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Disputatio on the Distinction between the Human Person and Other Animals: the Human Person as Gardener

I

The question of human uniqueness is a matter of much contemporary debate in scientific, philosophical, and theological circles.[1] Constructive dialogue around the complexities of this question, especially in light of the findings of modern science and philosophy, is important because differentiating human beings from other animals is essential for understanding the nature and purpose of human life and

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[1] See, for example: Marc Bekoff, Collin Allen, & Gordon Burghardt, eds., *The Cognitive Animal* (Cambridge, Massachusetts: MIT Press, 2002); Maciej Henneberg & Arthur Saniotis, *The Dynamic Human* (Sharjah, UAE: Bentham Science Publishers, 2016); Tetsuro Matsuzawa, *Primate Origins of Human Cognition and Behavior* (New York: Springer, 2001); Leon R. Kass, *Toward a More Natural Science: Biology and Human Affairs* (New York: The Free Press, 1985); Alasdair McIntyre, *Dependent Rational Animal* (Chicago, IL: Carus Publishing Company, 1999); Josep Call,

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the specific role of the human person in nature. The literature is replete with studies examining human uniqueness in light of particular physiological or intellectual capacities such as brain size, skeletal structure, language, empathy or moral judgment.[2] In this article, we consider an attribute of human beings that is unexplored in the literature about human uniqueness – namely, the human capacity to garden. Following Aquinas's model of *disputatio* in order to engage in robust dialogue around the question of human uniqueness, we aim to show that the human capacity to garden is unique and distinctive among all natural beings. Specifically, we argue that humans garden in a way that no

"Descartes' two errors: Reason and reflection in the great apes," in *Rational Animals?*, ed. Susan Hurley & Matthew Nudds (Oxford: Oxford University Press, 2006); Larry Azar, *Man: Computer, Ape, or Angel* (Hanover, Mass.: The Christopher Publishing House, 1989); Mortimer Adler, *The Difference of Man and the Difference It Makes* (NY: Fordham University Press, 1993); Marie George, "Thomas Aquinas Meets Nim Chimpski: On the Debate about Human Nature and the Nature of Other Animals," *Aquinas Review* 10 (2003): 1–50; Celia E. Deane-Drummond and David Clough, eds., *Creaturely Theology: Of God, Humans and Other Animals* (London: SCM Press, 2009); and many others.

[2] See, for example: Ajit Varki, Daniel H. Geschwind, & Evan E. Eichler, "Explaining human uniqueness: genome interactions with environment, behavior, and culture," *National Review of Genetics* 9, no. 10: 749–763 (2008); Kim Hill, Michael Barton, & Ana Magdalena Hurtado, "The Emergence of Human Uniqueness: Characters Underlying Behavioral Modernity," *Evolutionary Anthropology* 18: 187–200 (2009); Philip Lieberman, "Human Language and Human Uniqueness," *Language & Communication* 14, no. 1: 87–95 (1994); Jordan Zlatev, "Human uniqueness, bodily mimesis and the evolution of language," *Humana. Mente Journal of Philosophical Studies* 27: 197–219 (2014); James R. Hurford, "Human uniqueness, learned symbols and recursive thought," *European Review* 12, no. 4: 551–565 (2004); Shigeru Watanabe, "Evolutionary origins of empathy" in Douglas F. Watt & Jaak Panksepp, eds. *Psychology of Emotions, Motivations and Actions: Psychology and Neurobiology of Empathy*, 37–61 (Nova Biomedical Books, 2016; Francisco J. Ayala, "The difference of being human: Morality," *Proceedings of the National Academy of Sciences* (*PNAS*) 107, suppl. 2: 9015–9022 (2010); Jean Decety, "The Neurodevelopment of Empathy in Humans," *Developmental Neuroscience* 32: 257–267 (2010); and many others.

other creature does and that this unique human capacity can help elucidate critically important aspects of the nature and role of humans in the natural world.[3]

Gardening holds a special place in the history of humanity, beginning with the earliest cultivation of food, as the transition from hunter-gatherer to farmer was a signal one in human evolution and laid the foundation for changes in health and culture, including the development of civilization as we know it.[4] Prior to the advent of agriculture at the start of the Neolithic Revolution approximately ten to twelve thousand years ago, humans were primarily hunter-gatherers. The shift from foraging to farming precipitated revolutionary changes in diet and social organization that allowed for dramatic increases in popula-

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[3] As will be seen, we understand human gardening as a unique second order capacity, which is a habit made possible by the first order animal and rational capacities.

[4] History.com editors. "Neolithic Revolution" (updated August 23, 2019), https://www.history.com/topics/pre-history/neolithic-revolution/: Michael Balter, "The Seeds of Civilization" (May 2005), https://www.smithsonianmag.com/history/the-seeds-of-civilization-78015429/; Bruce Smith, *The Emergence of Agriculture*, Scientific American Library Series (New York: W.H. Freeman & Company, 1999); Peter H. Thrall, James D. Bever, & Jeremy J. Burdon, "Evolutionary change in agriculture: the past, present, and future," *Evolutionary Applications* 3: 405–408 (2010), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3352499/David Rindos, *The Origins of Agriculture: An Evolutionary Perspective* (San Diego: Academic Press, 1984); Timothy M. Ryan and Colin N. Shaw, "Gracility of the modern Homo sapiens skeleton is the result of decreased biomechanical loading," *Proceedings of the National Academy of Sciences* (*PNAS*) 112, no. 2 (13 January 2015): 372–377; Habiba Chirchir, Tracy Kivell, Christopher Ruff, Jean-Jacques Hublin, Kristian Carlson, Bernhard Zipfel, and Brian Richmond "Recent origin of low trabecular bone density in modern humans," *Proceedings of the National Academy of Sciences* (*PNAS*) 112 no. 2 (2015): 366–371; Clark Spencer Larsen, "Agriculture's Impact on Human Evolution," lecture at *The Evolution of Human Nutrition* event, (Dec 7, 2012), University of California-San Diego, https://carta.anthropogeny.org/events/sessions/agricultures-impact-human-evolution; John Hawks, "Evolution of human genes and the origin of agriculture," YouTube video posted June 24, 2014, from https://www.youtube.com/watch?v=9SnmmSZGV88.

tion size as well as the formation of settlements. More settled lifestyles and changes in workload laid the foundation for the development of technology and other forms of technical innovation related to food production. The surplus in food that comes with the advancement of farming gave rise to not only to the division of labor and new technologies for the amelioration of human suffering, but also the freedom of leisure time, which enabled human beings to pursue theoretical inquiry (knowledge for its own sake) in the arts and sciences.[5] In short, the transition to agriculture was the "crucible of evolutionary change" that initiated "enormously profound" impacts on human evolution and paved the way for the formation of human society as we know it today.[6]

The capacity to garden, thus, holds a unique significance for human evolution and history. Superimposed on this from a Christian standpoint is the Biblical call in Genesis for humans to garden and utilize plants and animals for their sustenance.[7] While philosophers have tended to emphasize human acts of reason and language as demonstrations of human uniqueness, the order of scripture suggests—since Adam was given the role of steward prior to naming the creatures—that a more appropriate starting point is with man acting as gardener. For these reasons, and because the distinctiveness of human farming is underexplored in the literature, we believe a focus on this particular attribute can make a unique contribution to ongoing debates about human uniqueness.

Indeed, focusing on the distinctiveness of human farming is especially important in the face of contemporary scientific research that has demonstrated that a number of nonhuman creatures also possess the

[5] A fact first noted by Aristotle regarding the founding of the mathematical arts by the priest class of Ancient Egypt. See *Metaphysics* 1.1 (981b22–24).

[6] Thrall, Bever, & Burdon, "Evolutionary Change in Agriculture," 405.

[7] See Genesis 1:27–30 and 2:15.

capacity to farm. These findings have bolstered the assertion in certain scientific circles that the gap between humans and other animals is not as wide as was once thought and that, in fact, humans are not significantly different from other animals. The philosophical underpinnings of this view can be found in accounts by modern philosophers such as David Hume, which have tended to conflate human and animal acts of intelligence to a single kind. Further, the widespread acceptance of nominalism, which rejects the reality of universal conceptions as signifying common natures and functional capacities possessed by individuals, has brought the foundation of this inquiry into the distinct meaning of human existence into question.[8] With the advent of modern science and evolutionary theory as first proposed by Charles Darwin, it seems that the problem has only been compounded.

How does one navigate in this entangled landscape? There is a need, not only for new images of the human person in nature (one of which, as we propose here, is supplied by the notion of the human person as gardener), but also for a new and "creative apologetics,"[9] if you

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[8] On Hume, see the "Degree vs. Kind" objection below, and footnote 13. Nominalism denies the existence of what Aristotle called secondary being/substance (οὐσία/*ousia*) in *Categories* 5, i.e., genus, species, and difference, and that these terms can be univocally predicated of individuals in acts of defining. Roscelin, Peter of Abelard, and—most famously—William of Ockham were nominalists in the medieval period. Virtually every modern thinker beginning with Descartes adopted this view, as John Deely has shown in his "Modern Epistemology and Solipsisms," in *The New Catholic Encyclopedia Supplement: Ethics and Philosophy* (2012–2013), eds. Robert L. Fastiggi, Joseph W. Koterski, Trevor Lipscombe, Victor Salas, and Brendan Sweetman, in association with the Catholic University of America (Gale: Farmington Hills, 2013). More will be said regarding this nominalist position below, in the objections and response.

[9] In relation to the encounter between faith, reason and the sciences in the New Evangelization, Giuseppe Tanzella-Nitti emphasizes the need for a "creative apologetics," in "Some Reflections of the Influence and Role of Scientific Thought in the Context of the New Evangelization," in *The Vatican Observatory, Castel Gandolfo: 80th*

will, in order to address the question of human uniqueness in a meaningful and substantive way. Since Vatican II, the Catholic Church has advocated for renewed approaches to apologetics, not with the goal of winning arguments, but rather, in order to engage in a robust and charitable dialogue with the culture.[10]

Historically, one of the most effective approaches to apologetics in the Christian tradition has been the practice of *disputatio*, which was made famous by medieval philosophers such as St. Albert the Great and St. Thomas Aquinas. They brilliantly employed *disputatio* to engage with secular Aristotelian thinking about perennial questions of meaning, as in St. Thomas' *Summa Theologiae*.[11] In our contemporary setting, defined as it is by the secular scientific culture, this method could be helpful in fostering a much-needed, robust dialogue between philosophy and theology and the natural sciences.

In this spirit, this article utilizes the method of *disputatio* to bring modern scientific philosophies that deny human uniqueness into dialogue with those that uphold human uniqueness. Aside from being the best way to seek the truth of the matter on this issue (or any other), this method is an excellent pedagogical tool for practicing the integration

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Anniversary Celebration, eds. Gabriele Gionti, S.J. and Jean-Baptiste Kikwaya Eluo, S.J., Astrophysics and Space Science Proceedings 51 (Cham, Switzerland: Springer International Publishing AG, 2018), 235–244, https://doi.org/10.1007/978-3-319-67205-2_17.

[10] See, for example: Avery Dulles, "The Rebirth of Apologetics" in *First Things* (May 2004): 19–23 and a good review in Glenn B. Siniscalchi, "Catholic Apologetics and the New Evangelization," *Church Life Journal* (September 26, 2016), https://churchlifejournal.nd.edu/articles/catholic-apologetics-and-the-new-evangelization/#_ednref26.

[11] The medieval practice of *disputatio*, with its origin in the work of Boethius, is a systematic perfection of the dialectical method practiced by Socrates and Plato. See, for example, Plato's *Phaedo*, where Socrates argues for the immortality of the soul, taking into account the major objections to his position.

of faith and reason—or to use Pope Emeritus Benedict's term, "expanded reason"[12]—in contemporary educational settings. In the face of the complexities of questions surrounding the nature and uniqueness of humans in nature, such tools are especially vital for contemporary discourse, in order to create meaningful dialogue where there appears to be a conflict between modern scientific or philosophical positions and established principles of philosophy or theology.

The method of *disputatio* involves proposing a fundamental question and articulating key positions on both sides of the issue, beginning with the strongest objections to the position the master teacher intends to support. After citing important and relevant expert authority in favor of his position "but against" (*Sed contra*) the objections, the master then says "I respond that" (*Respondeo*) and articulates his/her answer to the question, drawing upon a wide range of sources, both sacred and secular. Finally, having offered his *Respondeo*, the master returns to the objections and answers them one by one. The method is inherently dialogical, as well as knowledgeable and respectful of alternative viewpoints, while at the same time resolving itself in a commitment to the truth in relation to a particular issue.

We consider the five most formidable scientific and philosophical objections to our position that the capacity to garden makes humans distinct. (i) Contemporary science shows that other animals, such as certain species of ants, beetles, snails, fish and crabs, have the capacity to garden, so that this capacity is not unique to human beings.

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[12] See Pope Benedict XVI's lecture at the University of Regensburg, *Faith, Reason and the University*: *Memories and Reflections*; September 6, 2006; https://w2.vatican.va/content/benedict-xvi/en/speeches/2006/september/documents/hf_ben-xvi_spe_20060912_university-regensburg.html#_ftn3. Expanded reason is reason that is not restricted solely to empirical reality but is open to the transcendent, to the pursuit of metaphysical realities and universal, integrative truths. Pope Benedict emphasized the urgent need to practice this kind of "widening reason."

(ii) The difference between humans and other animals is properly explained in evolutionary biology as one of degree and not kind. (iii) Modern genetics and genome mapping show that humans share DNA with all life on earth, so that they are not significantly distinct from other creatures. (iv) As nominalism shows, universal conceptions by which human beings could be distinguished from other animals in terms of kind do not exist. (v) Finally, we should not seek to show a difference in kind between humans and other animals, as such an anthropocentric approach is detrimental to ecological and environmental progress.

We respond (*Respondemus*), taking a cue from Aristotle and St. Thomas Aquinas on the method of distinction of kinds in synthesis with the findings of modern and contemporary science and philosophy. Analysis of the human activity of gardening will show that human beings, in fact, must possess species-specific capacities in order to garden, setting humans apart from other animals not merely in degree, but also in kind. Engaging with various branches of ecological, evolutionary, and anthropological science, we demonstrate that human capacities and modes of gardening are not simply incrementally different, but also fundamentally different in kind, from those of nonhuman creatures. In effect, with human gardening, humans have crossed a tipping point or threshold into a new domain of being or existence. Philosophically, we utilize the power-object model of division or definition along with Aristotle's categorization of knowledge to rigorously express the difference in kind between human beings and other animals. Human gardening is distinct from that of other animals as human beings must utilize powers or capacities distinguished in relation to their proper objects or ends in order to garden, and these powers, generally speaking, have being and abstract universal conceptual meaning as their object. In essence, the action of human gardening is not an arbitrary or extraneous capacity; it is constitutive of a proper act of the human organism. These responses allow us to set aside each major objection.

Allow us to imagine a new article in Question 75 of St. Thomas Aquinas's *Prima Pars*: *Treatise on the Human Being*, following article 1 (whether the soul is the body), and preceding articles 2 (whether the human soul is subsistent) and 3 (whether the animal soul is something subsistent). This article will be entitled "On the Distinction Between the Human Person and Other Animals: Whether the capacity to garden makes the human person distinct from other animals?" Given the lack of attention to human gardening in the literature, along with its significance for human evolution and Christian understanding, we believe that St. Thomas would find this inquiry most appropriate, especially in a contemporary context like ours where the very uniqueness of the human being in relation to the rest of creation has been called into question.

II

On the Distinction Between the Human Person and Other Animals. Article 1: Whether the Capacity to Garden Makes the Human Person Distinct from Other Animals? Objection 1: Biological Argument. It would seem that the capacity to garden does not make humans distinct from other animals, since contemporary science shows us that other animals, such as leaf-cutter ants, termites, ambrosia beetles, marsh snails, farmer ants, *Melissotarsus* ants, damselfish, spotted jellyfish, and the *Yeti* crab, also have the capacity to garden.[13] And while the advent of human cultivation was about 10,000–12,000 years ago after

[13] These cases are well-documented in the scientific literature. For select summaries of the scientific findings regarding animals that farm, see: Daniel Cossins, "Humans aren't alone in farming crops and meat" (January 2, 2015), from http://www.bbc.com/earth/story/20150105-animals-that-grow-their-own-food; Bryan Nelson, "Animals that Know How to Farm" (November 29, 2010), https://www.mnn.com/earth-matters/animals/photos/7-animals-that-know-how-to-farm/agricultural-animals; Bob Holmes,

the retreat of the last glaciers, these animals began farming long before that, even as long as millions of years ago.

The earth's first known farmers, and probably the most advanced in the nonhuman animal kingdom, are the leaf-cutter ants from Central and South America and the southern United States. They began growing their own food about 10 million years ago and have coevolved with fungi in an elaborate farming relationship: Specialized workers in the ant colony called "mediae" forage for plant material, cutting off pieces of leaf and bringing them back to the nest. There, another kind of specialized worker ant called a "minim" chews them up and composts them around fungi that are being cultivated in the nest. The ants then eat the fungi. So, rather than eating the leaves, as was long believed, it is now known that the ants collect the leaves to use as manure to fertilize their underground fungal farms.

Ambrosia beetles, marsh snails, and termites also cultivate fungus for food. Ambrosia beetles are bark borers, but they do not eat the bark as was once thought. Rather, they carve tunnels into decaying tree trunks, removing the sawdust and building chambers into which they deposit fungal spores stored in special receptacles on their bodies. In these chambers, the beetles carefully tend their fungal crop, which serves as food for larvae and adults. Marsh snails, living in the southeastern Unities States, eat fungus that they grow on grooves in cordgrass leaves; they cut the grooves with their tongue-like radula and fertilize these fungus fields by defecating into the grooves. Many termite species are fungus gardeners, their large mounds serving as incubators maintained at the perfect temperature for growing fungal food.

Some creatures cultivate algae or bacteria for food. Damselfish grow a species of algae that they eat and vigorously protect from potential predators. Spotted jellyfish grow algae inside their own tis-

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"Zoologger: The first nonhuman meat farmers" (June 30, 2011), https://www.newscientist.com/article/dn20630-zoologger-the-first-nonhuman-meat-farmers/.

sues and orient themselves toward the sun to maximize photosynthetic production of the algae. *Yeti* crabs grow bacterial food on their arms, swaying their claws in the water to bring nutrients to feed the bacteria.

There also seem to be cases of "domestication" in the insect world. For example, farmer ants herd aphids, caring for them and training the aphids not to release their rich honeydew until they are stroked and "milked" by the ants. The ants will also carry their aphids to new locations and protect them from predators, even clipping the wings of their "domesticated" aphids to prevent them from flying away upon reaching maturity. *Melissotarsus* ants of continental Africa and Madagascar apparently raise insects for meat, and it is thought that they have "domesticated" these insects by selecting the easier-to-digest ones without hard, inedible scales.

These species show clearly that human beings are not the only animals that farm, and science may well uncover more instances of nonhuman farming in the future.

Objection 2: Darwinian Argument: Degree vs. Kind. It would seem that any differences between the ways that humans and animals garden are only "of degree" and not "of kind." The progression toward this position in modern thought began in the comparisons of human and nonhuman animals by the philosopher David Hume (1711–1776). With respect to knowledge of nature and practical agency, Hume held explicitly that 'reason' was merely a matter of calculating to obtain what one instinctually desires, based on associative inference from one's past experience of repeatedly connected events ("matters of fact"). However, other animals also possess this capacity, though to a lesser extent, as is clear from observation of their behavior. Therefore, the difference is one of degree, not kind.[14]

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[14] The conflation of human and animal reason is incipient in the materialist philosophy of Thomas Hobbes (1588–1679). See *Leviathan*, Part 1, Ch. 6, ed. John Charles Addison Gaskin (Oxford: Oxford University Press, 1996). Hume develops the approach

Charles Darwin (1809–1882), the modern founder of evolutionary biology, extended Hume's approach, completely denying the difference in kind between humans and other animals.[15] As he developed his theory of natural selection and the notion that slow incremental changes (of degree) gradually accumulate to create new species, he applied the same concept to the evolution of human beings. In his book, *The Descent of Man*, written later in life, he asserted famously that "the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind."[16]

Many prominent researchers in comparative cognitive psychology and the biology of behavior have followed this line of thinking, which

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in *An Enquiry Concerning Human Understanding*, § 9 ("Of the Reason of Animals"), ed. Tom L. Beauchamp (New York: Oxford University Press, 2000), and also in *A Treatise of Human Nature*, reprinted from the Original Edition in three volumes and edited, with an analytical index, by Lewis Amherst Selby-Bigge, M. A. (Oxford: Clarendon Press, 1896), section 16 ("Of the reason of animals"), where he states that "…no truth appears to me more evident, than that beasts are endow'd with thought and reason as well as men." Hume does *profess* an in-kind difference with respect to human abstract demonstrative reason and moral judgment. However, his nominalism and his conflation of imagination and intellect (*Enquiry*, § 12), would commit him to a denial of in-kind difference. Regarding Hume's in-kind and in-degree treatment of the difference between humans and nonhuman animals, see, Tom L. Beauchamp, "Hume on the Nonhuman Animal," *The Journal of Medicine and Philosophy: A Forum for Bioethics and Philosophy of Medicine* 24, no. 4 (1999): 322–335.

[15] In the century after his death, Hume was widely influential in scientific circles. He influenced Darwin through contemporaries like geologist Charles Lyell (1797–1895) and astronomer John Herschel (1792–1871). See William B. Huntley, "David Hume and Charles Darwin," *Journal of the History of Ideas* 33, no. 3, Festschrift for Philip P. Wiener (Jul.–Sep., 1972): 457–470. Further, Darwin expresses that he read Hume in published and unpublished writings. Hume influenced and engaged Darwin with respect to his theory of causation and epistemology (empirical methodology) and, most relevant here, "on reason in animals." Sometime after the beginning of 1889, Darwin explicitly referenced Hume's treatment "On the Reason of Animals" in section IX of the *Enquiry*.

[16] Charles Darwin, *The Descent of Man*, p. 85 of e-book, https://charles-darwin.classic-literature.co.uk/the-descent-of-man/ebook-page-85.asp

distinguishes humans from animals only in degree and not in kind.[17] While they do not refer to the particular case of gardening, many researchers point to the fact that behaviors once thought to be unique to humans have now been observed in other animals. These include tool use, social and kinesthetic (or bodily) intelligence, language, and cognitively sophisticated behaviors like deception, self-control, decision-making, mourning, preplanning and ingenuity.[18] Even the roots of morality can be found in nonhuman species.[19]

Some of these researchers (though not all) acknowledge that the special capacities of other animals in these areas does not necessarily

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[17] See footnotes 1 and 2.

[18] *Ibid*. See also: Karline R. L. Janmaat, Leo Polansky, Simone Dagui Ban, & Christophe Boesch, "Wild chimpanzees plan their breakfast time, type, and location," *Proceedings of the National Academy of Sciences* (*PNAS*) 111, no. 46 (November 18, 2014): 16343–16348; Josep Call, "Representing Space and Objects in Monkeys and Apes," *Cognitive Science* 24: no. 3 (2000): 397–422; Josep Call, "Three ingredients for becoming a creative tool user. Chimpanzees plan their tool use," in *Tool Use in Animals. Cognition and Ecology*, ed. Crickette M. Sanz, Josep Call, and Christophe Boesch (Cambridge, UK: Cambridge University Press, 2013), 3–20; David DeGrazia, *Taking Animals Seriously. Mental Life and Moral Status* (Cambridge: Cambridge University Press, 1996); Frans B. M. de Wall, & Peter L. Tyack, *Animal Social Complexity: Intelligence, Culture and Individualized Societies* (Boston, MA: Harvard University Press, 2003); Donald R. Griffin, *Animal Minds: Beyond Cognition to Consciousness* (Chicago: University of Chicago Press, 2001); Mary Midgley, *Animals and Why They Matter: A Journey around the Species Barrier* (Middlesex: Penguin Books Ltd., 1983); Nicola S. Clayton, Timothy J. Bussey, & Anthony Dickinson, "Can animals recall the past and plan for the future?" *Nature Reviews Neuroscience* 4, no. 8 (2003): 685–691; Luke Rendell, & Hal Whitehead, "Culture in whales and dolphins," *Behavioral and Brain Sciences* 24 (2001): 309–382; Sue Savage-Rumbaugh, Stuart G. Shanker, & Talbot J. Taylor, *Apes, Language, and the Human Mind* (Oxford: Oxford University Press, 1998); Peter Singer, *Animal Liberation*. (London: HarperCollins, 1975).

[19] Melissa Hogenboom, "Part I: Humans are nowhere near as special as we like to think" (July 3, 2015), http://www.bbc.com/earth/story/20150706-humans-are-not-unique-or-special; Sarah F. Brosnan & Frans B. M. de Waal, "Monkeys reject unequal pay," *Nature* 425, no. 6954 (18 September 2003): 297–299.

mean that human cognition is not more advanced, only that these animals were precursors to humans in the evolutionary sequence. For example, in relation to tool use, we now know that the actual origin of tool use within the hominin lineage—as primitive as it was—dates back to long before humans, originating with a common ancestor between 12 and 23 million years ago.[20] The central argument of these scholars is encapsulated in the words of Dr. Irene Pepperberg, a researcher in the field of animal cognition at Harvard University: "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 humans."[21] Such conclusions from contemporary empirical research have served to verify the rejection of the difference in kind between animals and humans commenced by Hume and culminating in Darwin.

Others argue that, even if there is a cognitive gap between humans and their closest evolutionary relatives (the chimpanzees and bonobos), there is also a huge gap between chimps and other animals like ants or fish. How can one of these be a gap "in kind" and the other a gap only "in degree"? Further, if the difference between humans and apes is a difference of kind, when did the jump occur? On the contrary, evolutionary theory supports a slow, incremental transition from nonhuman to human in which cognitive complexity accumulated gradually by degrees over very long periods of time. This same reasoning

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[20] David B. Morgan and Crickette M. Sanz, "Ecological and social correlates of chimpanzee tool use," *Philosophical Transactions of the Royal Society* 368, no. 1630 (Nov. 2013): 20120416, doi: 10.1098/rstb.2012.0416; Morgan & Sanz, "New insights into chimpanzees, tools, and termites from the Congo Basin," *The American Naturalist* 64, no. 5 (2004): 567–581; Bijal Trivedi, "Chimps Shown Using Not Just a Tool but a 'Tool Kit'" (October 6, 2004), https://news.nationalgeographic.com/news/2004/10/1006_041006_chimps

[21] Irene M. Pepperberg, "Intelligence and rationality in parrots," in *Rational Animals?*, 269.

would hold for the development of complex human farming practices from more rudimentary ones in nonhuman animals and insects.

Objection 3: Genetic Argument. In a broader sense, modern genetics and the genome mapping project have shown that human persons share DNA with all life on earth. For example, mice and humans share virtually the same set of genes, and it appears that neither the mouse nor the human genome has undergone major changes since they shared a common ancestor 80–100 million years ago.[22] As reported by the National Human Genome Research Institute: "Of the approximately 4,000 genes that have been studied, less than 10 are found in one species but not in the other [mouse and human]… On average, the protein coding regions of the mouse and human genomes are 85% identical."[23] Humans share as much as 98.8% of their DNA with chimpanzees and bonobos, their closest relatives, from whom they diverged 4–7 million years ago.[24] (In comparison, humans generally share 99.9% of their DNA with other humans.)

Modern genetics thus reinforces that humans are more a part of nature than they are distinct from it. Humans are animals, and while they are different from other animal species (as are all species from one another), they are also biologically related to them and in continuity with them in a fundamental way.

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[22] Richard J. Mural, Mark D. Adams, Eugene W. Myers, et.al, "A Comparison of Whole-Genome Shotgun-Derived Mouse Chromosome 16 and the Human Genome," *Science* 296, no. 5573 (2002): 1661–1671.

[23] National Human Genome Research Institute, "Why Mouse Matters" (2010), https://www.genome.gov/10001345/importance-of-mouse-genome

[24] Ann Gibbons, "Bonobos Join Chimps as Closest Human Relatives," *Science* (June 13, 2012), http://www.sciencemag.org/news/2012/06/bonobos-join-chimps-closest-human-relatives; Galina V. Glazko & Masatoshi Nei, "Estimation of Divergence Times for Major Lineages of Primate Species," *Molecular Biology & Evolution* 20, no. 3 (2003): 424–434; The Chimpanzee Sequencing and Analysis Consortium, "Initial sequencing of the chimpanzee genome and comparison with the human genome," *Nature* 437 (1 September 2005): 69–87.

Objection 4: Nominalist Argument. From a philosophical standpoint, it would seem, even prior to any considerations particular to modern science, that the human being cannot be defined as there are no universal conceptions signifying the common natures or essences of particular individuals in the world. As Ockham's nominalism has taught us, rather, all that is common to a given set of individuals in the world is the name (the term 'nominalism' derives from the Latin word for name, *nomen*). This is because there is no principle of identity between one individual nature/essence and another and the conceptual meanings that we form of them in the intellect. To say that we can define the common nature of human beings requires that what is common and universal in the mind (as predicable of many) also not be common and universal but individual; and, vice versa, what is individual will be common and universal in the mind. This, however, is a manifest contradiction, and cannot be held.[25] Therefore, human beings cannot be defined as distinct from other animals in relation to gardening or any particular capacity.

Objection 5: Ecological Argument. An ecological issue arises when humans are viewed as fundamentally distinct from other animals in kind rather than in degree. Distinctiveness in kind reinforces the perception that human beings are separate from, and somehow dominant or superior to, the rest of the natural world.[26] Contemporary ecological and agricultural efforts would benefit greatly if humans understood

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[25] For treatments of Abelard and Ockham, see Julius R. Weinburg, *A Short History of Medieval Philosophy* (Princeton, NJ: Princeton University Press, 1964), 72–91 and 235–266. At *Summa logicae* 1, ch. 64, in *Opera philosophica* 1, 195, Ockham denies a common human nature and corresponding definition.

[26] The classic article, which has been widely cited since its publication in 1967, is one by Lynn White in which he rejects what he calls the "human-nature dualism" and unbalanced anthropocentrism that he argues is inherent in the Western worldview. See: Lynn White Jr., "The historical roots of our ecologic crisis," *Science* 155 (1967): 1203–1207.

themselves as related to other animals, along a continuum of cognitive complexity, rather than as distinct from them. This self-understanding could help human beings develop a sense of humility in relation to their place in the world, as well as encourage them to use their cognitive capacities to manage food and other natural resources in more responsible and respectful ways.[27]

III

On the Contrary (Sed Contra): Biological Argument for Human Uniqueness. In recent decades, many scholars in different branches of the natural and social sciences have noted the exceptional cognitive capacities of human beings, as well as their unique capacity for complex language, linguistic communication, advanced culture, and innovation.[28] They argue that there is a qualitative difference—a fundamental discontinuity—between humans and other animals. While they do not refer to the practice of gardening or agriculture, scientific publications by researchers working in multiple disciplines have substan-

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[27] This view is prominent in such contemporary environmental movements as deep ecology (see the writings of Arne Næss, George Sessions, and Bill Devall), the writings of some preservationists like Aldo Leopold or Edward O. Wilson, as well as more recently in certain sustainability literature. See also the work of environmental philosopher Kathleen Dean Moore, for example: "Leaping Lisards! What Might It Mean to Recognize the Rights of Nature?" in *Minding Nature* 7, vol. 7, no. 2 (Spring 2014): 12–17.

[28] See, for example: J. Henrich, *The Secret of our Success: How Culture is Driving Human Evolution, Domesticating our Species, and Making Us Smarter*. Princeton: Princeton University Press, 2015); P. Richerson & R. Boyd, *Not By Genes Alone: How Culture Transformed Human Evolution* (Chicago: University of Chicago Press, 2005); M. Tomasello, *The Cultural Origins of Human Cognition* (Cambridge, MA: Harvard University Press, 1999); E. Jablonka & M. J. Lamb, *Evolution in four dimensions: genetic, epigenetic, behavioral and symbolic variation in the history of life* (Cambridge, MA: MIT Press, 2005).

tiated such distinctive human qualities as higher-order cognition, cumulative culture, sociocultural niche construction, and imagination.[29] In "Darwin's Mistake", for example, the authors argue that "Darwin was mistaken: the profound biological *continuity* between human and nonhuman animals masks an equally profound *discontinuity* between human and nonhuman minds."[30] They propose that, although there are striking similarities between how human and nonhuman animals' learn and act, there is "compelling evidence of an absence" of higher-order cognition (such as generalizing, making analogies, abstracting concepts, or postulating hypotheses of cause and effect) in nonhuman animals. Other researchers propose that humans have a unique capacity for cumulative culture that surpasses those of nonhuman animals in terms of the complexity, number, pace, and adaptiveness of innovations.[31] Humans also possess an unprecedented

[29] For examples of each of these four, see: Derek C. Penn, Keith J. Holyoak, Daniel J. Povinelli, "Darwin's mistake: Explaining the discontinuity between human and nonhuman minds," *Behavioral and Brain Sciences* 31 (2008): 109–178; Andrew Buskell, "What makes humans special?" (3 March 2016), http://www.lse.ac.uk/philosophy/blog/2016/03/03/what-makes-humans-special/; Erle C. Ellis, "Why is Human Niche Construction Transforming Planet Earth?" in "Molding the Planet: Human Niche Construction at Work," eds. Maurits W. Ertsen, Christof Mauch, & Edmund Russell, *RCC Perspectives: Transformations in Environment and Society* 2016, no. 5, 63–70; Erle Ellis, Peter Richerson, Alex Mesoudi, Jens Christian Svenning, John Odling-Smee, and William R. Burnside, "Evolving the human niche," *Proceedings of the National Academy of Sciences* (*PNAS*) 113, no. 31 (August 2, 2016): E4436; Agustin Fuentes, *The Creative Spark: How Imagination Made Humans Exceptional* (New York: Dutton, 2017), "The Extended Evolutionary Synthesis, Ethnography, and the Human Niche: Toward an Integrated Anthropology," *Current Anthropology* 57, no. 13 (June 2016): S13–S26; Kevin N. Laland, Tobias Uller, Marcus W. Feldman, Kim Sterelny, Gerd B. Müller, Armin Moczek, Eva Jablonka, and John Odling-Smee, "The extended evolutionary synthesis: its structure, assumptions and predictions," *Proceedings of the Royal Society of Biology* 282 (August 2015): 20151019.

[30] Penn, Holyoak, and Povinelli, "Darwin's mistake."

[31] See Buskell, "What makes humans special?" and footnote 28.

capacity for "sociocultural niche construction," imagination, cooperation, and symbolic thinking which has allowed humans to progressively transform the entire planet.[32]

On the Contrary (Sed Contra): Philosophical Argument for Human Uniqueness. In the history of ancient and medieval philosophy, Plato, Aristotle, St. Augustine, and St. Thomas Aquinas—just to name a few of the most highly regarded philosophers—all held that there is a difference in kind between human beings and animals.[33] Contemporary philosophers in the Hermeneutic, Phenomenological, Analytic, Thomistic, and Semiotic schools have also continued this tradition, bringing to light through various arguments the fundamental difference between human beings or persons and other animals.[34]

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[32] See footnotes 27 and 28.

[33] See *Republic* 1, 4, and 5–7, where Plato develops a definition of the human soul as that which not only possesses sensual appetite and spirit/irascible-emotion, but reason. See Aristotle, *De anima*, 2.1–4, where Aristotle divides organic living beings into the classes of nutritive (plant), sense-perceptive (animal), and rational. This division will be treated in more detail below. See, St. Augustine, *De libero arbitrio*, 1, 7.16–12.22. See St. Thomas Aquinas, *Sentencia libri de anima* 2, lect. 3; *ST* 1, q. 75, a. 3.

[34] See, for example, in order of the schools listed: Charles Taylor, *The Language Animal: The Full Shape of the Human Linguistic Capacity* (Harvard University Press, 2016); Robert Sokolowski, *Phenomenology of the Human Person* (New York: Cambridge University Press, 2008); Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology*, seventh essay, "Image-Making and the Freedom of Man" (Chicago, IL: Chicago University Press, 1996), 157–175; Alasdair McIntyre, *Dependent Rational Animal*; William A. Wallace, *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis*, Part I, Ch. 5 (Washington, D.C.: The Catholic University of America Press, 1996); Marie George, "Thomas Aquinas Meets Nim Chimpski" and "Humans and Apes: On whether Language Usage, Knowledge of Others' Beliefs, and Knowledge of Others' Emotions Indicate that They Differ when it comes to Rationality," in *Reading the Cosmos: Nature, Science, and Wisdom*, ed. Guiseppe Butera (Washington D.C.: American Maritain Association Publication distributed by Catholic University Press, 2012), 163–191; John Deely, "Animal Intelligence

On the Contrary (Sed Contra): Theological Argument for Human Uniqueness. Finally, in theology, there are long-standing arguments for the uniqueness of the human person in creation. The Catholic Intellectual Tradition has clearly asserted that humans have a particular place in creation: they are a unique combination of the physical world and the spiritual world, a union of a physical body and a spiritual soul, in a way that nonhuman animals are not.[35] Beginning in Genesis, when God distinguished humans from the rest of creation by giving them the mission to steward creation and utilize plants and animals for their sustenance, humans have been set apart from the rest of creation. As part of their Christian vocation, humans are to respect and care deeply for animals and the rest of creation, but with the awareness that "none of the animals can be man's partner."[36] From this perspective, humans are essentially different "in kind" and not just "in degree" from the other animals.

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and Concept Formation, *The Thomist: A Speculative Quarterly Review* 35, no. 1, (January 1971): 43–93, and *Semiotic Animal: A Post Modern Definition of "Human Being" Transcending Patriarchy and Feminism* (South Bend, IN: St. Augustine's Press, 2010); Daniel De Haan, "Approaching other Animals with Caution: Exploring Insights from Aquinas's Psychology," in *New Blackfriars* 100, no. 1090 (November 2019): 715–737; Thomas A. Sebeok, "Language: How Primary a Modeling System?," in *Semiotics* (1987), 15–27. See also, Kass, *Toward a More Natural Science*, Ch. 10, "Teleology, Darwinianism, and the Place of Man: Beyond Chance and Necessity?", 249–275; Robert Spitzer, S.J., *The Soul's Upward Yearning: Clues to our Transcendent Nature from Experience and Reason* (San Francisco, CA: Ignatius Press, 2015).

[35] *Catechism of the Catholic Church* (2003), http://www.vatican.va/archive/ENG0015/_INDEX.HTM, paragraphs 355–373. See also, St. Thomas Aquinas's treatise on the human being, *ST* 1, qq. 75–90 and 1–2 qq. 6–14. Thomas expresses that the human soul is distinct from that of other animals as it is immaterial intellect, incapable of physical corruption, and that, as such, it is capable of perfect free voluntary agency. For St. Thomas, these attributes set the human person apart as specially created in the image and likeness of God.

[36] *Ibid.*, paragraph 371.

IV

I Respond That (*Respondeo*). The ability to garden is a unique capacity that distinguishes human persons from other animals. As this particular capacity has been unexplored in the literature, we wish to contribute to the ongoing dialogue about human uniqueness by demonstrating that the capacity to garden provides a compelling case for the distinctiveness of humans in both degree and kind.

First Response: Distinction between Difference in Degree and Difference in Kind. In terms of Aristotle's classic treatment of definition (*Categories*), "degree" pertains to a contrast under the category of quantity, while "kind" generally refers to a contrast under the categories of quality and action. So, as Adler says, "two entities differ in degree if both have the same defining traits, but one has more and one has less of the same trait. When the difference in kind cannot be reduced to a difference in degree, it remains a difference in kind."[37] A difference in kind therefore represents a substantive, qualitative, and radical difference between two entities, not just an apparent or superficial one. Importantly, things can be similar in kind in one respect *generically*, but different in kind in another respect *specifically* through some *differentiating* feature. To use an example in the realm of artifice, if one of two cars is slower than the other, and both are built for speed and victory on the track, the cars differ in degree but not in kind as they are both racecars. If, however, one of the vehicles was constructed for carrying 50 passengers, and not for competitive racing, we take it as different in kind—*specially*—(though under the same genus) from the racecar. Here, we can already see that one of the difficulties in discerning a "difference in kind" is that "kind," when taken

[37] Mortimer J. Adler, "On Man," *Adler's Philosophical Dictionary* (1995), http://www.thegreatideas.org/apd-man.html.

generically or specifically, has a certain relativity and plasticity about it.[38] The racecar and the bus are of the same kind, in a sense, as they belong to the same genus: vehicle. On the other hand, in terms of their respective form and function, they are specifically different: one is a racer while the other is a mass-transporter. From the outset, then, it is important to note that many classes of individuals might be generically the same, but specifically different.

Having this understanding of the classical sense of the terms "genus" and "species,"[39] let us now see the application of these principles in terms of a biological example, close to the theme of this article. Charles Darwin himself used this approach in his original formulation of the theory of natural selection. On the voyage of the Beagle, he collected bird specimens from the Galápagos Islands as part of the collecting expedition. It was not until he returned to England that he realized, on pondering the shape of their bills, the location where the specimens were collected, and the food sources available, that their beak characteristics varied depending upon the food source present on the island. Because of this difference in bill morphology and function, the finches were eventually identified as different and distinct biological species, as shown in Figure 1. The different species of birds were understood to be different in kind and not merely in degree (even as they belong to the same broader genus, *Geospiza*).

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[38] The word 'kind' is Germanic, from 'kin,' meaning race. Its meaning, then, is etymologically identical to 'genus' from the Greek γένος/*genos*, whence we have the English 'genus,' meaning 'race, family' and then 'class or sort.'

[39] See, again, Aristotle's *Categories*, 1–5, especially 3, and also Porphyry's *Isogoge*. As Aristotle expresses in chapter 3 of *Categories*, generic attributes are always predicable of lower species and the ultimate subjects/individuals, whereas specific features are not predicable, in the reverse direction, of higher order genera.

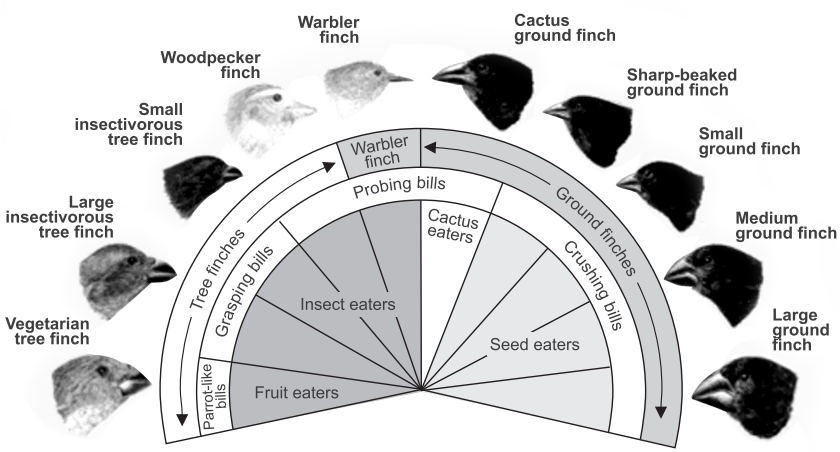

FIGURE 1. Darwin's finches[40]

Notice that, in both the artificial and biological cases, we understand a difference in kind by grasping differing structures or forms in individuals that give rise to distinct capacities or powers ordered toward distinctive activities. The bus is a different kind of vehicle than the car because of structural design, engine type, etc.: it is much longer as it has a fifty-person seat capacity (as opposed to two), has doubled rear tires, a more powerful engine in terms of load capacity, and it is also less swift and agile. The way the materials of the bus are organized in terms of its body, engine, seats, etc., gives rise to its distinct capacity to transport large numbers of passengers, and it is different in both its capacity and form than the racecar for these obvious reasons. Similarly, one species of Darwin's finches is distinct from another because of its distinctive beak shape and size as adapted to different food sources and, thus, correspondingly distinct food gathering functional behaviors.

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[40] "PBS Evolution Library for Teachers and Students," https://www.pbs.org/wgbh/evolution/library/01/6/l_016_02.html.

One might object, here, that the large, medium, and small ground finches are, along with the large and small insectivorous tree finches, not actually different in kind according to this model, as the differences in their beak shape and form are superficial and not really illustrative of a substantive difference in kind. In response to this objection, we would first point out that these finches are biologically and genetically different in kind as they are incapable of cross breeding. Thus, the form and structure of these birds' genetic makeup makes them different in kind in terms of the reproductive function. Second, our example is sufficient to illustrate the validity of the model even at the phenotypic level, as it does include clear cases of differences in kind by appeal to morphological and not merely quantitative differences. These morphological differences are clearly manifest, for example, by comparing the beak of the warbler finch to those of the rest of the finches, and especially to that of the large ground finch. The qualitative differences in these beaks are functionally ordered to the food gathering behaviors in which each finch species engages, respectively, and they are morphologically distinct, not simply a gradation of size along a continuum, as they would be if the difference were only in degree. The order and practice of the entire lives of these birds depends upon these morphologies. To understand that this is no superficial difference, again, simply consider what would likely happen if the food sources to which the warbler finch's morphology are suited disappeared, while those for the large ground finch remained. For the former species, this difference in kind likely means extinction![41]

[41] As will be made clear below, not all differences in kind can be reduced to an observable morphology, as in the case of the finch example. This is because there are differentiating capacities, e.g., the intellectual capacity, which cannot be reduced to a material form or *skhēma*, to use an Aristotelian distinction. Nonetheless, there are many examples in nature, which are better known to us, where differentiating functional-activities are directly connected to observable morphological features. Aristotle himself gives

In fact, this approach to distinguishing beings in kind by identifying powers/capacities in relation to their acts (objects) constitutes a model of definition or division first put forward by Plato and then developed and perfected by Aristotle. We call this the power-object model of definition.[42] As already indicated, the model discerns difference in kind by identifying an activity as the correlative object or end of a morphological disposition constituting a power or capacity. The model is functional and purposive as it holds that formal or morphological features of living beings are ordered toward the normative activities of the beings as their end. While teleology received much opposition with the rise of reductive materialism and positivism in the modern period, philosophers of science and biologists doing philosophy pertaining to the life sciences now recognize the necessity of teleology in biological explanation and have successfully defended the Aristotelian approach.[43] Empirical research seeking to identify defining attributes in individual living beings such as

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us such an example, connecting the long-legged, long-toed (as opposed to webbed) feet morphology of a bird species to its normative marsh-dwelling behaviors. See *De partibus animalium* 4.12 (649b11–17).

[42] We are inspired to use the descriptive phrase "power-object model" by William Wallace, *The Modeling of Nature*, especially pages 157-189. In Plato, see *Phaedrus* (270c9–d7 and 245c2–4), and *Sophist* (247d8–247e4). Aristotle adopts this model and develops it for biological division in *De partibus animalium* 1–2. He utilizes it in his generic division of living organisms in *De anima* 2.1–4. For a rigorous textual account of this topic, see Daniel Wagner, *Φύσις καὶ τὸ ἀνθρώπινον ἀγαθόν: The Aristotelian Foundations of the Human Good* (dissertation, available through ProQuest).

[43] For the relevance of the Aristotelian approach to natural explanation, see Wallace, *The Modeling of Nature*; Joe Sachs, *Aristotle's Physics: A Guided Study* (New Jersey: Rutgers University Press, 1980), 17–25; Jacob Klein, "The World of Physics and the 'Natural' World," in *Jacob Klein: Lectures and Essays* (Annapolis, Maryland: St. John's College Press, 1985), 1–34. On the need for teleology or "final causality" in contemporary biology, see Jonas, *The Phenomenon of Life*, especially 33–37; Kass, *Toward a More Natural Science*. On teleology in contemporary science, see Ernst Mayr, "The Idea of Teleology," *Journal of the History of Ideas* 53, no. 1 (Jan.–Mar. 1992): 117–135; Michael Chase, "Teleology and Final Causation in Aristotle and Contemporary Science," in

these proceeds from the observation of activities/behavior taken as effect[s], which are better known to us at first, to the connection of these acts to the capacity nested in organic form.[44] This is precisely the approach we are taking here in relation to our analysis of the activity of human gardening as reflective of a distinctive human capacity.

This model of division was used by Aristotle to generically divide the living from the non-living as organic and inorganic, and then plants, animals, and humans. Looking to the activities of (i) nourishment (including homeostasis and metabolism), growth, and reproduction, (ii) sense-perceptive awareness, and (iii) intellection, Aristotle divides plants, animals, and human beings by difference of kind.[45] These natural beings are not simply different by degree, but they differ by being in possession of categorically other functional capacities. Most generically, all living beings share in common the possession of organic parts constituting the capacities for nutrition (homeostasis), growth, and reproduction. Then, there are living beings in possession of these capacities and sense-perceptive capacities ordered to their proper objects, e.g., as sight is ordered toward the activity of making color and shape present to the awareness of the animal. Generically speaking, sense perception is the act whereby a physical organ makes some object present to the awareness of the animal. Sense perception,

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Dialogue 50 (2011): 511– 536; Harold J. Morowitz, *Entropy and the Magic Flute* (London: Oxford University Press, 1993), 153–154 as cited by Chase, 521; Michael W. Tkacz, "Neo-Darwinians, Aristotelians, and Optimal Design," *The Thomist* 62, no. 3 (July 1998): 355–372, "The Retorsive Argument for Formal Cause and the Darwinian Account of Scientific Knowledge," *International Philosophical Quarterly* 43, no. 2 (June 2003): 159–166, and "Thomistic Reflections on Teleology and Contemporary Biological Research," *New Blackfriars* 94, no. 1054 (Nov. 2013): 654–675.

[44] *De anima*, 1.1 (402b16–25).

[45] See: *De anima* 2.1–4. The fact that some beings fall between the divisions in no way dissolves them, but actually enforces them logically. This is because proper identification of a natural being that lies 'between' the division, say a plant which displays some sense-perceptive behavior, presupposes the defined classes into which its attributes fall.

in its connection to pleasure and pain, also gives rise to voluntary animal behavior. Finally, human beings possess not only the nutritive (i) and sense-perceptive capacities (ii), but also the capacity of intellect as ordered to its proper object, abstract universal understanding.[46] In turn, this gives rise to free or deliberate voluntary agency in human beings who, knowing their ends and themselves as the causes of their acts, are capable of choosing between alternative acts and are not determined to the ends they seek.[47] Below, we will say more regarding the difference between human intelligence and animal cognition.

A related question that needs to be addressed is whether progressive degrees of difference can eventually become a difference in kind. To answer this, it is helpful to refer to the concept of ecological resilience originally developed by C. S. Holling and based in complexity theory.[48] Ecological resilience measures how much disturbance can be sustained by a particular ecosystem before a radical change in system identity occurs.[49] A "ball-in-cup" diagram such as the one shown in Figure 2 illustrates the concept.[50]

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[46] For a contemporary defense of Aristotle's division of the grades/levels of soul with their genetic and hierarchically ascending relation in the context of modern biology and the theory of evolution, see Jonas, *The Phenomenon of Life*, 2, and especially essay four, "To Move and Feel: On the Animal Soul," and Kass, "Teleology, Darwinism, and the Place of Man," in *Toward a More Natural Science*, 270–272.

[47] See: Aristotle, *Nicomachean Ethics* 3.1–4 and St. Thomas Aquinas, *ST* 1–2, qq. 6 and 12–14.

[48] For more on ecological resilience and its explanatory power, see: Sr. Damien Marie Savino, FSE, *The Contemplative River: The Confluence between People and Place in Ecological Restoration* (VDM Verlag, 2008).

[49] Crawford S. Holling & Lance H. Gunderson, "Resilience and Adaptive Cycles," in *Panarchy: Understanding Transformations in Human and Natural Systems*, eds. Gunderson and Holling (Washington, DC: Island Press, 2002), 25–62.

[50] "Difference between Engineering, Ecological, and Social-Ecological Resilience" (February 21, 2016), https://soroushmz.wordpress.com/2016/02/21/3-difference-between-engineering-ecological-and-social-ecological-resilience

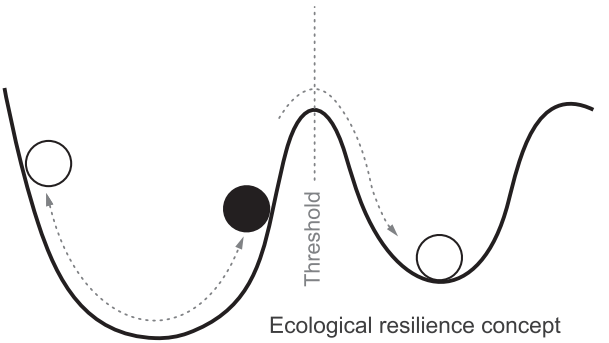

FIGURE 2. "Ball in Cup" Diagram of Ecological Resilience

In response to gradual changes (i.e., of "degree"), the ball moves up and down in the first cup, but when disturbances to the ecosystem accumulate over time to a particular threshold point, a small disturbance can "flip" the ball into the second cup (or stability basin). In the resilience literature, this represents a "catastrophic shift" in the ecosystem. This ecological shift is very difficult, if not impossible, to reverse. An example is when a lake eutrophies from one ecological state (clear) to a radically different one (turbid), sometimes as quickly as overnight, after years of gradual changes in response to fertilizer inputs.

While not a perfect analogy, this image can assist in envisioning the distinction between degree and kind. Many small changes in degree can bring a system to a threshold that when crossed results in an irreversible difference in kind. While the two states, or stability basins, are related, they represent a difference in both degree and kind. Just as gradually increased movement of the ball over time eventually results in its radical relocation to a new cup, so also gradual changes in qualitative features can result in radical changes in kind. Applying the analogy to evolution presents an image of evolutionary processes that unfold over long periods of time, with extended periods of small, incremental changes punctuated by radical discontinuities.

Indeed, as Marie George has pointed out, evolutionary gradualism is not incompatible with the claim that there are radical differences and discontinuities between humans and their ancestors. To make her point, and following the psychologist Clive Wynne, George appeals to an example given by contemporary psychologist and linguist, Steven Pinker. Pinker's example is that of the relation and difference between the elephant and its closest living biological relative, the hyrax (a "guinea-pig-like mammal").[51] These two species have a common genetic ancestor, share about 90% of their DNA, and have speciated through gradual morphological adaptations, but this does not change the fact that there is radical qualitative difference between them, not reducible to difference in degree. The elephant has a tubular, six-foot long trunk for a nose, which, *inter alia*, allows it to pick up trees, move them and stack them, and shower its back with water. While the hyrax does have nostrils, it is incapable of performing these functional actions with its nose. Perhaps the difference occurred through gradual accumulation of the trunk from members of parent species to their progeny. This does not change the fact that there is a difference in kind, here and now, between particular animals expressing the elephant morphology and those expressing the hyrax morphology. An analogous argument could be proposed in relation to the question of the difference in kind between humans and the chimps, their closest evolutionary ancestor.

Second Response: Distinction in Kind Utilizing Aristotle's Categorization of Knowledge. By examining and analyzing the human activity of gardening, it becomes clear that human beings utilize capacities as gardeners that other animals do not use in their gardening-like

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[51] See: George, "Humans and Apes" 163, note 1, and 166–167, note 10. As cited by George, see Clive Wynne, *Do Animals Think?* (Princeton, New Jersey: Princeton University Press, 2004), 42–43; and Steven Pinker, *The Language of Instinct* (New York, NY: HarperCollins Publishers, 2007).

behaviors—which is also to say that gardening, properly speaking, is a species-specific activity of human beings. To achieve this understanding, it is helpful to refer to Aristotle's categorization of knowledge in *Nichomachean Ethics* VI. Here the Philosopher describes three types of knowledge: *techné* (τέχνη), *phronesis* (φρόνησις), and *episteme* (ἐπιστήμη).[52] *Techné* translates to craftsmanship or art and refers to knowledge ordered to the production of material goods; it is pragmatic knowledge which employs instrumental reasoning to make or produce something. The English word, "technology," derives from this Greek root. *Phronesis* is practical wisdom or prudence; it is an understanding, not only of universal moral norms, but of the particulars of given circumstances such that the good can be obtained by deliberation. *Episteme* means, most properly, "science;" it is theoretical, demonstrative knowledge of universal causes of facts.[53] The English word, "epistemology," meaning the study of knowledge, comes from the Greek ἐπιστήμη/*episteme*. Human uniqueness in the exercise of these three types of knowledge will now be addressed.

In relation to *techné*, or technical knowledge, it is clear that humans garden in a way that is distinct from other animals. First, humans farm multiple crops, while animals typically specialize in one. This shows that humans understand the nature of gardening *qua* gardening (universally), and are thus capable of extending their gardening activities beyond a singular garden type behavior that might otherwise simply be determined by instinct. Humans have also domesticated and implemented selective breeding programs for multiple plant and animal species, while other animals do not do so in such a far-reaching manner. Humans have even gone so far as to genetically manipulate plants and animals in order to create GMOs, new breeds of meat and dairy

[52] *Nicomachean Ethics* 6.3–13.

[53] On τέχνη and ἐπιστήμη in Aristotle, see also *Metaphysics* 1.1–2 and *Posterior Analytics* 1.2.

cattle, etc. The ability to manipulate plants genetically in this manner requires that the agent doing so has the capability to grasp what the plant is in its being itself and then reason about cause-and-effect relations given this meaning. Desired plant features are understood as a sub-kind of a given species and selected for various physical forms of manipulation.

A similar pattern of complexification in *techné* is manifested in the development and use of tools. Although some animals like chimps and crows use tools, they have not developed advanced (and now even computerized) technologies like plows, tractors, irrigation systems, seeders, milking equipment, etc. These tools have been produced based on knowledge of what the task is, along with relevant materials, and how it can best be accomplished in terms of cause-and-effect relations.

In addition, humans evaluate the functioning of agricultural technologies and attempt to devise improved solutions in an iterative and hyper-cooperative manner. Current technologies are the result of widespread human cooperation and building upon previous knowledge, expressed and recorded in propositional-linguistic form, over broad ranges of time and space. What has taken most animals millions of years to develop has increased in complexity rapidly in human communities in just thousands of years. As Fuentes states: "Humans have a great capacity to ratchet up, or scaffold, information. …Other animals do some ratcheting and scaffolding, but they lack the human combination of discovery, innovation, cooperation, and information transfer. Human cognitive capacities and manual dexterity (our brains and hands) and our hyper-cooperation give us a broader range of ways to manipulate the world relative to other species."[54]

In relation to agriculture, consider the level of *techné* necessary for the development of technologies of food production, security, trans-

[54] Fuentes, *The Creative Spark*, 253.

portation, preparation, and consumption; the complexity and synergy of these systems far exceeds that of other animals. Nonhuman animals do not have the capacity to cook foods, to develop recipes and share them, to sell food and to create local and global economic markets surrounding food. Humans have the capacity for organization and creativity, for pushing the limits and imagining new futures, and for developing whole cultures around gardening and agriculture in ways that do not exist in nonhuman animals. The empirically given fact of these differences is explained by appeal to *techné* as following on the capacity of intellect.

Human communities have responded to the widespread and complex application of technical knowledge with *phronesis*, or practical wisdom and ethics, in order to discern the best uses and impacts of those technologies in particular situations. While there may be seeds of morality in the most cognitively advanced animals—such as chimps who evidence a sense of fairness, helpfulness, and sharing—the ability to make moral judgments and act upon them (or not) is unique to humans.[55] Numerous researchers have found that the higher apes are not able to make moral judgments about the behavior of other animals.[56] For example, Dr. Jerome Kagan, pioneer of developmental psy-

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[55] Judith M. Burkart, Rahel K. Brügger, and Carel P. van Schaik, "Evolutionary Origins of Morality: Insights from Nonhuman Primates," *Frontiers in Sociology* 3 (July 2018): 17; Jerome Kagan, *Three Seductive Ideas* (Cambridge, MA: Harvard University Press), 1998; Richard A. Shweder, "Humans Really are Different," Science 283 (1999): 798–799; Michael Gazzaniga, *Human: The Science Behind What Makes Your Brain Unique* (New York: HarperPerennial, 2008); Francisco Ayala, "The difference of being human: Morality," *Proceedings of the National Academy of Sciences* (*PNAS*) 107 (May 11, 2010): 9015–9022; Michael Tomasello, *A Natural History of Human Morality* (Cambridge, MA: Harvard University Press, 2016).

[56] Keith Jensen, Josep Call, & Michal Tomasello, "Chimpanzees Are Vengeful But Not Spiteful," *Proceedings of the National Academy of Sciences* (*PNAS*) 104, no. 32 (2007): 13046–13050; Katrin Riedl, Keith Jensen, Josep Call, & Michael Tomasello, "No third-party punishment in chimpanzees," *Proceedings of the National Academy of*

chology, points out: "Not even the cleverest ape could be conditioned to be angry upon seeing one animal steal food from another."[57] The reason, we take it, that animals do not display such moral behavior, is that they lack the powers of intellect and will and, consequently, the ability to understand universal moral norms and to reason in conjunction with them regarding particular circumstances. In this case, the animal would have to grasp justice and 'what is due' in universal terms in order to have the consequent (human emotion) of indignation.

Humans, on the other hand, are concerned with right and wrong and about the long-term consequences of their actions, as well as the actions of others. In relation to farming, they care about such questions as whether food is equitably distributed, whether farm workers are treated fairly, whether persons are starving, whether the land is being polluted or soil fertility is being compromised, etc. Not only do they care about such questions, but they modify their actions in response to what they reason is for the common good.

Humans generally feel anger at disruptions or inequity in relation to the practice of farming and growing food. They demand restitution and seek to develop measures to protect or provide for persons who are underprivileged, starving, or treated unfairly. Understanding, universally, that all humans have a right to nourishment—are due food—they act accordingly given particular circumstances. They pursue ways to limit large multinational corporations who exploit others or the land. They consider which agricultural practices have positive and which have negative effects and test out new ideas to improve them.

Not only that, but humans are also capable of *not* acting in a moral way. No other animal species is capable of the moral depravity found

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Sciences (*PNAS*) 109, no. 37: 14824–14829 (2012); Daniel J. Povinelli, *Folk Physics for Apes: The Chimpanzee's Theory for How the World Works* (Oxford: Oxford University Press, 2003).

[57] Kagan, *Three Seductive Ideas*, 158.

in human life, nor is any other species capable of disrupting natural cycles to such a dramatic extent on a global scale. This is because only an animal intellectually aware of a universal moral norm can be responsible for violating it. Humans alone are capable of the widespread destruction associated with desertification, soil erosion, pesticide contamination, and other environmental and agricultural disasters. Nonhuman animals do not have the freedom to choose this level and kind of destructive activity, or to practice it, as they are not intellectually aware of themselves as causal agents responsible for their effects.

According to Daniel J. Povinelli from the University of Louisiana's New Iberia Research Center: "Humans constantly invoke unobservable phenomena and variables to explain why certain things are happening. Chimps operate in the world of concrete, tangible things that can be seen. The content of their minds is about the observable world."[58] Humans, on the other hand, ask why and reflect on general, universal principles. They are capable of naming, organizing, and studying plants and animals in ways that other animals cannot. Using their gift of *episteme*, humans have developed the sciences of agronomy, horticulture, animal husbandry, botany, agricultural economics, organic farming, sustainable agriculture, and agricultural chemistry, to name a few. Whole universities are devoted to providing courses of study and training in these faculties.

Humans envision, design, and build technology (*techné*) and have the capacity to farm for the benefit of the common good (*phronesis*). From experience and action, they are able to generalize knowledge of

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[58] Povinelli, "Animal Self-Awareness: A Debate – Can Animals Empathize?" *Scientific American Presents: Exploring Intelligence* 9, no. 4 (1998): 66–75. St. Thomas Aquinas and Aristotle held that sense-cognition was limited to the apprehension of particulars of sensation and that animals with this power alone are limited to calculative acts of association (they cannot properly reason, which requires the apprehension of universals, abstract and separate from the particulars).

abstract principles and laws (*episteme*) which enable them to better comprehend the world around them and share it with others. No other animal is capable of such coordinated understanding, deliberation, and action.

Importantly, all three forms of knowledge are second order capacities that follow on the first order intellectual capacity, as they share three fundamental acts of the intellect: concept formation, judgment, and reasoning.[59] After sense-perceptive experience of individual beings in the world, human beings form conceptual meanings that are free, separated, or abstracted from individual material conditions. These are universal meanings not reducible to matter as extended and individuated.[60] This is possible as the meaning of sensed objects for human beings goes beyond benefit (attraction) and harm (repulsion)—the type of meaning necessary for estimative or instinctual behavior ordered to survival—extending in orientation to the being or existence of the object in itself. The human knows the tomato not merely as attractive for satisfaction of hunger (as does a squirrel), but he is also

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[59] The most generic intellectual concepts and acts of judgment are treated by Aristotle in *Topics* and *Categories*. Valid forms of syllogistic reasoning and the material conditions (soundness) for demonstrative reasoning are treated in the *Prior* and *Posterior Analytics*. Inductive type reasoning and division used for knowing first principles (definitions) is generically treated in *Posterior Analytics* 2 (especially, chapters 13–14 and 19) while *De partibus animalium* 1–2 treats the division of animal kinds. The three acts of the intellect are explicitly recognized by St. Thomas in *Expositio posteriorum*, lib. 1. First order capacities are powers that are the ontological or entitative perfection of the human. They are the primary end of ontogenesis. Second order capacities are operative powers that arise in the human from the exercise of first order capacities and the formation of perfective habits/states/dispositions. As we have shown, farming is a second order capacity constituted by a unique formation of the habits of *techné*, *phronesis*, and *episteme*. On the distinction between entitative and operative perfection, see Wallace, *The Modeling of Nature*, 163–168 and 185–189.

[60] See: *Categories* 5 (3b10–18). See also, *De anima* 3.4–6, and St. Thomas' commentary on the text.

aware of its existence in itself. This is why the human person can wonder about what it is and give an account extending from its basic phenomenal attributes to its elemental and atomic composition. Moreover, grasping the being of things in this manner, humans not only know things in the world and their meaning through concepts, but also in turn make concepts/meanings into objects of knowledge in themselves.[61]

Related to this capacity are the intellectual possibilities for grammar, syntax, and the proper linguistic expression of the being of things through meaning in propositional statements.[62] For example, while animals are able to communicate intentional meaning, they do not comprehend grammatical syntax. The linguist and philosopher of language, Noam Chomski, formulated a brilliant test for syntax comprehension: animals that grasp syntax should be able to understand the

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[61] By the intellect, human beings make concepts into objects of knowledge themselves, and form concepts of concepts (Logic). Humans and animals use signs (percept or concept meaning) to act in and relate to the world. However, humans are aware of sign use and signs themselves, so that they make the sign an object in itself and form signs about signs. "Semiotic" then is referred to this latter capacity while mere animal use of percepts is "semiosis." See John Deely, *Semiotic Animal*, and *Intentionality and Semiotics: A Story of Mutual Fecundation* (Chicago, IL: Scranton University Press, 2007). Helpful treatments of this topic are also given by Brian Kemple in "Signs and Reality: An Advocation for Semiotic Realism," *Reality* 1, no. 1 (Fall 2019): 11, and De Haan, "Approaching Other Animals with Caution."

[62] See: Sokolowski, *Phenomenology of the Human Person*, parts 1–2; George, "Thomas Aquinas Meets Nim Chimpski," and "Humans and Apes;" Spitzer, *The Soul's Upward Yearning*, 133–139. As Spitzer details, the scientists Allen, Gardner, and Van Cantfort claimed to have taught a chimpanzee, Washoe, American Sign Language. While Washoe did understand 350 signs, Herbert Terrace successfully challenged their study because they did not rigorously test for apprehension of grammatical syntax. In another study that has since been repeatedly verified, researchers concluded that chimps "show no unequivocal evidence of mastering the conversational, semantic, or syntactic organization of language." (Herbert S. Terrace, Laura-Ann Petitto, R. J. Sanders, and Thomas G. Bever, "Can an ape create a sentence?" *Science* 206 (1979): 891–902.)

difference in meaning between syntactically different sentences with the same terms, e.g., 'dog bites man' and 'man bites dog.' In fact, there is no evidence to suggest that chimps or other primates possess such a comprehension, as they have failed to distinguish the meaning of sentences such as these. More recent attempts have been made by researchers to show that other animals utilize syntax in communicating. In one study, researchers sought to establish the use of syntactical rules in communication by the Japanese bird species, the great tit (*Parus minor*). They show that members of this species utilize ten different calls, and that they regularly recombine sounds in order to communicate different meanings to their conspecifics. However, their conclusion is that the species uses "compositional syntax," but not the "grammatical syntax" used in human language.[63]

Language is constituted in the second act of the intellect: judgment. Judgments arise when humans compose conceptual meaning in a sentence with a subject and a connecting verb (copula). All judgments, then, like 'the stream is fluid,' have in common the characterization of the existence of a subject through a predicate and truth value (judgments can be true or false).[64] Having formed statements of judgment in this manner, human beings are then capable of reasoning, which works by connecting judgments (premises) through logical relations that

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[63] Toshitaka Suzuki, David Wheatcroft, and Michael Griesser, "Experimental evidence for compositional syntax in bird calls," in *Nature Communications* 7 (March 2106): 10986, (https://doi.org/10.1038/ncomms10986). Here, 'compositional syntax' means the regular ordering of various sounds so as to convey different meaning, e.g., 'scan for danger.' Such recombination is merely a complex form of sign/percept use in communication that can be fully explained by acts of one-to-one perceptual association. 'Compositional syntax' does not entail an understanding of the syntactical order of subject, verb, and predicate, which is what linguists, philosophers of language and philosophers in general mean by 'syntax.'

[64] Thus, St. Thomas holds that being is the primary thing that belongs to the intellect—its first apprehension. See, *ST* 1–2, q. 94, a. 2, resp.

necessitate another judgment as a conclusion. For example, 'roses are in need of pruning; this is a rose; ergo, this is in need of pruning.'

In the most general terms, then, and by analyzing the expression of these acts in language, it becomes apparent that intellect is a capacity or power distinct from others in terms of its object, which is abstract universal meaning and being of things.[65] *Techné*, *phronesis*, and *episteme* all entail that the practitioners of such knowledge have formed concepts from experience, utilized them in judgments expressed in linguistic propositions, and reasoned to conclusions. It seems that careful and proper analysis of gardening and agriculture shows these three types of knowledge are present in the activities, making them distinct and unique to the human being.

Third Response: Analogical and Theological Knowledge. Another important distinction between humans and nonhumans is that human persons have the capacity to think abstractly, metaphysically, and holistically about the philosophical and even spiritual dimensions of agriculture. For example, humans can learn from the "book of nature" and are capable of making analogies based upon lessons learned from the natural world. In the Christian tradition, agricultural analogies are the foundation for many of Christ's parables of the spiritual life. Consider the parables of the sower, the mustard seed, the weeds, the tenant farmers, the laborers in the vineyard, the lost sheep, or the leaven. Christ clearly favored agricultural analogies as a way to speak of spiritual realities in a manner that his (human) listeners could hear and understand.

Furthermore, while other animals cannot comprehend or believe in God, human persons have a capacity for God. Throughout the Scriptures, it is to humans, and not to the nonhuman creation, that God

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[65] See: Aristotle, *De anima* 3.4–6; St. Thomas Aquinas, ST 1, q. 79, especially a. 3 on the active intellect.

communicates himself.[66] The great story of the Scriptures is of God's searching for his people and of their human responses to the Divine call—not to mention that Jesus Christ himself, the Son of God, was a man.

Humans, moreover, are able to perceive God's creative handiwork in creation and to grow in faith through their relationship with the created world. One could say that farmers regularly exercise "expanded reason" as they apply their considerable human knowledge and cooperative effort to bring forth their crops, while always aware of factors beyond their control such as weather, seasonal variations, predation, etc. A farmer by nature recognizes his or her ultimate dependence upon forces transcending human control.

In addition, an essential aspect of the call of humans in the Scriptures relates to gardening. In Genesis, God gives Adam the mission to "till and keep" the earth (GN 2:15). No other animal receives this role. In God's eyes, humans are to be gardeners in order to fulfill His Divine plan for the world.

Conclusions. It is clear that human acts and proficiency in gardening distinguish human persons from other animals, both in degree and kind. While some of the human practices in relation to gardening are shared with other animals on a rudimentary level (implying a difference only in degree), human technical, ethical, theoretical, and spiritual knowledge, accompanied by hyper-cooperative action, work together synergistically to make human gardeners fundamentally different from their closest relatives in the evolutionary sequence and from other species that garden. The activity of gardening manifests knowledge capacities of *techné*, *phronesis*, and *episteme*, as following on the generic acts of the intellect of concept formation, judgment, and rea-

[66] See, for example: Exodus 3:1: God communicates himself to Moses, not to the flock he is tending. Similarly, God spoke through human prophets and human apostles.

soning, which are distinct from the capacities of other animals. These powers, generally speaking, take being and abstract universal conceptual meaning as their object. In this manner, they are distinct by way of the power-object model of definition. In effect, these multiple and extensive distinctions have pushed the ball into another cup or stability domain, in which with humans we have a "leap" into a qualitatively different state, representing a difference in kind from other animals. The approach to distinguishing human gardening activity from the garden-like behaviors of other animals by appeal to the power-object model, moreover, holds great explanative force. It allows us to explain the empirical fact that other animals do not exhibit proper gardening acts: they lack the capacity of intellect and the corresponding forms of knowledge necessary to act properly as gardeners, namely, *techné*, *phronesis*, and *episteme*.

In terms of how one might envision the fullest and most comprehensive understanding of the human person, using expanded reason to integrate scientific, philosophical, and theological knowledge, one could say that humans are both part of nature and distinct from the rest of nature. Human persons are clearly corporeal beings, in evolutionary continuity with other animals, but they are also intellectual and spiritual beings. To appeal to Aristotle's genetic account of the division of living beings, as possessing and containing the powers of the inorganic (utilized by organic beings), organic plant life (nutrition, reproduction), and animal life (sense-perceptive cognition and agency), human beings are connected to and part of the natural world. However, as possessing the capacity of intellect and free voluntary agency, human beings are distinct from the rest of nature. Humans are a unique synthesis of body and soul, not to be reduced to their physical or intellectual constitutions. Rather, there is a mutuality between external practices and interior capacities of intellect and will, such that they inform one another in constituting the nature of the human person as a whole. The uniqueness of the human person rests upon this multilayered dis-

tinctiveness, which is evident in the way that persons garden, as has been described.

V

Replies to the Objections: Reply to Biological Argument. While it is true that other animals grow their own food, they do this according to their instinct and nature. The empirical fact that they normatively "garden" a narrow/limited plant form shows that they do not grasp the meaning of gardening *qua* gardening in abstract universal terms as human beings do. They are not aware that humans farm. Humans are the only creature able to study, name, and categorize animals that farm, via the intellectual capacities of concept formation, judgment, and reasoning. In fact, this kind of observation and study is the joy of the scientist's particular vocation. Even though many species have been farming for millions of years, and humans for only 10,000–15,000 years, it is interesting that humans have developed a high degree of complexity in their farming practices in a short evolutionary period, while it took creatures like ants millions of years.

Reply to Darwinian Argument. The difference between humans and animals is one of kind as well as of degree. As shown above, human beings can be distinguished from other animals by the power-object model of definition. Aside from basic vegetative and animal capacities, human beings possess the capacity of intellect ordered to the distinct objects in the apprehension of being and abstract universal meaning. As was also shown above, humans have developed whole technologies, economies, social and educational structures and spiritualities around farming. There is a categorical difference between how humans and animals garden, even though they are in evolutionary continuity with other creatures. Further, it is not fair to compare the gap between chimps and ants with that between humans and chimps, since this compares distantly related species with closely related ones.

Reply to Genetic Argument. Even though humans are genetically related to all species, and most closely related to the chimpanzees and bonobos, it is now known that genes alone do not determine the organism; epigenetics and culture also play significant roles.[67] In fact, the human genome underwent rapid changes when humans evolved from primarily hunter-gatherers to farmers; the cultural change came first, and genetic adaptation followed.[68]

In addition, how genes influence the nature and behavior of organisms is regulated by the turning off and on of genes, not just by the genes themselves. This regulatory function is modulated in the noncoding regions of the genome. Recent research indicates that the noncoding regions in humans differ significantly from those of other species. For example, the noncoding regions in the mouse genome are not very similar to those in the human genome (50% or less).[69] Even though human and chimp DNA are 99% similar in the protein coding regions, "the vast majority of all genomic changes that happened since the human–chimpanzee ancestor are in noncoding regions."[70] This suggests that the degree and kind of relationship between humans and

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[67] Ethan Watters, "DNA Is Not Destiny: The New Science of Epigenetics," *Discover* (November 21, 2006), https://www.discovermagazine.com/the-sciences/dna-is-not-destiny-the-new-science-of-epigenetics; Daniel Frías & Christian Villagra, "The Importance of ncRNAs as Epigenetic Mechanisms in Phenotypic Variation and Organic Evolution," *Frontiers in Microbiology* 8, no. 2483 (2017): 1–13.

[68] See footnote 3 and Iain Mathieson, Iosif Lazaridis, Nadin Rohland, et.al., "Genome-wide patterns of selection in 230 ancient Eurasians" *Nature* 528 (2015): 499–503; Michael J. O'Brien & Kevin N. Laland, "Genes, Culture, and Agriculture: An Example of Niche Construction," *Current Anthropology* 53, no. 4 (2012): 434–470.

[69] National Human Genome Research Institute, "Why Mouse Matters." https://www.genome.gov/10001345/importance-of-mouse-genome.

[70] Lucía F. Franchini & Katherine S. Pollard, "Human evolution: the non-coding revolution," *BMC Biology* 15, article 89 (2017). https://doi.org/10.1186/s12915-017-0428-9: 1–12 (2017).

chimps is more strongly governed by differences in the noncoding regions of the genome, rather than by similarities in the protein-coding regions of the DNA.

Moreover, this criticism is based in a fundamental methodological error concerning causation and the division of natural kinds. From the Aristotelian standpoint, the primary principle/cause for the division of kinds is not common matter, but rather, distinguishing form. Therefore, although humans are over 99% genetically similar to their closest evolutionary relative, the bonobos, the human form in connection to gardening is distinctive, as we have proposed in this article, and represents a difference in kind between humans and bonobos.

Reply to Nominalist Argument. Proper analysis of human knowledge and language shows first, that the nominalist position itself results in a manifest contradiction and second, that there is, in fact, a principle of identity between individual natures and the universal conceptions formed in the intellect.[71] First, while the denial of universal conceptions signifying common natures can be uttered in speech (*ut significata*), this assertion contradicts and is incompatible with the use of defining terms in language already given to us as a phenomenon and exercised (*ut exercita*) in human life and culture. When I am in the garden, for example, I identify tomatoes as distinct from soil and rock as organic plant life, and as distinct from other plants such as peppers, which possess similar features like leaves and fruits. In fact, I apply the name and universal meaning to these particular individuals in the garden precisely because I know/believe these universal characteristics to be ontologically present in the particulars themselves. The presence of

[71] For a more developed argument in defense of the Aristotelian, realist approach to definition against nominalism see Daniel Wagner, "The Logical Terms of Sense Realism: A Thomistic-Aristotelian & Phenomenological Defense," and Brian Kemple, "Signs and Reality: An Advocation for Semiotic Realism," in *Reality* 1, no. 1 (Fall 2019): 19–67 and 75–123.

universal common features is verifiable by sense-perceptive experience: I see directly the generic and specific features of *x* in *y*, or know them through experiment, etc. The nominalist denial of universal conceptions used to identify particular plant beings in the garden results in a contradiction, then, because, except that I believe that the essential features expressed in the definition are really present in the particular plant, it would be impossible for me to say the definition of the plant, classifying it with others of its kind. However, I, along with many other horticulturists and botanists, already regularly predicate definitions in this manner.[72] Moreover, nominalism would make all human thought and action involving the application of universal meaning to particulars impossible, including human science. Every science, however, actually rigorously defines its subject-genus in order to study it. Therefore, nominalism is false as resulting in these impossibilities.

Second, following Aristotle and the development of his hylomorphic philosophy of nature by Avicenna and St. Thomas Aquinas, we identify the natural form, distinct from matter, as the principle of identity between individual natures/essences and universals apprehended in human understanding.[73] The individual cannot be identical to the

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[72] This *reductio ad impossibile* style argument against nominalism is inspired by Etienne Gilson, *The Unity of Philosophical Experience* (San Francisco CA: Ignatius Press, 1999), 4. At the outset of his *New List of Categories*, Charles Sanders Peirce appears to offer a similar argument. Human knowers could not experience a unity from the sensuous manifold constituted and expressed by the connection of a predicate to subject through the copula, unless the universal (predicate) exists. However, humans do experience this unity and express it in language. Therefore, the universal conceptual meaning and the common essence it signifies are real.

[73] Aristotle shows with necessity that explanation of natural beings capable of change/motion requires appeal to matter and form (hylomorphism) at *Physics* 1.5–7. For recent defenses of this doctrine of physical explanation, see the following: Wallace, *The Modeling of Nature*, Part 1, and "A Place for Form in Science: The Modeling of Nature," in *American Catholic Philosophical Quarterly* 69 (1995): 35–46; Robert Sokolowski, "Formal and Material Causality," in *American Catholic Philosophical Quarterly* 69

universal meaning by which we know it with respect to its extended material existence. However, it is possible that the formal nature of the individual exists in two modes: form is capable of existing in the individual as the essence, making it to be what it is, and as separate in the intellect where it may, in abstraction, be predicated of those individuals from whence it was derived.[74]

Reply to Ecological Argument. We have two points in response to ecological concerns about humans being viewed as distinct in kind and therefore as somehow justified in relating to other creatures and nature in a reckless and destructive manner. The first is that a distinction in kind does not imply a lack of relationship or continuity with other creatures. It is in no way logically necessary that, since human beings are different in kind from the rest of nature as possessing higher order capacities of gardening, as we posit here, that, therefore, it is acceptable for human beings to engage in wasteful, reckless, destructive practices in relation to nature. Evolutionary science, as we have indicated, is predicated on the fundamental interrelatedness of all life, which by definition includes human life. Further, the Aristotelian and Thomistic division of human beings that we have proposed here, far from disconnecting the human from the natural world and providing humans with reason for such despicable behavior, shows an essential connection of human beings with the rest of the continuum of natural being. According to this approach, the human being is not a rational

(1995): 57–67; Tkacz, "The Retorsive Argument for Formal Cause"; Jonas, *The Phenomenon of Life*, especially 33–37; and Kass, *Toward a More Natural Science*.

[74] For a detailed textual account of this Aristotelian solution to the problem of universals, see Wagner, "The Logical Terms of Sense Realism," 36–38. The key texts in Aristotle for producing this account are *Categories* 5, *Physics* 2.3, *Metaphysics* 5.8, and *De anima* 3.4. Avicenna first distinguished two modes of existence of essence along these lines, in *The Metaphysics of the Healing* 5.1. St. Thomas Aquinas picks up and develops the distinction in his *De ente et essentia*, 3.

ghost, unrelated in kind and superior to its own body and the bodies of other natural beings. In fact, this was the view of René Descartes and his Modern followers who did, upon taking it up, view nature as an object for human domination, and who coldly and cruelly engaged in such horrific practices as vivisection.[75] Rather, the human soul, in animating the organic human body, is defined not only by its rational capacities but also by the animal capacities connected to sense perception and the nutritive capacities connected to growth, homeostasis, and reproduction.[76] This, precisely, is a principle and source of a true and authentic connection of empathy between humans and animals and plants. Properly understanding their ontological connection to nature in this manner leads humans to treat other natural beings with care and respect – knowing, as it were, that other animals are intentionally aware of pleasure and pain and live emotional lives, and that plants too

[75] For Descartes' substance dualism, radically separating *res cogitans* from nature as matter and mechanism in this manner, see *Meditations on First Philosophy* 1, 2, 3, and 6. Following Francis Bacon, and rejecting the Ancient and Medieval conception of human knowledge as ordered to the perfection of the person in the satiation of wonder (Aristotle, *Metaphysics* 1.1–2), Descartes held the purpose of science and human knowing was to control and dominate nature for material benefit. In the introduction to his *New Organon*, Bacon says the following: "But any man whose care and concern is not merely to be content with what has been discovered *and make use of it*, but to penetrate further [has gone astray]; and not to defeat an opponent in argument but *to conquer nature by action* [is the point of knowledge]." Emphasis added. For an excellent treatment of the Moderns' "mastery of nature" project, see Richard Kennington, "Bacon's Reform of Nature," in *Modern Enlightenment and the Rule of Reason*, in *Studies in Philosophy and the History of Philosophy* (vol. 32), ed. John C. McCarthy (Washington, D.C.: The Catholic University of America Press, 1998). For more on the disjunct between the Aristotelian-Thomistic view of humans and the Cartesian one, see Sister Damien Marie Savino, F. S. E. and John Hittinger, "Loss of Creation and its Recovery through Aquinas and Bonaventure," *New Blackfriars* 97, no. 1067 (2016): 5–21, especially 6–8.

[76] See: Aristotle, *De Anima* 2.1–4.

live lives ordered to nutrition and reproduction, and that it is as good for them to achieve these ends as it is good for us.

Secondly, while the authors acknowledge that humans have unfortunately manifested their unique capacities in destructive ways upon the earth, it is important to recognize that those unique human capacities are irreversible and cannot be "dialed back," so to speak. It is precisely because humans are different in kind from the other animals and not merely in degree that they have been able to effect such far-reaching, global environmental changes. No other creature is capable of this, nor has any other creature succeeded in doing so in the evolutionary history of the earth. However, asserting the difference in kind between humans and other creatures does not need to imprison humans in a negative understanding of their nature and purpose as created beings. Rather, an alternative, compelling vision is needed in which the special capacities of humans are put to the service of others and of the created world in a more humble and life-giving manner. The conception of human persons as gardeners is one such vision. Gardeners enrich their soil, tend their crops, care for their animals, and feed others. In the Christian understanding, it is in this sense that human persons have been commissioned by God to till and keep the garden of the world.

Disputatio on the Distinction between the Human Person and Other Animals: the Human Person as Gardener

SUMMARY

While the Catholic intellectual tradition upholds the uniqueness of humans, much contemporary scientific research has come to the opposing conclusion that humans are not significantly different from other animals. To engage in robust dialogue around the question of human uniqueness, we utilize Aquinas's

model of *disputatio* to focus on an attribute of human beings that is unexplored in the literature – namely, the human capacity to garden – and address five scientific and philosophical objections to our position that the capacity to garden makes humans distinct. Engaging with various branches of science, we demonstrate that human capacities and modes of gardening are not only incrementally different, but also fundamentally different in kind, from those of nonhuman creatures. Philosophically, we utilize the power-object model of division and Aristotle's categorization of knowledge to express the difference in kind between human beings and other animals. These responses allow us to set aside each major objection.

Keywords: human uniqueness, gardening, person, personalism, philosophical anthropology, philosophical biology, Thomas Aquinas, Aristotle, human intelligence, animal intelligence, cognition, epistemology, metaphysics, philosophy of language, evolutionary biology, ecology, logic, ethics, *disputatio*

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