come to computing to give structure to and process data and to draw on its formally systematic ways of conceptualizing social behavior. My interest in probing artificially intelligent entities anthropologically is motivated not by the practical effectiveness of ethnographic description to improve the products of computer science nor vice versa but by the theoretical effectiveness of anthropology to illumine a way forward with computing. Simply put, anthropology is where the right sort of questions are being asked so that we may move beyond utility and impact. It is the discipline, Kant wrote in the *Jäsche Logik* (1800), that asks the summative question of philosophy in the “cosmopolitan [*weltbürgerlichen*] sense”: “What is man?” (1992: 538). Kant’s question is the principal one raised by the disturbingly different machine when, in fits and starts, its disturbing difference emerges and draws us in.

In the late 1980s Terry Winograd and Fernando Flores put the argument toward which I am gesturing most succinctly: “In designing tools we are designing ways of being” (1987: xi). In other words, in its participant observation an anthropology of the artificially intelligent would have to be “a way of knowing from the inside” (Ingold 2013: 10), which would in turn be predicated on a human-machine resonance rather than a symbolically mediated representation of the world.

I conclude by returning to Margaret Masterman’s “telescope of the mind.” She referred in her clear-sighted article to Newton’s instrument, but I think a much more telling one is Galileo’s *occhialino*. The question

is, to echo Hacking, do we *see* through, or see *through*, such a telescope (1983: 186–209)? Today, just as in the microscopy Hacking studied, optoelectronics interposes a hermeneutic black box between the eye and its object, complicating—but not essentially altering—the philosopher’s question. For when Galileo looked through his spyglass, much of what he saw had been seen before, but the differences were enough to make what was “momentarily mutable,” stuff of the eye reshaped by his mind into “a compelling argument for Copernicanism.”¹³

It’s an altogether more interesting challenge we face than we have so often supposed.

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13. Thanks to Crystal Hall (Bowdoin College) for the commentary on Galileo (email message, June 1, 2017). The literature is extensive (see especially Biagioli 2006: chap. 2; Lipking 2014).

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