

The Convergence of Cognitive Science and Aristotelian Anthropology

Brian Patrick Green
Graduate Theological Union, Berkeley
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“By nature, all men desire to know”—with this phrase Aristotle opens his *Metaphysics*. The orientation of human nature is towards knowledge; but specifically what kind of knowledge? Of all the kinds of knowledge available to know, Aristotle states that it is teleology—final causality, the “that for the sake of which” or “why” behind reality—which is the most sought after and the most highly prized. But why should we value teleology so highly? For Aristotle it is simply the most divine knowledge, the hardest to attain and thus the most valuable in its rarity. But contemporary cognitive science can give us an additional insight: we seek final causality because we have evolved to do so.

Cognitive scientists have found compelling evidence that humans have an innate desire to learn teleology, and that teleological explanation is in fact our most natural means of explanation. Some cognitive scientists have even gone so far as to propose an evolutionary explanation for this teleology seeking: a “why” for why we seek after “why.” In this investigation I will first summarize Aristotle’s anthropology, in particular his intellectual virtues of *techné* and wisdom, then examine the cognitive science data concerning the foundations of these capacities for *techné* and wisdom. Next I will examine the ways in which these two investigations are consistent and convergent, and lastly examine the significance of this convergence for both philosophy and biology.

Aristotle's Teleology and the Virtues

Aristotle's notion of teleology expresses in his understanding of human nature.

Therefore to explain his teleology I will first review his anthropology. To do this we must first understand what Aristotle means by *nature* and *virtue*.

To Aristotle, "nature" or *physis*, was not merely that which was not artificial. Nature was that which contained its own *telos*, and, therefore, its own good, as Aristotle explains in many of his works (Aristotle 1941a; 1941b; 1991; 1999; see also Johnson 2008). Human nature was not exceptional from the rest of nature in this respect; just as animals and plants had *teloi*, and goods, so did humans. Thus the question of exactly what human nature was gained great significance: if the human *physis* could be determined, then it could be determined what the human *telos* was, and, having established a starting and ending point, what behavior to engage in to progress from start to finish, to achieve one's *telos* and fulfill one's nature. Nature was one's whither and whence, our end and beginning, and to cultivate and achieve one's nature was *eudaimonia*: fulfillment, flourishing, or happiness. Because all humans share a common nature, we all have a common happiness we are called to, though individuals will necessarily vary in their specifics (Aristotle, 1999).

To Aristotle, virtue was constitutive of achieving *eudaimonia*. Virtue was excellence: the perfection of one's natural capacities; for example, the virtue of the eye was to see well (Aristotle, 1999). Human nature had three areas in which virtue could reside: the body, the moral character, and the intellect. Bodily virtues included health, strength, good eyesight, and so on; they were the excellences of one's physical body. Moral virtues were excellences of character and included courage, justice, temperance, prudence (which is also an intellectual

virtue), among others. The five intellectual virtues were *techne* (art/craft/technical skill), *phronesis* (prudence), *episteme* (scientific knowledge), *nous* (understanding), and *sophia* (wisdom) (Aristotle, 1999).

Aristotle thought that the human function (our *telos*) was rational activity (1999), therefore the bodily and moral virtues were mainly important for their role in making possible the development of the intellectual virtues. Of the intellectual virtues, Aristotle saw *techne* as the virtue which rationalized production (allowing the architect to build great structures, for example), and prudence as the virtue which rationalized action (thus allowing proper human social interaction). Unlike *techne* and prudence, which each stood alone and ordered production and action, respectively, knowledge, understanding, and wisdom were all connected and functioned to rationalize thought. Knowledge was knowledge of eternal truths, understanding drew the connections between these eternal truths, and wisdom related understandings of truths to the ultimate ends (final causes) (1999).

The virtues of *techne* and wisdom stand out in their importance for this current investigation of teleology and cognitive science. *Techne* is the virtue which permits excellent production, and a person with the virtue of *techne* knows the “whys” of production. To illustrate the difference between a person with *techne* and one without, Aristotle compares the craft worker to the master builder. The worker simply follows instructions, not knowing the reason why he does what he does. The master builder, on the other hand, conceives of the project as a whole, knowing what materials and proportions are proper to use, thus rationally ordering production to suit the particular situation. In other words, the worker knows “how” but not “why,” while the master builder knows both how and why (1941a).

Wisdom is the virtue which integrates the knowledge and understanding of the highest things to the *telos* of human life. Aristotle associates the impulse to wisdom with the human propensity to make myths: in our desire to know purely for the sake of knowing, we seek explanations: the “whys” behind everything. Just as myths have no use other than to explain, wisdom neither has a practical use: it is purely theoretical, contemplative. Because wisdom is rooted in the theoretical and contemplative, Aristotle argues that it must come after the practical considerations of life have been filled; thus, Aristotle explains, mathematics was invented among the priests of Egypt, who had the leisure to seek knowledge for its own sake and not out of practical need (1941a).

To illustrate his point in a more concrete fashion, Aristotle describes the traits of a wise person:

We suppose first, then, that the wise man knows all things, as far as possible, although he has not knowledge of each of them in detail; secondly, that he who can learn things that are difficult, and not easy for man to know, is wise (sense-perception is common to all, and therefore easy and no mark of Wisdom); again, that he who is more exact and more capable of teaching the causes is wiser, in every branch of knowledge; and that of the sciences, also, that which is desirable on its own account and for the sake of knowing it is more of the nature of Wisdom than that which is desirable on account of its results, and the superior science is more of the nature of wisdom than the ancillary; for the wise man must not be ordered but must order... (1941a)

Ultimately, wisdom orders all of human nature towards the purpose of human existence: to fulfill the human function of rational activity, the highest activity of which is seeking the divine knowledge of final causes: metaphysics. Wisdom is both the hardest and the most divine form of knowledge; hardest because it is most removed from sensory perception, and most divine because it concerns the principles and causes underlying reality itself (1941a).

Aristotle’s anthropology is not only teleological in that it pursues a goal, but also teleological in that the goal it pursues is the understanding of teleology itself. For Aristotle, this

double-layer teleology is the core of human nature; knowledge of *teloi* is the human *telos*. The most virtuous human—the most excellent and most moral—will be the philosopher who reaches the farthest towards wisdom: the contemplation of the deepest theoretical insights of teleology. He will also be the happiest human, for he will have achieved his function and purpose as a human being. For Aristotle, the good life is one lived fulfilling one's function to its maximum degree, and so contemplation of theoretical truths (which best fulfills the human function of rational thought) is the best life of all (1999).

Aristotle's ethical system and its anthropological foundation is of great philosophical significance, but the question with which we must concern ourselves is whether it is accurate. For this we must step away from theory and into the world of senses and data: the world of contemporary natural science. And what we find there will be supportive of many of Aristotle's theses.

The Cognitive Science of Teleology

Several authors have already begun alignments of contemporary science and Aristotle's moral virtues (Arnhart 1998; Churchland 1998; Murphy 1998; Casebeer and Churchland 2003; Casebeer 2003a). The intellectual virtues are a logical next step. The work of three scientists forms the core of my evidence for the existence of natural virtue-capacities for *techne* and wisdom. American cognitive developmental psychologist Deborah Keleman's work provides evidence for an innate teleology-seeking capacity, as well as a link between practical teleological thinking and theoretical teleological thinking. The work of Hungarian cognitive psychologists Gergely Csibra and Gyorgy Gergely provides not only more evidence for a natural practical

teleological capacity linked specifically to tool use, but also for a natural pedagogical capacity to convey meaning, and an evolutionary hypothesis relating these discoveries.

Deborah Keleman's work with young children has demonstrated that the human mind is innately teleological in its orientation, most highly valuing questions of "why?" and "what's it for?" In a series of papers over the last ten years, Keleman has convincingly demonstrated that teleological explanation is the prime means of understanding throughout human life, from early childhood through old age. Keleman has used three phrases to help summarize her discoveries: "promiscuous teleology," "function compunction," and "intuitive theism."

Promiscuous teleology is the propensity for children (mainly between ages 4 and 8) to prefer explanations in terms of teleology rather than mechanistic causality, for example, saying that mountains are "for climbing," rather than because dirt piled up (Keleman 1999). Keleman says: "young children promiscuously assert that entities of all types, including non-living natural objects, are 'made for something'" (Keleman 1999). This is in contrast with adults, who allow that artifacts and biological parts can be described teleologically, while complete organisms and non-living natural objects should not (Keleman and Rosset 2009)

What Keleman calls the *function compunction* is a further elaboration of the discovery of promiscuous teleology in children. Through further studies, Keleman and others discovered that teleological thinking in fact seems to be the default form of thinking for humans throughout our lifetimes. Alzheimer's patients revert to teleological explanation as their conditions worsen (Lombrozo et al. 2007). When given choices between teleological and mechanistic explanations on an exam, American undergraduates with severe time-constraints tend to choose teleological explanations as well (Keleman and Rosset 2009). Romanian Roma (Gypsy) adults also tend to prefer teleological explanations, unless they have been exposed to Western education, which

then suppresses this response (Casler and Keleman, 2008). In short, while Western-educated adults suppress teleological explanation in favor of mechanistic causation under certain circumstances, under conditions of stress teleological explanation reappears. Teleological explanation, then, appears to be our innate or most natural form of understanding.

One logical outgrowth of this preference for teleological explanation is what Keleman has termed *intuitive theism*. Intuitive theism is the tendency of children (beginning at age 3) to think of natural objects as “quasi-artifacts” with a creator; in the words of Keleman: “children view natural phenomena as intentionally designed by a god” (2004). This intuition exists not only among children in the United States, but also in Britain and other nations, and not only in children of those who are religious, but also in children from secular households (Keleman 2003, Keleman 2004, Keleman and DiYanni 2005, Diesendruck and Haber, 2009).

Keleman (2004) enumerates several necessary preconditions for intuitive theism to arise. First, children must be able to have a conception of intangible agents. This mental ability is present in 3 and 4 year olds, in the concept of “imaginary friends.” Second, they must be able to conceive that these agents have minds with mental powers normal agents do not have; this ability is present among 3 year-olds. Third, children must be able to attribute design intentions to agents and understand that objects can have a purpose according to such intentions. And indeed, children are sensitive to intended function at just 3 years of age.

Thus, children ages 3 to 5 already have the cognitive capacities to envision intangible agents with superhuman powers of perception and the ability to design objects with functions. Furthermore, children do in fact combine all these attributes into one god-like concept, and use it to explain the existence of natural objects. These findings suggest that intuitive theism is correct.

The above characteristics of human psychology have implications for the teaching of science, as well as the cognitive science of religion (Bloom and Weisberg 2007, Barrett 2004). However, for the purposes of this paper it is enough to demonstrate the natural aspect of the human teleological instinct, and how this natural instinct serves to bridge the gap from practical teleology to theoretical teleology.

Gergely Csibra and Gyorgy Gergely have likewise found remarkable innate capacities in humans. Their studies have looked at children's abilities to find intentions and rationalize the intentions of others, but what is most interesting about their studies are the way they root human teleology-seeking into the practical activity of using and making tools. Like Keleman, Gergely and Csibra have key phrases which help summarize their thinking, in this case there are two: "cognitive opacity" and "natural pedagogy."

Cognitive opacity refers to the lack of ability to understand the intentions of others just by watching what they are doing. To illustrate their point, Gergely and Csibra relate the story of Sylvia, a distinguished cook who always prepared her ham by first cutting off both ends. One day when preparing her ham this way, Sylvia's mother watched her and asked what she was doing. Sylvia replied that she was preparing the ham just as she (her mother) had taught her to prepare it, by first cutting off the ends. To this her mother replied "But that is because I did not have a wide pan!" The moral of the story is that Sylvia learned her recipe for ham under conditions of cognitive opacity—she did not understand *why* the ends needed to be cut off, but only *that* they were to be cut off. The blind imitation of her mother was a simple cognitive task, the understanding of the reason why was another matter altogether, and required a step beyond blind imitation: it required pedagogy of the teleo-functional nature of the action being performed (Gergely and Csibra 2006).

Gergely and Csibra hypothesize what the origin could be of this strange predicament that people do things which cannot be easily understood or learned by blind imitation. They present an evolutionary story with significant circumstantial evidence. Other primates are quite capable of using tools, making tools, and even teaching each others how to perform certain actions, however, primate tool use is almost always triggered by the presentation of some goal, and then the seeking of a tool to fulfill that goal. In this case there is no cognitive opacity, this is cognitively transparent to other creatures present, who can obviously see the same goal and same seeking of a tool as the tool-maker itself can see; the visibility of the end precedes the means to the end.

However, it is apparent from human evolutionary history that at some point in our past our ancestors began to create tools prior to having specific goals; for example, chipping stone tools for later use. This procedure is a reversal of teleological perspective, that is, the means to the end precedes the visibility of the end, and it is therefore cognitively opaque. The teleological perspective of a bystander/learner thus changes from seeing goals and then searching for means, to seeing means and then mentally searching for goals. Of highest importance is the open-ended nature of this innovation in thought. Rather than the previously simple one-to-one relation of end to means, the reversed relation is limitless: the means could have thousands of potential ends, and these must be learned and transmitted or the cultural behavior will be lost. The observer must think “what is the tool maker doing that for?” i.e. what is the *telos* of this activity? With this cognitive leap tool culture and further human culture become possible, but at a price: how can the teleological reason for making a means be taught? For this some kind of pedagogy is necessary, and the ability for humans to both learn and teach teleology, in the absence of visible *teloi*.

We do not know exactly how this transition occurred, but we know that it did occur because we have ourselves as proof. We know the cognitive facts of current human nature, and that they are substantially different from the cognitive facts of other creatures, and that this difference came about at some point in the past. We know from the archaeological record that early hominins not only manufactured tools at distances from where they were used, but also used tools to make tools (recursive tool use) and we can surmise that in these cases cognitive opacity represented a serious “learnability problem... thereby endangering the cultural reproducibility of such new cultural practices” (Gergely and Csibra 2006) Gergely and Csibra argue that this formed an intense evolutionary pressure for the selection of cognitive capacities to rapidly learn cultural and teleological knowledge, as well as communicate this knowledge to others.

Csibra and Gergely call this ability to communicate knowledge *natural pedagogy*, and argue that it is the primary foundation for human communication (Csibra and Gergely 2009; reminiscent of the theory put forward by Engels 2003). They cite numerous studies of children and adults on how subtle cues either enhance or reduce attention to persons and objects. Infants are extremely sensitive to adult intentions and actions, especially ones which indicate pedagogical intent. Children are so sensitive to pedagogy that often knowledge can be taught with only one attempt, for example, the simple act of pointing at an airplane and the statement “airplanes fly,” or a manual demonstration of how to open a milk carton (Csibra and Gergely 2009).

Csibra and Gergely give a further example of the extreme sensitivity of children to pedagogy:

When children are shown an action performed in a particular style leading to a clear end state (e.g. a mouse is hopping across the table into a house), they tend to reproduce only

the end state (put the mouse in the house), often ignoring the manner of action (hopping). However, if the relevant information concerning the end state is communicated to them verbally by the actor before the demonstration ('the mouse lives in the house'), they reproduce the action style more often. They do so because they conclude that the demonstrator's communicative intention cannot be to redundantly present the same information that she has just told them about, and so they identify the manner of action as the new information communicated and to be learnt"(2009).

In other words, children naturally fill in the teleological blanks: if no end state is told, a child will infer that the end state is the *telos* of the operation and the means is irrelevant. On the other hand, if the end state is relayed verbally, then the child will assume that the means must be important for the teleology of the operation. This is done automatically and completely unconsciously.

If Keleman's work serves to prove *that* we ask "why," then Gergely and Cisbra's work serves to ground human teleological sensitivity by getting at the "*why* we ask why" question. Their answer is that we ask "why" to overcome cognitive opacity, which is a necessary aspect of the complex cultural systems which we have evolved to inhabit.

The cognitive data that humans are extremely sensitive to teleology, both in terms of pedagogy as well as naturally seeking it out, make it clear that Aristotle was on to something about human nature when he made teleology the focal point of his intellectual virtues. But do these two vastly different fields—cognitive science and Aristotelian anthropology—really integrate? In the next section I will make clear the connections between these two fields of discourse and demonstrate that contemporary cognitive science really does support Aristotle's anthropology.

The Consistency of Cognitive Science and Aristotelian Anthropology

In aligning these two disparate systems some important questions must be answered. Among the questions are five of primary importance. 1) Are cognitive scientists and Aristotle using the concept of teleology in the same way? 2) Are the artifact-orientation and tool-making discussed by Keleman, Gergely, and Csibra the same as the Aristotelian capacity for *techne*? 3) Does the mere natural hypothesization of God, or intuitive theism, qualify as a capacity for wisdom? 4) Can *techne* and wisdom be linked to each other through this cognitive data, and if so, how? 5) Does cognitive opacity exist in Aristotle's system, and if so does it play the same role as it does in Gergely and Csibra's system?

As a final point, I will address the issue of what exactly would constitute proof of consistency between natural science and Aristotelian anthropology, and then address whether I have been able to present such proof.

1) Are cognitive scientists and Aristotle using the concept of teleology in the same way?

In the conceptual and psychological senses, yes, but in the metaphysical sense, no. They agree on what teleology is and that we psychologically seek it, but disagree on the ontological status of the teleology sought, and on exactly where it exists to be found. However, the conceptual and psychological levels are sufficient for my case.

Despite differences in culture, language, and time, both parties are talking about functions, purposes, ends, goals, final causes, the "cause for the sake of which": *teloi*. They are using the same concept. Aristotle thought knowledge of final causes was the most desirable kind of knowledge for humans to possess, which is the same determination which these scientists'

work discovers: humans innately value teleological knowledge above other kinds of knowledge, and there is a psychological priority to questions of “why?” and “what’s it for?” (Keleman 1999).

The concept of “why” is a crucial one here, because it digs into cognitively opaque matters and tries to clarify them. For Gergely and Csibra, the “why” and “what for” concept functions to find the end behind the action performed (Csibra and Gergely 2006). For Aristotle’s worker and master builder example, the master builder knows “why” while the worker does not. Similarly with Aristotle’s teacher example, the good teacher knows *why* things are the way they are, not just *that* they are (Aristotle 1941a). Additionally, Aristotle’s assertion that knowledge of final causes is most prized because it is farthest from sense-perception fits exactly with Gergely and Csibra’s notion of cognitive opacity: in both cases thoughts of ends cannot be seen.

What role does the concept of teleonomy play in this discussion? While teleology is the study of ends, teleonomy is a term used in biology to describe how apparent ends can appear without really being ends (i.e. they are not purposive, but programmed). In other words, the “cause for the sake of which” does not really exist in this view because organisms arise *from a beginning* and are programmatically pushed forward, they are not teleologically drawn *towards an end* (Monod 1971; Mayr 1988).

Neither the cognitive scientists nor Aristotle are arguing that humans are looking for teleonomy. Humans are psychologically compelled to seek teleology. However they differ in the reason *why* humans are seeking teleology. For Aristotle we are teleologically seeking teleology: the cause for the sake of which humans exist is to look for the causes for the sakes of which things exist. For the cognitive scientists we are teleonomically seeking teleology: we are biologically programmed to seek teleology due to the natural selection of our ancestors for the ability to learn culture. These descriptions are in one way highly divergent and in another way

highly similar. The purpose of this article is not to investigate the reality (or lack thereof) of the ends which humans seek, but rather to recognize that psychologically humans are seeking ends, as both current cognitive science shows and with which Aristotelian philosophy agrees.

2) *Are the artifact and tool-centered ideas discussed by Keleman, Gergely, and Csibra the same as the Aristotelian capacity for techne?* Yes, in some ways. While Keleman concentrates on how children manifest their innate capacity to learn about artifacts and Gergely and Csibra on the cognitive difficulties associated with such learning, Aristotle's virtue of *techne* focuses on the innate capacity for excellence in the production of artifacts, which requires, first of all, knowledge of artifacts and their functions (gained through learning), second, the skills associated with such artifacts, and third, the knowledge of why the skills are to be applied as they are. As such Aristotle's virtue-capacity for *techne* is broader than the categories being examined by Keleman, Gergely and Csibra. They are effectively reporting on a subset of the virtue capacity of *techne*. Therefore, while the cognitive scientists' work serves to support the most basic aspects of the virtue of *techne*, they do not address its further aspects.

3) *Does the mere natural hypothesization of a god, or intuitive theism, qualify as a natural capacity for wisdom?* Yes, partially. Aristotle says myth-lovers are searching for wisdom (as the children in Keleman's study are hypothesizing a mythological designer of nature). The important link here is in the ability to conceive of concepts which are not based on sensory data, i.e. which exist solely in the mental realm. Aristotle says that that knowledge which is most remote from the senses is the hardest to understand and therefore is the most prized: this is the realm of wisdom. The fact that children can conceive of immaterial agents (and, concomitantly, final causes) completely without sensory verification shows that there is a

basic capacity for wisdom inherent in them (Keleman 2004). As the highest and most difficult of the virtues it is most likely to go astray, but it does exist.

4) *Can techne and wisdom be linked to each other through this cognitive data, and if so, how?* Yes, they can be linked not only through the cognitive science data, but also in Aristotle's system itself, and through the same links in both systems. Within the cognitive data there is the beginning of a link between these two capacities through the simple innate analogy discovered by Keleman: that artifacts are to humans as the natural world is to a god. In this analogy the material objects exist first and then the immaterial purposes are hypothesized to exist behind them, along with the agents necessary to bear those purposes: in the first case a designing human, in the second a hypothetical immaterial designing god. The first half of the analogy aligns with *techne*, the second half with wisdom, and the logical link is teleology.

Keleman's idea of an innate function compunction also helps explain how *techne* and wisdom are related. Humans seek teleological explanation no matter the nature of the "why" question; whether in regards to artifacts, body parts, entire organisms, or natural objects (Keleman 1999; 2006). The faculty that asks "why" is innately indiscriminate in its attribution of teleology, only with training (i.e. a Western education) does it become selective (Keleman 2009). Aristotle parallels Keleman in his first phrase of *Metaphysics*, stating that "All men by nature desire to know," and in his further elaboration he states that it is final causes that are the most desirable knowledge (Aristotle 1941a).

Gergely and Csibra's ideas of cognitive opacity and natural pedagogy serve to dig somewhat deeper into this link between *techne* and wisdom. For the learner to learn what is in the mind of the teacher of a technical skill, the learner must be able to hypothesize purposes in that other mind. This is the basic postulation of a "why" question in regards to production:

techne. As Gergely and Csibra note, this would have been under heavy selective pressure as dependence on tools increased. Once the basic capacity to ask material (concrete, practical) questions of teleological nature had been achieved, there would be no apparent reason why this same capacity could not be applied to immaterial (abstract, theoretical) questions as well, as Keleman's work shows that in fact it does. The basic necessity is to be able to hypothesize the existence of goals: final causes. Whether another mind is directly present or not is of no concern. Once the abstraction to final causes occurs, the capacity for wisdom exists.

Aristotle also sees the link between *techne* and wisdom, but characteristically downplays it in favor of the more contemplative virtue. The link which Aristotle perceives is that the true virtue in both cases requires knowledge of final causes. Aristotle even causally links the two virtues, stating that *techne* had to come first because it exists out of necessity, while wisdom exists out of wonder and leisure; thus somewhat paralleling the evolutionary explanation given by Gergely and Csibra, where tool-culture drove human sensitivity to teleology (Aristotle 1941a; Gergely and Csibra 2006). Overall, all three authors agree that the practical teleological sensitivity of *techne* in some way precedes theoretical teleological sensitivity of wisdom: for Aristotle historically, for Keleman cognitively and (ana)logically, and for Gergely and Csibra evolutionarily.

5) *Does cognitive opacity exist in Aristotle's system, and if so does it play the same role as it does in Gergely and Csibra's system?* Yes, and yes, clearly. Cognitive opacity is precisely the reason why the master builder knows "why" and the worker does not. The knowledge of "why" in production can require years of training, knowledge of many specific techniques, the tools to perform the techniques, the knowledge to make the tools themselves (in some cases), knowledge of materials, and so on. Without overcoming numerous cases of cognitive opacity, a

learner cannot gain this teleological knowledge. However, by simple imitation they can learn to carve stone or other artisanal skills. The artisanal worker may know “how,” but the master-builder knows “why,” and the gulf that separates them is cognitive opacity, which blocks easy transmission of teleo-functional information.

The difference between the teacher and the learner is well understood by Aristotle and by Gergely and Csibra. Aristotle’s test for knowledge of teleology is whether the examinee can teach it, and just like this, Gergely and Csibra also divide teacher and learner by the divide of cognitive opacity (Aristotle 1941a; Gergely and Csibra 2006).

In summary, I think there is strong evidence that cognitive science does support Aristotle’s anthropology. But there is still the matter of what exactly constitutes proof that these systems are consistent with each other.

I believe that what constitutes proof that this science is consistent with and supportive of Aristotelian anthropology is that they are talking about 1) the same concepts 2) in the same way and 3) coming to the same conclusions 4) for the same reasons, 5) thus allowing progression together. Points 1 through 4 display the congruency of these systems, but point 5 displays their consistency: that they can be integrated and lead towards new things. As demonstrated above, first, Aristotle and the cognitive scientists are talking about the same psychological concepts of teleology, and second, they are talking about it in the same way, that is, what its role is in human life. Third, they also come to the same conclusions, that teleology is deeply natural to us and prized by us, and teleology is active in both practical and theoretical aspects of human thought. Fourth, Aristotle and the scientists both come to their conclusions by observation of human nature which show how teleology is important in human life. Fifth, these systems are not only congruent, but consistent: they harmonize with and support each other. Aristotle could not

perform the same kinds of scientific research as today's scientists, yet their data supports his system. At the same time, Aristotelianism is very systematic and organized, and has weathered the test of time as a source of ideas for further investigation. It may well be that not only will further science support Aristotelian anthropology, but further investigation into Aristotle may provide suggestive paths for further scientific investigation (as has certainly happened in the past, with investigators attempting to prove or disprove various aspects of Aristotle's biology and physics).

The Significance of this Convergence

This convergence is significant for both biology and philosophy, and the ethical ramifications are of special interest. There are three significant ramifications to expect from this process of supporting Aristotelian ethics with contemporary science. First, Aristotelianism would become a scientifically supported philosophical system. Second, science could seek new paths for knowledge via Aristotelianism if it proves to be a fruitful framework for future research. Third, the ethical implications of this convergence could help not only bridge the is-ought gap, but also give us insights into the relationship of technology and religion.

As a first ramification, Aristotelianism and its philosophical offspring will gain strength as anthropological and ethical systems. Naturalistic and/or natural law ethics and virtue ethics may rise in prominence relative to other ethical methods. This has already been occurring for some time now with virtue ethics, but with the support of scientific data the pursuit of a naturalized ethics will gain momentum (for the beginnings of this debate, see, for example, Casebeer 2003b, and Greene 2003).

Additionally, Aristotelianism will be changed in the process of updating and those aspects of Aristotle which are demonstrably wrong will need to be corrected. For example, his essentialism might be “softened” in light of Darwinian evolution and human diversity (Casebeer 2003a). New scientific data will provide a way to correct Aristotelianism and update some of its particulars while maintaining some larger aspects of the system as a whole.

A second ramification could be that Aristotelianism will provide a structure for new cognitive science data, and may even provide ideas for continuing research. If science is providing inductive strength to Aristotle’s anthropology, at some point it might become worthwhile to look to Aristotle’s anthropology for further research projects, for example research into the virtues of prudence or courage. In fact, many aspects of virtues are already being studied, but in other contexts and not as virtues (for example, Brunner et al. 1993; Haidt 2007; Koenigs et al. 2007; Haidt and Graham 2009). Aristotelianism may give the opportunity to take these divergent fields of inquiry and integrate them into a coherent anthropology.

As a third ramification, integrating natural science and Aristotelian ethics could provide the ability to derive “ought” from “is” by aligning description and teleology. This would be a major achievement in ethics, which has struggled with the relationship of nature and goodness ever since Hume. Because science provides a descriptive anthropology and Aristotle provides a normative anthropology, a coherent integration of the two systems could bridge the is-ought gap in a way that may be broadly convincing. There are two further ramifications of this effect.

The integration will provide insight for investigating technology and the ethics of technology. When a good descriptive anthropology of the role and evolved purpose of technology (as built upon the virtue of *techne*) in human life is possible, then we will better be able to ethically evaluate new technological innovations in light of their relationship to the

human good. For example, if a new technology allowed for humans to better acquire teleological knowledge, this could be good because it enhances a natural capacity crucial for human flourishing.

The integration will also provide insight for investigating religion and the ethics of religion. If the quest for wisdom, and therefore religion as one manifestation of wisdom, is an integral part of human nature, then we gain deep insight both into human nature and religion itself. This has ethical implications for how religion is treated in society; for example, that attempts to ban religion will harm human flourishing as well as necessarily fail because it is natural to us, and that attempts to aid religious flourishing (for example, by allowing free exercise of religion) may aid general human flourishing as well.

The above ways of developing the cognitive science-Aristotelian integration towards ethics brings us towards questions of what it means for a human to live a good life. In Aristotle's view, the best human life is one which best fulfills its nature, actualizing its full potential into excellence, cultivating natural capacities into their corresponding virtues. To live this life, we must first know who we are, so that we can live in a way so as to grow into who we should be. As science does more research into human nature and our natural capacities, we will learn more about who we are and who we can be, and combined with Aristotelian ethics we can better learn what it means to act in such a way so as to cultivate our natures into full flourishing. If we are creatures which innately possess the capacities for *techne* and wisdom, then our happiness will be deeply linked to how these capacities are developed into virtues. In order to be happy, we will need not only to master our practical/tool-centered culture, e.g. how to use communications or transportation technology, but also our theoretical/meaning-centered culture, e.g. how to make sense of our lives, up to the largest scales.

Conclusion

In this paper I have shown that recent findings in cognitive science are consistent with and supportive of Aristotelian anthropology and ethics and that this alignment of evidence and theory may have significant effects for both fields. Cognitive scientists have found that humans have an innate teleological impulse, and have hypothesized that it originates in our need to rapidly learn cultural information under conditions of cognitive opacity. Our teleological impulse even leads to the natural hypothesization of a god. Aristotle would agree that we innately seek teleology and would go farther and call it the highest knowledge we can seek. I am hopeful that this new connection between philosophy and biology will lead not only to more theoretical progress in both fields, but practical progress in ethics as well.

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