Contra Darwin,
Humans are Rational Animals, But Mere Animals are Not; and Darwin is Irrational in Thinking Otherwise

Selmer Bringsjord
Are Humans Rational?
11/6/17
RPI
Logistics …
Logistics ...
Logistics ...

Darwin’s mistake: Explaining the discontinuity between human and nonhuman minds

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Abstract: Over the last quarter century, the dominant tendency in comparative cognitive psychology has been to emphasize the similarities between human and nonhuman minds and to downplay the differences as “one of degree and not of kind” (Darwin 1871). In the present target article, we argue that Darwin was mistaken: the profound biological continuity between human and nonhuman animals is an equally profound discontinuity between human and nonhuman minds. To wit, there is a significant discontinuity in the degree to which human and nonhuman animals are able to appreciate the higher-order, systematic, relational capabilities of a physical symbol system (PSS). (Newell 1990). We show that this symbolic-relational discontinuity pervades nearly every domain of cognition and is much deeper and more fundamental than the spectacular scaffolding provided by language or culture alone can explain. We propose a representational-level specification as to where human and nonhuman animals’ abilities to appreciate a PSS are similar and where they differ. We conclude by suggesting that recent symbolic-connectorist models of cognition shed new light on the mechanisms that underline the gap between human and nonhuman minds.

Keywords: analogy; animal cognition; causal learning; connectionism; Darwin; discontinuity; evolution; human mind; language; language of thought; physical symbol system; reasoning; same-different; theory of mind

1. Introduction

Human animals – and no other – build fires and wheels, diagnose each other’s illnesses, communicate using symbols, navigate with maps, think; their lives for ideals, collaborate with each other, explain the world in terms of hypothetical causes, punish strangers for breaking rules, imagine impossible scenarios, and teach each other how to do all of the above. At first blush, it might appear obvious that human minds are qualitatively different from those of every other animal on the planet. Ever since Darwin, however, the dominant tendency in comparative cognitive psychology has been to emphasize the continuity between human and nonhuman minds and to downplay the differences as “one of degree and not of kind” (Darwin 1871). Particularly in the last quarter century, many prominent comparative researchers have claimed that the traditional hallmarks of human cognition – for example, complex tool use, grammatically structured language, causal–logical reasoning, mental state attribution, metacognition, analogical inferences, mental time travel, culture, and so on – are not nearly as unique as we once thought (see, e.g., Biedl et al. 2002; Call 2006; Clayton et al. 2003; de Waal & Tyack 2003; Matsuzawa 2001; Peperberg 2002; Rendell & Whitehead 2001; Savage-Rumbaugh et al. 1998; Smith et al. 2003; Tomasello et al. 2005b; Peperberg 2006, p. 460) apply roughly the comparative consensus as follows: “for over 35 years, researchers have been demonstrating through tests both in the field and in the laboratory that the capacities of nonhuman animals to solve complex problems form a continuum with those of...
Logistics ...

Again: must have read for next class.

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Recall that for your convenience is hotlinked from our syllabus.
Recall our overall context …
Humans, at least neurobiologically normal ones, are fundamentally rational, where rationality is constituted by certain logico-mathematically based reasoning and decision-making in response to real-world stimuli, including stimuli given in the form of focused tests; but mere animals are not fundamentally rational, since, *contra* Darwin, their minds are fundamentally qualitatively inferior to the human mind. As to whether computing machines/robots are fundamentally rational, the answer is also "No." For starters, if $x$ can’t read, write, and create, $x$ can’t be rational; neither computing machines/robots nor non-human animals can read nor write nor create; ergo, they aren’t fundamentally rational for this reason alone. But news for non-human animals and computing machines/robots gets much worse, for they have not the slightest chance when they are measured against $\mathcal{H}$. 
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$\mathcal{R}$
And Supporting Main Claim …

Humans have the ability to gain knowledge by reasoning (e.g., deductively) quantificationally and recursively over abstract concepts, including abstract concepts of a highly expressive, including infinitary, nature, expressed in arbitrarily complex natural language.
Check your history books ...
Darwinism comes to Penn
A century-and-a-half after the November 1859 publication of *On the Origin of Species*, a Penn microbiologist looks back at how Darwin’s ideas were received by some of the University’s leading thinkers. BY HOWARD GOLDFINE

ON June 18, 1858, Charles Darwin received a manuscript from Alfred Russel Wallace, which outlined a theory of evolution based on natural selection. Wallace’s letter came from an island in the Malay Archipelago, where he was collecting field specimens and studying the distribution of species. Wallace, like Darwin, invoked the Malthusian concept that a struggle for existence within rapidly expanding populations would be the driving force for selection of natural variants within a species. Darwin’s immediate reaction was one of dismay. He had been working on his “big book on species” since his five-year voyage on the Beagle (1831-36) and a relatively unknown naturalist had forestalled him. Darwin wrote to Charles Lyell, “If Wallace had my [manuscript] sketch written out in 1842, he could not have written out a better short abstract.”

Fortunately, Darwin had previously outlined his theory to his friends, the distinguished geologist Lyell and the botanist Joseph D. Hooker, and in a brief, unpublished draft to Asa Gray, a botanist at Harvard. Lyell and Hooker immediately arranged for Wallace’s paper and a brief summary of Darwin’s theory to be read simultaneously at the Linnean Society in London on July 1, 1858. These were received with little comment. The president of the society later noted that nothing of great interest had happened that year.
A century and a half after the November 1859 publication of On the Origin of Species, a Penn microbiologist looks back at how Darwin's ideas were received by some of the University's leading thinkers. BY HOWARD GOLDFINE

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Darwin did not.
And he defended his position in a book: *Descent of Man.*
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Darwin did not. And he defended his position in a book: *Descent of Man.*

Wallace seems to me to be right; Darwin to be wrong...
The book that shook the world, and supposedly obliterated the stupid notion that human persons are made in (in Milton’s unpacked version of the phrase) God’s image.
Praise for Darwin & DoM

Back cover of my Amazon.com version of DoM:
“Darwin’s engaging literary style, charming modesty, brilliant argument, and discursive method of proof makes the book an exhilarating romp through Earth’s natural history and Man’s history …”
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Really?
I found no brilliant arguments, and not a single proof.
Perhaps the emperors have no clothes.
A Key Proposition
There is at least one mental power possessed by human persons, but not by any mere animal; and the mental powers of human persons are of a wholly different nature than those of mere animals.
Efficient Refutation of Darwin’s DoM

| (1) | If human persons are the product of evolution, then it’s not the case that $\bar{A}$ holds. |
| (2) | $\bar{A}$ does hold. |
| (3) | Human persons are not the product of evolution. |

\[ \therefore \quad (3) \quad \text{Human persons are not the product of evolution.} \quad \text{from (1), (2) by modus tollens} \]

QED
Efficient Refutation of Darwin’s *DoM*

| (1) | If human persons are the product of evolution, then it’s not the case that $\bar{A}$ holds. |
| (2) | $\bar{A}$ does hold. |
| \[ \therefore \] | (3) Human persons are not the product of evolution. |

\textit{QED}

\textit{Note:} (3) doesn’t deductively entail that \textit{no} parts of human personhood are the product of evolution. In other words, (3) can be rephrased as: “Human persons are not solely and completely the product of evolution.” As seen shortly, the power of human persons to carry out abstract, infinitary reasoning (as in the case of developing the tensor calculus) would be — according to Wallace & Bringsjord — something that evolution didn’t produce.
Whence comes the first premise in this argument?
“If no organic being excepting man had possessed any mental power, or if his powers had been of a wholly different nature from those of the lower animals, then we should never have been able to convince ourselves that our high faculties had been gradually developed.”

(Descent of Man, Part One, Chapter Two)
So, Darwin devotes himself to trying to overthrow \( \overline{A} \).
So, Darwin devotes himself to trying to overthrow $\bar{A}$. How?
Darwin’s Defense

\[
\begin{align*}
\text{(1)} & \quad \text{Story or anecdote } S. \\
\therefore \text{(2)} & \quad \text{There exist animals manifesting behavior } B. \\
\text{(3)} & \quad \text{Anything behaving as in } B \text{ has purportedly differentiating mental powers } M_1, \ldots, M_k. \\
\therefore \text{(4)} & \quad \text{There exist animals having purportedly differentiating mental powers } M_1, \ldots, M_k. \\
\therefore \text{(5)} & \quad \neg A \\
\therefore \text{(6)} & \quad \text{Bringsjord’s intended refutation fails.}
\end{align*}
\]

from (1)

from (2), (3), (4)

(4), def of $\neg A$

(5), def of refutation
Darwin’s Defense wrt Reasoning

(1) Story or anecdote $S$.

\[ \therefore \]

(2) There exist animals manifesting behavior $B$.

(3) Anything behaving as in $B$ has the purportedly differentiating mental power of reasoning.

\[ \therefore \]

(4) There exist animals the having purportedly differentiating mental power of reasoning.

from (1)

from (2), (3), (4)
What is reasoning?
What is reasoning?

- Well, deductive, inductive/probabilistic, abductive, analogical?
What is reasoning?

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- All varieties, if even marginally rigorous, presuppose *deductive* reasoning.
What is reasoning?

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• Examples:
What is reasoning?

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• Examples:
  • “Intergalactic Diplomacy” ... (see end of slide deck)
What is reasoning?

• Well, deductive, inductive/probabilistic, abductive, analogical?

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• Examples:
  • “Intergalactic Diplomacy” ... (see end of slide deck)
  • Karkooking Problem ...
What is reasoning?

- Well, deductive, inductive/probabilistic, abductive, analogical?
- All varieties, if even marginally rigorous, presuppose deductive reasoning.
- Examples:
  - “Intergalactic Diplomacy” … (see end of slide deck)
  - Karkooking Problem …
  - And infinitary deductive reasoning: “Gödel-level” Theorems … (see Bringsjord, S. Gödel’s Great Theorems, forthcoming from Oxford Univ Press)
Karkooking Problem …

Everyone karkooks anyone who karkooks someone.

Alvin karkooks Bill.

Can you infer that everyone karkooks Bill?

ANSWER:

JUSTIFICATION:
Larking Problem …

Everyone larks anyone who larks someone.

Alvin larks Bill.

Can you infer that everyone larks Bill?

ANSWER: No.

JUSTIFICATION: Quantification!

Quantification!

Recursion!

Recursion!
So, ...

minimally, deductive reasoning is valid, and grasped as such, when the content-independent form of the progression from premise(s) to conclusion accords with certain unassailable, abstract structures that ensure that if the premises are true, the conclusion must be true as well. And the production of worthwhile deductive reasoning is based on the search for interesting progressions that accord with such structures.
So, we return to ...

Darwin’s Defense wrt Reasoning

\[\begin{align*}
(1) & \quad \text{Story or anecdote } S. \\
\therefore (2) & \quad \text{There exist animals manifesting behavior } B. \quad \text{from (1)} \\
(3) & \quad \text{Anything behaving as in } B \text{ has the purportedly differentiating mental power of reasoning.} \\
\therefore (4) & \quad \text{There exist animals the having purportedly differentiating mental power of reasoning.} \quad \text{from (2), (3), (4)}
\end{align*}\]
Very well. And the stories?

They embarrass me, and Darwin may well have had a dog fetish, but I convey some to you ...
“Dogs on Thin Ice”

“Dr. Hayes, in his work on *The Open Polar Sea*, repeatedly remarks that his dogs, instead of continuing to draw sledges in a compact body, diverged and separated when they came to thin ice, so that their weight might be more evenly distributed.”
“Thirsty Dogs”

“Houzeau relates that, while crossing a wide and arid plain in Texas, his two dogs suffered greatly from thirst, and that between thirty and forty times they rushed down the hollows to search for water. These hollows were not valleys, and there were no trees in them, or any other difference in the vegetation, and as they were absolutely dry there could have been no smell of damp earth. The dogs behaved as if they knew that a dip in the ground offered them the best chance of finding water.”
“Mr. Colquhoun winged two wild ducks, which fell on the further side of a stream; his retriever tried to bring over both at once, but could not succeed; she then, though never before known to ruffle a feather, deliberately killed one, brought over the other, and returned for the dead bird.”
“A Murderous Dog”

“Col. Hutchinson relates that two partridges were shot at once, one being killed, the other wounded; the latter ran away, and was caught by the retriever, who on her return came across the dead bird: ‘she stopped, evidently greatly puzzled, and after one or two trials, finding she could not take it up without permitting the escape of the winged bird, she considered a moment, then deliberately murdered it by giving it a severe crunch, and afterward brought away both together. This was the only known instance of her ever having willfully injured any game.’ Here we have reason ... they show how strong their reasoning faculty must have been ...”
Please.
• This comes nearly 2000 years after Aristotle explained what deductive reasoning is, and gave simple but powerful deductive logics to make this clear ... and these dogs are said by a learned man to reason?
• This comes nearly 2000 years after Aristotle explained what deductive reasoning is, and gave simple but powerful deductive logics to make this clear ... and these dogs are said by a learned man to reason?

• We can build non-reasoning robots to do much more problem-solving than this.
Please.

• This comes nearly 2000 years after Aristotle explained what deductive reasoning is, and gave simple but powerful deductive logics to make this clear ... and these dogs are said by a learned man to *reason*?

• We can build *non*-reasoning robots to do much more problem-solving than this.

• A dog can’t even have third-order beliefs.
Please.

• This comes nearly 2000 years after Aristotle explained what deductive reasoning is, and gave simple but powerful deductive logics to make this clear ... and these dogs are said by a learned man to *reason*?

• We can build non-reasoning robots to do much more problem-solving than this.

• A dog can’t even have third-order beliefs.

• Animals can’t reason, *certainly* can’t reason in infinitary fashion; and so, my friends, I am home free, and part ways with the undressed king and those who follow the groupthink of our age, and hence proclaim with the co-discoverer of evolution, that while my spine may be descended from some brute’s in an epoch long past, my mind, and yours alike, is not.
Finis
Finis
(1) If human persons are the product of evolution, then it’s not the case that $\bar{A}$ holds.

(2) $\bar{A}$ does hold.

\[ \therefore \]

(3) Human persons are not the product of evolution.

\textit{from (1), (2) by modus tollens}

\textbf{QED}
You have been sent to the war-torn and faction-plagued planet of Raq. Your mission is to broker peace between the warring Larpal and Tarsal factions. In a pre-trip briefing, you were informed that the Larpals are sending one delegate to the negotiations, and the Tarsals are sending a pair. You were also warned that Larpals are liars, i.e., whatever they say is false, while Tarsals are not, i.e., whatever they say is true. Upon arrival, you are met by the three alien delegates. Suddenly, you realize that though the aliens know whom among them are Larpals, and whom are Tarsals, you do not. So, you ask the first alien, “To which faction do you belong?” In response, the first alien murmurs something you can't decipher. Seeing your look of puzzlement, the second alien says to you, “It said that it was a Larpal.” Then, with a cautionary wave of an appendage and an accusatory glance at the second alien, the third alien says to you, “That was a lie!”

Whom among the three aliens can you trust?
The Dialogue

Solved by Christina Elmore, student in F15 AHR?. A solution is available at the following url to check your work:
http://kryten.mm.rpi.edu/Sophisticated_KRandR_Requires_Phil.pdf.
The Dialogue

@ t1, Y: “A1, to which faction do you belong?”

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The Dialogue

@ t1, Y: "A1, to which faction do you belong?"

@ t2, A1: "** ^% ### =+++"

Solved by Christina Elmore, student in F15 AHR?. A solution is available at the following url to check your work:
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@ t1, Y: “A1, to which faction do you belong?”

@ t2, A1: “** ^% ###_ =+++”  

@ t3, A2: “It said that it was a Larpal.”

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The Dialogue

@ t₁, Y: “A₁, to which faction do you belong?”

@ t₂, A₁: “** ^% ### _=+++”

@ t₃, A₂: “It said that it was a Larpal.”

@ t₄, A₃: “A₂, that was a lie!”

@ t₁, Y: “A₁, to which faction do you belong?”

You

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The Dialogue

@ t1, Y: “A1, to which faction do you belong?”

@ t2, A1: “** ^% ###_ =+++”

@ t3, A2: “It said that it was a Larpal.”

@ t4, A3: “A2, that was a lie!”

@ t1, Y: “A1, to which faction do you belong?”

Whom among the aliens here can you trust?

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More on Larpals, Tarsals, & Lying ...

$L$ lies to $D$ = _df_ There is a proposition $p$ such that (i) either $L$ believes that $p$ is not true or $L$ believes that $p$ is false and (ii) $L$ asserts $p$ to $D$.

\[
C \left( \forall_{l,d,p,m} \happens(action(l, lies(p,d)), m) \leftrightarrow \left( B(l, \negholds(p,m)) \land \happens(action(l, asserts(p,d)), m) \right) \right) \tag{1}
\]

$L$ asserts $p$ to $D$ = _df_ $L$ states $p$ to $D$ and does so under conditions which, he believes, justify $D$ in believing that he, $L$, accepts $p$.

\[
C \left( \forall_{l,d,p,m} \happens(action(l, asserts(p,d)), m) \leftrightarrow \left( \happens(action(l, states(p,d)), m) \land B(l, B(d, \happens(action(l, states(p,d)), m) \rightarrow B(l, holds(p,m)))) \right) \right) \tag{2}
\]

from Bringsjord, Clark, Taylor (2014) “Sophisticated Knowledge Representation and Reasoning Requires Philosophy” (http://kryten.mm.rpi.edu/Sophisticated_KRandR_Requires_Phil.pdf)

(For a fresh treatment of mendacity from the perspective of AI and computational logic, see Clark (2010) _Cognitive Illusions and the Lying Machine: A Blueprint for Sophistic Mendacity_).