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Creating in Our Own Image: Artificial Intelligence and the Image of God

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by Noreen Herzfeld

Abstract. There is remarkable convergence between twentieth-century interpretations of the image of God (*imago Dei*), what it means for human beings to be created in God's image, and approaches toward creating in our own image in the field of artificial intelligence (AI). Both fields have viewed the intersection between God and humanity or humanity and computers in terms of either (1) a property or set of properties such as intelligence, (2) the functions we engage in or are capable of, or (3) the relationships we establish and maintain. Each of these three approaches reflects a different understanding of what stands at the core of our humanity. Functional and relational approaches were common in the late twentieth century, with a functional understanding the one most accepted by society at large. A relational view, however, gives new insights into human dignity in a computer age as well as new approaches to AI research.

Keywords: artificial intelligence; Karl Barth; creation; image of God; *imago Dei*; robots; Gerhard von Rad.

In a recent controversial article in *Wired*, Bill Joy (2000), chief scientist at Sun Microsystems, warns that self-replicating robots and advances in nanotechnology could result, as soon as 2030, in a computer technology that may replace our species. Hans Moravec, of the artificial intelligence (AI) lab at Carnegie Mellon, pushes the time back to 2040 but agrees that "by performing better and cheaper, the robots will displace humans from essential roles. Rather quickly, they could displace us from existence" (Moravec 1998, 3). Even Stephen Hawking, in an interview with the German magazine *Focus*, states that humans may need genetic modification in order to

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keep ahead of advances in computer technology (Walsh 2001). These are frightening predictions indeed!

Lest we begin to panic at the prospect of our immanent demise as a species, let me state at the outset that we very likely have much longer than thirty or forty years. Since the beginnings of AI in the mid-1950s, achievements have lagged far behind both the prognostications of scientists and the hopes and fears of the public.[1] Our fascination with and fears of AI are not rooted in the reality of results; even Moravec admits that the field has made relatively little progress in the last thirty years. Still, now is the time for us to examine exactly what it is we hope to create. Whether computers, our "mind children" as Moravec (1988) calls them, are positioned to replace humanity or to coexist with us could depend on which aspect or aspects of our own nature we try to copy in our attempt to create autonomous machines.

One goal of AI is to create an "other" in our own image. That image will necessarily be partial; thus we must determine what it is in ourselves that computers must possess or demonstrate to be considered our "mind children." The question of what we humans might share with such an other has been examined by Christian theologians through the concept of the image of God, in which, according to Genesis 1, human beings were created. Is this image that humans share with God related to the image we wish to share with our own creation in AI? In this paper I show that it is, and that there are implications in what part of ourselves we choose to image in the computer—implications for both our self-understanding and for our future coexistence with our own creation.

Three Approaches to Human Nature: To Be, To Do, To Encounter

Interpretations of the image of God through history have varied, and a complete survey of all the ways theologians have understood this symbol would be far beyond the scope of this article. I propose, however, that most of these interpretations can be understood as falling into one of three categories: (1) substantive interpretations, which view the image as an individually held property that is a part of our nature, most often associated with reason; (2) functional interpretations, in which the image of God is seen in action, specifically our exercise of dominion over the earth; and (3) relational interpretations, in which God's image is found within the relationships we establish and maintain.[2] Oddly enough, approaches to developing an artificial intelligence have followed similar lines. We will examine each of these three paradigms—the substantive, the functional, and the relational—considering their implications for the project of AI.[3]

Reason as Image: "I Think, Therefore I Am." At a superficial glance, finding God's image in human beings in our ability to think or reason

would seem to be the interpretation of the image of God that most closely fits the project of AI. Paul Ramsey calls this a "substantive" understanding of the image of God because in it the image appears as "something within the substantial form of human nature, some faculty or capacity man possesses" that serves to distinguish "man from nature and from other animals" (1950, 250). Substantive interpretations of the image of God are primarily historical. Though the quality or set of qualities making up the image has varied over time, reflecting the concerns and preoccupations of each age, reason has often been considered, if not the entire image, at least a strong component of it—so much so that David Cairns writes, "In all the Christian writers up to Aquinas we find the image of God conceived of as man's power of reason" ([1953] 1973, 60). This is an overstatement. However, the image of God is bound with the human intellect in some way by most writers up to the Reformation, which is no surprise, given the influence on both the early Fathers and the Scholastics of Greek philosophy, in which reason is seen to be the "most godlike" of all human faculties, that which separates the human *animal rationale* (Aristotle) from other species.[4] What is important for our argument, however, is not the prominence of reason but that a substantive approach looks for the image of God in an individual quality per se rather than in the manifestations of that quality. Thus it assumes that a quality, such as reason, exists apart from any action that demonstrates it.

The approach known as classical or symbolic AI parallels the substantive interpretation of the image of God, both in its premise of intelligence as an individually held quality and in its current fall from favor. Symbolic AI is predicated on the hypothesis that thought can be described by a physical symbol system. Just as geometry can be built from a finite set of axioms and primitive objects, so symbolicists, following rationalist philosophers such as Ludwig Wittgenstein and Alfred North Whitehead, predicated that human thought is represented in the mind by ideas that can be broken down, according to a finite system of rules, into more basic ideas. For a symbolicist, any patternable kind of matter can represent intelligence by representing the basic ideas and using programs to embody the rules that build these basic ideas into more complex thought.

Symbolic AI met with immediate success in areas in which problems could be described using a limited domain of objects that operated in a highly rule-based manner. Game playing is an obvious example of one such area. The game of chess takes place in a world in which the only objects are the thirty-two pieces moving on a sixty-four-square board, and these objects are moved according to a limited number of rules. Other successes for symbolic AI occurred rapidly in similarly restricted domains.[5] These early successes led to a number of remarkably optimistic predictions of the prospects for symbolic AI, not unlike the predictions we read today.

Symbolic AI faltered, however, not on difficult problems like passing a

calculus exam but on the easy things a two-year-old child can do, such as recognizing a face in various settings or understanding a simple story. One problem with these programs is that they tend to break down at the edges; in other words, they cannot function outside or near the edges of their domain of expertise, since they lack knowledge that is outside of that domain, knowledge we often call common sense (McCarthy 1984, 129–35). Humans make use of millions of bits of knowledge, both consciously and subconsciously. Should it exist, it is now clear to AI researchers that the set of primitive facts necessary for representing thought would be exceedingly large.

Terry Winograd and Fernando Flores ([1986] 1991) advance another critique of symbolic AI, suggesting that human intelligence is not a process of symbol manipulation. They note that humans do not carry conscious mental models around in their heads. Few of us, for example, would suppose that when we ride a bicycle we are busy calculating equations of balance, force, and trajectory (p. 73). Hubert and Stuart Dreyfus (1986) make a similar point; they argue that experts do not arrive at their solutions to problems through the application of rules or the manipulation of symbols but rather use intuition, which is acquired through multiple experiences in the real world. They describe symbolic AI as a "degenerating research project," by which they mean that, while promising at first, it has produced fewer results as time has progressed and is likely to be abandoned should alternatives become available (p. 29). And, indeed, this prediction has proven to be fairly accurate; as with the substantive approach to the image of God among theologians, the once-dominant symbolic position in AI has been all but abandoned, with only one major ongoing project, Douglas Lenat's CYC, remaining.[6] Reason seems to be a quality that can be neither easily captured in symbols nor even understood apart from action.

Function as Image: "To Be Is to Do." Substantive interpretations fell out of favor among twentieth-century theologians as well. While we find reason as a part of the image of God, though definitely not the whole, in the work of theologians such as Reinhold Niebuhr ([1943] 1996), the strongest proponents of this view today are found among Evangelical writers.[7] Most biblical scholars and other systematicians espouse functional or relational interpretations, views of the human person that are dynamic.[8]

Critics of the substantive interpretations note their almost inevitable implication of a mind/body dualism and their static nature. In a 1915 article, "*Zum Terminus 'Bild Gottes*,'" Johannes Hehn introduced a nonsubstantive way of looking at the image of God. Hehn understood the image of God as a royal title or designation rather than an attribute of human nature. Old Testament scholar Gerhard von Rad was one of several scholars who extended Hehn's work into a dynamic, functional approach to the image of God, one that locates this image not in a quality we possess

but in what we are called to do, and this approach has come to dominate the field of biblical exegesis. In his commentary on Genesis, von Rad argues for the translation "as the image of God," rather than the usual "in the image of God," thus implying that the whole person, rather than some quality of the person, is God's image.[9] Von Rad also notes that the noun *selem*, usually translated as "image," connotes a material image and is translated variously as "duplicate," "idol," and even "painting" in its occurrences in other Old Testament texts (1961, 56).[10] While such a translation could imply a physical interpretation of the image of God, von Rad uses it in support of a functional interpretation:

> The close relation of the term for God's image with that for the commission to exercise dominion emerges quite clearly when we have understood *selem* as a plastic image. Just as powerful earthly kings, to indicate their claim to dominion, erect an image of themselves in the provinces of their empire where they do not personally appear, so man is placed upon earth in God's image, as God's sovereign emblem. He is really only God's representative, summoned to maintain and enforce God's claim to dominion over the earth." (1961, 58)[11]

The image of God as the human function of exercising dominion, in effect acting as God's deputy on earth, was prominent among Old Testament exegetes throughout the twentieth century.

A similar shift occurred in the 1980s in the field of AI. I have noted the lack of progress in developing a general intelligence through symbolic programming methods. This does not mean, however, that AI produced no results at all. If we view the computer in functional terms, that is, in its capacity to act as a human deputy, carrying out tasks previously accomplished by humans, there has been quite a bit of success. Rather than trying to replicate the human process of reasoning, functional AI builds on the strengths inherent in computer technology and measures success in practical terms. As computer researcher Jerry Felman succinctly states, "AI no longer does cognitive modeling. It is a bunch of techniques in search of practical problems" (Dreyfus 1998, 193). If results are what matters, then it is possible to exploit the speed and storage capabilities of the digital computer while ignoring parts of human thought that are not understood or easily modeled, such as intuition. This is, in fact, what was done in designing the chess-playing program Deep Blue. Deep Blue does not attempt to mimic the thought of a human chess player. Instead, it capitalizes on the strengths of the computer by examining an extremely large number of moves, more than any human could possibly examine.[12] Deep Blue does not use intuition, nor can it learn. To know anything of its opponent's style, it must be reprogrammed for each opponent. As the IBM programming team puts it, Deep Blue "doesn't think, it reacts . . . using speed and brute force" ("FAQ" 1999).

When Moravec states that computers could displace humans in the future, he is looking at the problem functionally. Indeed, computers already have displaced humans from many roles, though we tend not to think of

these as essential once a machine can accomplish them. This points out the first problem with a functional definition of AI, namely, that it is difficult to determine what falls into the category of AI and what is simply a normal computer application. A functional definition that includes any program that accomplishes some function human beings normally do would encompass virtually all computer applications, but it would be ludicrous to consider all programs to be artificially intelligent. Nor is there agreement among computer scientists as to what sorts of programs should fall under the rubric of AI. Once an application is mastered, there is a tendency to no longer define that application as AI (Brooks 1997, 397).

Second, for a functional approach to result in a full humanlike intelligence it would be necessary not only to specify which functions make up intelligence but also to make sure those functions are suitably congruent with one another. Functional AI programs are rarely designed to be compatible with other programs; each uses different techniques and methods, the sum of which is unlikely to capture the whole of human intelligence.[13] Nor are many in the AI community satisfied with a collection of task-oriented programs. The building of a general, humanlike intelligence, as difficult a goal as it may seem, remains the vision for many. According to John Haugeland, the AI community "wants only the genuine article: machines with minds, in the full and literal sense" (1985, 2). A functional approach, while it produces salable results and viable careers, fails to meet the hopes and dreams of many in the AI community and much of the public at large.

Relationship as Image: "I Am Because You Are." A third approach is to consider being in relationship as that which we share with God and hope to share with intelligent computers. The most influential proponent of a relational interpretation of the image of God is Karl Barth. According to Barth (1958, 184–85), the image of God "does not consist in anything that man is or does" but is identified with the fact that the human being is a "counterpart to God."[14] Like the functionalists, Barth roots his argument in a textual exegesis of Genesis 1:26–27. He focuses, however, on two very different portions of the text: "Let us make humankind in our image" (1:26 NRSV) and "male and female he created them" (1:27). As is typical for Barth, he begins in a top-down manner, not with observation of the qualities or functions of human beings but with God.[15] He interprets the plural in "Let us make humankind" as referring not to a heavenly court but to the nature of God himself, a Trinity that contains both an "I" that can issue a divine call and a "Thou" capable of a divine response.[16] This I-Thou confrontation, existing within the Godhead, forms the ground of human creation, thus rooting our very nature in relationship with an other. This relationship can take two forms, the human-God relationship and the human-human relationship. The image is in the relationship itself, not the capacity for relationship. Thus for Barth the image of God is not a

quality, nor is it held by each human being as an individual. It exists first in our relationship to God and secondarily in our relationships with each other.[17]

Barth also finds evidence for a relational interpretation of the image of God in the divine-human person of Jesus, in whom he sees a revelation of human nature as it was intended to be. What Barth sees as significant about Jesus is his relationships with God and with other humans. Jesus actively gives himself to others: "If we see Him alone, we do not see Him at all. If we see Him, we see with and around Him in ever widening circles His disciples, the people, His enemies, and the countless multitudes who never have heard His name. We see Him as theirs, determined by them and for them, belonging to each and every one of them" (1958, 216). Jesus is for Barth a clear model of the twofold (both vertical and horizontal) relationality that Barth places at the center of humanity. (This does not mean that Barth equates Jesus' nature with human nature. Barth finds in Jesus the model for humanity in a perfection that "others cannot even approach" [p. 222]).

Although many theologians have differed sharply with Barth on the details of what constitutes authentic relationship or whether the male-female differentiation mentioned in Genesis 1:26 is an adequate model for all human relationship, a relational model of the image of God became the dominant approach among systematic theologians in the mid to late twentieth century.[18]

A relational approach exists in AI as well. As we have seen, a functional definition of intelligence as the ability to accomplish a task or set of tasks is problematic in that it is difficult to determine which tasks demonstrate intelligence or, more broadly, provide a convincing image of ourselves. This difficulty was recognized by the British mathematician Alan Turing before the advent of the computer. In his landmark paper "Computing Machinery and Intelligence," published in 1950, Turing addresses the question of which actions are essential for a true *imago hominis* (image of the human) with a proposal for what has come to be the generally accepted test for machine intelligence. This test is based on a parlor game called the imitation game, in which an interrogator questions a man and a woman and tries to tell from their written responses which is which. In Turing's version, an interrogator is connected by terminal to two subjects, one a human, the other a machine. If the interrogator fails as often as she succeeds in determining which was the human and which the machine, the machine could be considered as having intelligence. Turing predicted that by the year 2000 "it will be possible to programme computers . . . to make them play the imitation game so well that an average interrogator will not have more than a 70 percent chance of making the right identification after five minutes of questioning" ([1950] 1997, 38). This, like most predictions in AI, was overly optimistic. No computer has yet come close to passing this test.[19]

The Turing Test, as it is generally called, is based not on the completion of any particular task or the solution of any particular problems by the machine but on the machine's ability to relate to a human being in conversation. Discourse is unique among human activities in that it subsumes all other activities within itself, at one remove. If we accept the Turing Test, as many in the AI community have, as the ultimate arbiter of intelligence, then we have defined intelligence relationally.[20] Turing considers the ability to relate in discourse, as human beings do, to be far more important than accuracy or precise functioning in any realm. He writes:

> It is claimed that the interrogator could distinguish the machine from the man simply by setting them a number of problems in arithmetic. The machine would be unmasked because of its deadly accuracy. The reply to this is simple. The machine (programmed for playing the game) would not attempt to give the right answers to the arithmetical problems. ([1950] 1997, 44–45)

Turing notes here that intelligence goes far deeper than mere competence; indeed, mistakes or hesitancy are hallmarks of human functioning.

The Turing Test also makes no assumptions as to how the computer would arrive at its answers. Turing writes, "We . . . allow the possibility that an engineer or team of engineers may construct a machine which works, but whose manner of operation cannot be satisfactorily described by its constructors because they have applied a method which is largely experimental" (p. 31). Not only need the machine not be limited to the same processes used by humans, its processes need not even be known. The functionality that matters is purely external, in the machine's ability to carry on a conversation.

The Turing Test uses relationality to determine intelligence. However, Turing also notes the importance of being in relationship for the acquisition of knowledge or intelligence. He estimates that the programming of background knowledge needed for a restricted form of the game would take at a minimum three hundred person-years to complete.[21] This is assuming that we could identify the appropriate knowledge set at the outset. Turing suggests that, rather than trying to imitate an adult mind, one construct a mind that simulates that of a child. Such a mind, when subjected to an appropriate course of education, would learn and develop into an adult mind.

One AI researcher taking this approach is Rodney Brooks of M.I.T. Brooks's lab constructed the well-known robots Cog and Kismet (a project described and analyzed by Anne Foerst [1998]). These robots represent a new direction in AI in that being embodied is crucial to their design. Also, rather than being designed to accomplish high-end intellectual problems, these robots are designed to learn those tasks associated with newborns, such as eye-hand coordination, grasping an object, and face recognition through social interaction with a team of researchers. Although Cog has developed abilities such as tracking moving objects with its eyes and with-

drawing an arm when touched, Brooks's project is much too new to assess at this point. It may be no more successful than any previous work in AI in producing a machine that could interact with humans on the level of the Turing Test. However, Cog represents a movement toward Turing's opinion that intelligence is socially acquired and demonstrated.

Some go even further and suggest that intelligence is itself a social phenomenon. According to psychologist Cristiano Castelfranchi (1998, 158), human intelligence arises out of the necessities of social life. Les Gasser thinks that current research in AI has been inadequate, largely because of the underlying asocial view of knowledge:

> In attempting to create machines with some degree of intelligent behavior, AI researchers model, theorize about, predict, and emulate the activities of people. Because people are quite apparently social actors, and also because knowledgeable machines will increasingly be embedded in organizations comprising people and other machines, AI research needs to consider the social aspects of knowledge and action. (Gasser 1991, 107–8)

Human intelligence may be something that is held in common rather than as a strictly individual attribute. John Haugeland points out that many things that we do or use every day are not the product of any one individual's design nor held as instructions in the consciousness of any one individual:

> Think how much "knowledge" is contained in the traditional shape and heft of a hammer, as well as in the muscles and reflexes acquired in learning to use it—though, again, no one need *ever* have thought of it. Multiply that by our food and hygiene practices, our manner of dress, the layout of buildings, cities, and farms. To be sure, some of this was explicitly figured out, at least once upon a time; but a lot of it wasn't—it just evolved that way (because it worked). Yet a great deal, perhaps even the bulk, of the basic expertise that makes human intelligence what it is, is maintained and brought to bear in these "physical" structures. It is neither stored nor used inside the head of *anyone*—it's in their bodies and, even more, out there in the world. (Haugeland 1997, 26)

Designs, plans, and behaviors arise through and out of the relationships between and among individual human beings. Haugeland and Castelfranchi view intelligence as predicated on social activity.[22] Though they approach it in different ways, each suggests that the idea of an individual intelligence is meaningless; intelligence has meaning only in encounter.

HAL OR R2D2: REPLACEMENT OR RELATIONSHIP AS THE GOAL OF AI

Substantive approaches dominated both theology and AI initially; in both fields, recent scholarship has moved away from this approach, implying that the center of our being is dynamic and cannot be isolated from the bodies, societies, and natural world in which they are embedded. The real debate in both theology and AI is now between the functional and relational camps. Each of these approaches locates the core of our humanity in

a different sphere and suggests different trajectories for the project of AI.

Contemporary American society strongly supports a functional approach, in which we are defined by what we do or are capable of doing.[23] Within this approach successful AI is the development of machines that do some task. Such functionality is easy to measure and produces results that can contribute to our quality of life. However, our fears of being replaced by machines are also rooted in a functional paradigm. If dominion on earth, as measured by the completion of tasks, is the center of our being, Bill Joy may be right to hold such a fear. Machines can and will do much of our work for us. I submit that functionality alone is ultimately an unsatisfying image of humankind and an equally unsatisfying image of God. For computers, a functional definition provides no demarcation between ordinary programs and AI, making AI a meaningless category. For humans, it can all too easily lead to a works-oriented mentality. When I visit a 93-year-old friend of mine, I note that there is very little she can still do, yet she remains an intelligent and viable human being, in the image of God.

If our center is in our relationships, then we need not fear replacement. But what measure can be used to determine relationality? Are Cog or Kismet relational because they turn toward humans and cause humans to react in a relational manner toward them?[24] Barth outlines four criteria for full encounter that could help answer these questions. First, he suggests, we must be able to look the other in the eye. This does not simply mean that the other must be embodied but that we must recognize the other as both distinct from ourselves and as our true fellow. More important, to look another in the eye means not to hide from the other but to be open to mutual self-disclosure. The second criterion for true relationship is that we speak to and hear one another. Here we have the Turing Test as a necessary prerequisite, and not only for our own self-disclosure; it is also the way we ask another to admit us into his or her world. Barth insists (1958, 253) that "humanity as encounter must become the event of speech," but this event is not true speech unless it involves true mutual understanding. Such speech need not be verbal, but it must be personally addressed to another, clearly expressed, and received by the other, both as address and expression. Barth's third and fourth criteria move into the realm of action. We must render mutual assistance to one another, and we must do so gladly. We must be willing to both give and receive help, for "my humanity depends on the fact that I am always aware and my action is determined by this awareness, that I need the assistance of others as a fish needs water. It depends upon my not being content with what I can do for myself, but calling for the thou to give me the benefit of his action as well" (p. 263). This assistance must be rendered "gladly" in the sense that it is freely given, not coerced. According to Barth, there is no such thing as being "reluctantly human."

I present these four criteria as food for thought in our ongoing quest for

a humanlike artificial intelligence. The quest for an other with which we can relate strikes me as far more noble than merely wanting machines that will do our work for us. Building such an "other" will not be easy, however, for it demands self-consciousness and free will on the computer's part. And on our part there lies a further danger of which we must be aware. To replace relationship with God and with each other with relationship with our own artifacts is idolatry. If we hope to find in AI that other with whom we can share our being and our responsibilities, then we will have created a stand-in for God in our own image. This is not to say that AI is in itself idolatrous. However, whether or not it is possible to develop, artificial intelligence is bound to be a disappointment if we look toward it to find the I-Thou relationship that will make us whole.

Notes

1. For example, in a 1970 article in *Life*, Marvin Minsky predicted, "in from three to eight years, we will have a machine with the general intelligence of an average human being" (Kelley 1993, 104). AI researcher Thomas Binford (1985, 99) kept a sign over his desk at M.I.T. that read, "We shall overclaim."

2. Some have looked for the image of God in a quality of the human being, such as our physical form (Hermann Gunkel), the ability to stand upright (Ludwig Koehler), our rationality or intellect (Thomas Aquinas), our personality (Otto Procksch), or our capacity for self-transcendence (Reinhold Niebuhr). Others have thought of God's image as dynamic, rooted in human actions, such as our dominion over the animals (Gerhard von Rad). Another approach defines the image as emergent in the interrelationship of two beings, human with human, or human with divine (Karl Barth, Emil Brunner). See Westermann 1984, 147–48 for a summary. Another excellent survey of the image-of-God literature among Old Testament scholars is Jonsson 1988. Detailed histories of the image of God in theology can be found in Berkower 1962, chaps. 2 and 3, and Cairnes [1953] 1973.

3. This methodology for characterizing approaches to the image of God is an expansion of the twofold categorization used by Douglas Hall (1986) and is described in fuller detail, along with its implications for artificial intelligence, in Herzfeld 2002, chaps. 2 and 3.

4. Early Christian writers who discuss the image of God in terms of reason or the rational mind include Clement of Alexandria (*Stromateis* 5.14), Origen (*Against Celsus* 4.85), Gregory of Nazianzus (*Orations* 38.11), and Gregory of Nyssa (*On the Making of Man* 5). Augustine, while emphasizing the importance of relationship between God and human beings, defines the image of God in *On the Trinity* (chaps. 12–14) as the triune capacities for reason, will, and memory. Augustine's focus here is on the image as the triad of these qualities in and of themselves—our capacity for reason, memory, and will—rather than the exercising of these qualities.

5. These include medical diagnosis, mineral prospecting, chemical analysis, and basic mathematics.

6. Lenat hopes to overcome the general-knowledge problem by providing an extremely large base of primitive facts, an encyclopedic knowledge base, that would provide the CYC program with a conceptual understanding of the world. Lenat plans to combine this large database with the ability to communicate in a natural language, hoping that once enough information is entered into CYC the computer will be able to continue the learning process on its own, through conversation, reading, and applying logical rules to detect patterns or inconsistencies in the data CYC is given (Lenat 1995). Initially conceived in 1984 as a ten-year initiative, CYC has yet to show any evidence of independent learning. Outside reviewers of the project are dubious, seeing to date only a massive database (Putnam 1991).

7. Gordon Clark (1973) also gives a christological argument for reason as the image of God, based on the understanding of Christ as the *Logos* or Wisdom of God. Sin is understood as either incomplete knowledge or a malfunctioning of the mind. Clark remarks that in heaven we will no longer make mistakes, "even in arithmetic." In this case, computers have perhaps brought us a bit of heaven on earth!

8. Recent biblical scholars espousing a functional approach include Walter Brueggemann (1982) and Laurence Turner (2000). Systematicians espousing a relational approach include Barth (1958) and Wolfhart Pannenberg (1984).

9. While the translation of *beth* as "as" is rare in Hebrew, it is accepted by most grammarians. See, for example, Gesenius 1910, 119i.

10. See 1 Samuel 6:5, Numbers 33:52, 2 Kings 11:18, and Ezekiel 23:14 for other uses of *selem*.

11. Von Rad cites Wilhelm Caspari, who was the first to suggest this interpretation. This interpretation is supported by a 1979 find, at Tell Fekheyre in Syria, of an inscription in Akkadian and Aramaic on a statue of Hadadyis'i, ruler of Guzan, that refers to the statue twice using the Aramaic *salma* and twice as *demuta* (Millard and Bordreuil 1982, 135–41).

12. Deep Blue calculates 200 million moves per second, giving it the ability to look fourteen moves ahead.

13. Winograd and Flores ([1986] 1991, 214) agree with Brooks on this point, cautioning against the "naive optimism" that mistakes local success for a more global understanding.

14. Barth (1958, 249) lists and denies the variety of substantive interpretations in vogue at his time: "The fact that I am born and die; that I act and drink and sleep; that I develop and maintain myself; that beyond this I assert myself in the face of others, and even physically propagate my sperm; that I enjoy and work and play and fashion and possess; that I acquire and have and exercise powers; that I take part in all the work of the race; and that in it all I fulfill my aptitudes as an understanding and thinking, willing and feeling being—all this is not my humanity."

15. Barth (1958, 75) considers reasoning about human nature through self-observation as bound to result in a vicious circle: "How does he [man] reach the platform from which he thinks he can see himself?" Pannenberg (1984, 16) criticizes Barth's top-down approach for purporting to begin with God's nature, while actually projecting a "quasi-Buberian anthropology of I-Thou personalism" onto God.

16. Of course an I-Thou relationship within the Godhead does not imply more than two entities. Barth (1958, 220–21) writes specifically of the relationship between the Father and Son as prototype for the image of God. The Spirit receives little attention.

17. Foerst presents a slightly different relational understanding of the image of God in "Cog, a Humanoid Robot, and the Question of the Image of God" (1998, 104–7). She describes the image as "performative" in that, through the creation of humans in God's image, God makes a promise that relationship between humans and God will be possible. Foerst views the image of God as representing this promise of God's to relate to us. While Foerst emphasizes the importance of relationship between creator and creature both in AI and in our relationship to God, Mary Gerhart and Allan Russell, in "Cog Is to Us as We Are to God: A Response to Anne Foerst" (1998, 266), note that Foerst fails to extend this vertical relationality to the horizontal sphere, where our creation in God's image calls us to be in relationship with one another, a relationship patterned after our relationship with God. In this, Foerst fails to take into consideration the ethical implications of biblical passages other than Genesis 1 that speak of humankind's creation in the image of God, such as Genesis 9:5–6, Colossians 3:9–10, and James 3:9.

18. David Cairns ([1953] 1973, 146) claims that Barth's interest in the image of God developed as a reaction to Emil Brunner. Although Barth and Brunner initially differed sharply and carried on a sixteen-year controversy between 1934 and 1951 regarding the image of God, their mature thoughts are quite closely aligned. Brunner (1946, 32) sees the image of God in the human as a "point of contact of divine grace." While Brunner initially divides the image into two aspects, a formal aspect retained in the Fall and a material aspect which is lost, he abandons this distinction in *Man in Revolt* (1947, chaps. 5–7), stressing in its place the image as the whole person, responsible for responding to God and one another in love. Berkower (1962, chap. 3) criticizes Barth's method more than his conclusions. While both arrive at a relational interpretation, Berkower charges Barth with theological speculation in his use of Jesus as archetype for our nature; Berkower points out that Jesus became like us rather than we like him. He further defines the relationship that constitutes the image of God, suggesting that the analogy between humans and God is neither an *analogia entis* nor an *analogia relationis* but an *analogia amoris* in that we image God in our love for others; Pannenberg (1984) locates the center of humanity in the tension between our self-consciousness as individuals and our exocentricity or openness to others. For a comparison of Pannenberg's and Barth's concepts of the image of God, see Schults 1997, 304–22.

19. In 1991 Hugh Loebner began funding a yearly competition that offers $100,000 for the first program to pass a Turing Test. The first four years of the competition allowed the area of questioning to be restricted. Since 1995, the areas of questioning have been unrestricted. Judgments on the relative success of various programs differ; however, Loebner has yet to part with his money. Sherry Turkel (1995, 94) seems to feel that several programs have been remarkably successful in limited domains. Robert Epstein (1992) is less optimistic. Having conversed with some of the Loebner contestants myself, via the Internet, I agree with Epstein. These programs are remarkably easy to fool through the use of metaphor, simile, or a sudden change of topic. Still, optimistic predictions continue to be made. Kurzweil (1999, 279) fully expects computers to have mastered the Turing Test by the year 2030.

20. While most in the AI community accept the Turing Test as sufficient, an opposing view can be found in Searle 1980, 417–24.

21. Turing writes, "At my present rate of working I produce about a thousand digits of program a day, so that about sixty workers, working steadily through the fifty years might accomplish the job, if nothing went into the wastepaper basket. Some more expeditious method seems desirable" ([1950] 1997, 51–52). Mitchie notes that the typical programming rate for large commercial systems in 1997 was ten lines of code per programmer per day (1997, 2).

22. See also Winograd and Flores [1986] 1991, chap. 6.

23. How often the first question asked on meeting someone is "What do you do?"

24. Foerst notes (1998, 103) that the reaction of human observers who are quick to respond to these machines in a relational manner is, perhaps, the most interesting part of the Cog project and tells us much about our own nature as human beings.

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