A Tendency Toward Teleology: Why We See Purpose in the Natural World

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Introduction

Currently the field of evolutionary biology is up in arms over the issue of *teleology*—the idea that things are designed and have purpose, or to put it another way, the idea that things exist to serve a purpose. Obviously this view is quite applicable to anything man-made, but is it correct to view the natural world this way?

For many evolutionary biologists the answer is a simple “no, things exist because they exist.” The question “why” can be answered *mechanistically* or *proximately* but not *finally*, to use Aristotle’s classification of causes. Proponents of the *Intelligent Design* hypothesis take a completely opposite view, as the name of their movement suggests. They begin with the idea that it is completely valid to view the natural world through the lens of purpose and design (Behe 2006; Dembski 2006).

However, the debate over teleology is not completely split into two sides; within evolutionary biology there are many scientists that argue that to a certain degree, a teleological view is valid or even necessary in biology. They argue that we can talk about natural selection “designing” things, or say that an organ has a “purpose” or “function” that it serves (Mayr 1974; Nagel 1977).

The purpose of this paper, however, is not to argue for one side or the other of this debate. Instead I want to make the argument that whether or not it is scientifically valid, our automatic inclination is to view the natural world teleologically, and that there is a cognitive basis for this tendency.

Regardless of whether the natural world actually has “purpose” (a question philosophers could debate till the end of time), we easily and intuitively view it and speak about it that way. Even when discussing the actions and functions of organisms in a setting when inserting teleology is a social faux pas (for example in the company of Allen MacNeill, Will Provine, and Warren Allmon) it’s easy to slip-up and insert the words “in order to” or “so that.” To put it simply, teleology feels natural.

So why is this kind of purpose-oriented thought so natural and automatic? Why don’t we just look at the world and say, “a bird has wings because it has bones that extend at a certain angle, covered with muscles, covered with skin, covered with feathers,” or, “a bird has wings because its parents had wings”? Instead we say, “a bird has wings in order to fly." Or as another example, if we see a man knocking at a door, how do we automatically know that he wants to come inside?

As Pascal Boyer writes, "Physical events around us are not just one damn thing after another; there often appear to be causes and effects. But you cannot *see* a cause, at least literally. What you see are events and your brain *interprets* their succession as cause plus effect." Similarly, we cannot see purpose, all we actually see is "one damn thing after another," but our brain takes these observations and infers that the things and events around us our purposeful.

So how and why does our brain do this? Do we have a built-in "purpose detector" that prompts us to ask the question "why" about any organism or natural process, then seek to answer that question through inference of motivations and intentions? Are we cognitively predisposed to view the world teleologically?

Evidence for a purpose-detector

Beyond our easily observable tendency to speak about things in teleological terms, research findings also lend support to the theory that teleology is our automatically preferred framework with which to view the world. Experiments by Deborah Kelemen (1999) found that preschool age children tend to infer purpose in all sorts of entities, including clocks, tigers and clouds. She also found that elementary school age children consistently preferred teleological explanations to physical explanations for natural phenomena, both biological and non-biological. Interestingly, adults preferred physical explanations for the non-biological phenomena, and teleological explanations for the biological.

There is also evidence for the existence of an innate cognitive purpose-detector which would be the root cause of our teleological viewpoint. experiments show that infants as young as 9 months of age tend to interpret the movement of self-propelled dots on a computer screen as "intentional, goal-oriented movement (Csibra, et al., 1999)," and are also able to interpret other people's body-movements as goal-oriented and purposeful (Behne, et al., 2005).

The bulk of research referring to purpose-detection, or "agency-detection" as it is more frequently referred to in this literature, assumes its existence as a cognitive process and uses it to explain religious thought. Essentially the argument is that purpose-detection arose as a hair-trigger response to possibly threatening circumstances in the natural world, but because of its over-activity (it's frequently referred to as the Hyper-active agent detection device, or HADD) led to detection of super-natural agents (Barrett 2000; Boyer 2001; Atran & Norenzayan 2004).

Therefore, according to this argument, religion itself is evidence for innate purpose-detection ability. As Atran & Norenzayan (2004) write, "Supernatural agents are readily conjured up because natural selection has trip-wired cognitive schema for agency-detection in the face of uncertainty."

Most of these ideas are an extension of Guthrie's theories of animism and anthropomorphism, which he also then uses as a causal explanation for religion. He argues that in the environment of evolutionary adaptation it would have been beneficial for humans to be able to quickly and easily identify the presence of other people and animals with harmful intentions. Therefore, the evolution of an extremely sensitive detection system was favored which would have been triggered by anything with the slightest resemblance to a living thing because there would have been no evolutionary disadvantage associated with false-positives. His evidence for this theory includes the phenomena of people hearing voices in the wind and seeing faces in the clouds (Guthrie 1993, 2002).

This research all lends support to the hypothesis that we have a "hard-wired" tendency to look for and detect purpose which would then lead to a teleological outlook. More-over, much research has been done showing evidence of other cognitive processes that appear closely related to purpose-detection in terms of inferring motive and meaning.

Related Cognitive Processes

In order to interpret our surroundings and navigate our world we rely on cognitive processes which allow us to take in empirical observations and automatically produce inferences based upon them. Most of our behavior and our understanding about the world rely directly on these inferences.

Pascal Boyer (2001) identifies four specific inference systems that he believes to be present in humans from birth: an "intuitive physics" system, a "goal-detection" system, "an intuitive psychology" system, and a "structure-function" system. According to Boyer, each of these allows us to make inferences about the things we encounter and the events we witness on a daily basis.

While many people would disagree with Boyer about the specificity and individuality of his outlined inference systems, his underlying idea that we organize empirical observations and then produce inferences based upon these observations in a reliable and testable way is generally agreed upon. This tendency has been well researched in areas relating to communication, "Theory of Mind," facial recognition, and cheating detection.

Relevance theory states that when communicating we not only hear and decode utterances, but also take in other information relevant to the utterance and the speaker and use this information to make inferences about the message being transmitted and the speaker's intentions (Sperber 1995). Thus, all communication relies heavily on inferring meaning and purpose.

"Theory of Mind" is our well-researched ability to conceptualize the mental states of others based on our knowledge of our own internal state. We are able to infer emotions, motivations and purposes in others. Children develop a theory of mind at around age two and it continues to develop and increase in accuracy with increased social interaction (Leslie 1987).

While arguing for this theory of animism, Boyer (1993) claims, "Humans are the most highly organized and significant things we know, so we are predisposed to look for them." He cites examples of people seeing faces in mountains and clouds and cars. It's true that we tend to see faces everywhere, as anyone who's stared at knots in wood long enough can attest to. Researchers have found that infants will respond to face-like stimuli shortly after birth (Goren 1975). The key here is that an actual face is not required for us to detect a face. We see certain features (researchers are still trying to determine exactly which aspects of faces are the ones we react to most) and from those infer a face.

Another cognitive ability which requires inference of purpose is cheater-detection. Cosmides & Tooby (2005) argue that we have a mechanism that allows us to recognize those who break social contracts and violate the rules of reciprocal altruism. Researchers have found evidence of this ability in people from various cultures (Sugiyama, Tooby &

Cosmides 2002) and have determined that brain damage to the limbic system can impair it (Stone, et al. 2002).

While the connection between these cognitive processes and the type of purpose-detection which leads us to view the world teleologically may not be immediately obvious, I would argue that it is the application of these processes to the natural world which leads us to see purpose in it. For example, the "Theory of Mind" describes our attribution of intentions and purposes to others, but I would argue that we don't limit its application to our peers but rather extend it broadly to the natural world as well. It's almost as if anytime we observe an organism performing a function, we place ourselves in the position of that organism (as we would if it was our peer), then imagine what our motivations or purposes would be in that situation, and then attribute that purpose to the organism. We have a tendency to place ourselves in another's shoes, even when that "other" isn't human, but is instead, say, a bacteria.

Given that our brain's standard method of extracting meaning from and interpreting the world around us is through automatic inference based upon observed empirics, I would argue that it is not a stretch of the imagination in any sense to suggest that we are predisposed to infer teleological purpose when observing the natural world.

I wouldn't go so far as to argue that the cognitive processes I outlined above are all the same thing, as I obviously can't identify their specific neural basis, however I would definitely argue that they are all at least closely related and are perhaps different manifestation of the same underlying cognitive wiring. The next goal of this paper is to examine and make some tentative hypotheses about that underlying wiring. One way to begin this is by examining situations in which many of the cognitive processes I've discusses are impaired.

What Autism Tells Us

According to the American Psychiatric Association, autism is a spectrum disorder characterized primarily by impaired social interaction and impaired communication ability. Considerable research has been done on the causes of these impairments and it seems that most findings indicate an inability to make certain types of inferences that unaffected people make on a day-to-day basis. For example, there is a general consensus that autistic people lack a "Theory of Mind," and therefore are unable to infer emotions and intentions in others (CITE). Looking at which cognitive processes autism causes to become defective may allow us to identify processes which are linked and enabled by the same underlying "machinery," and perhaps with further research even identify what this machinery is.

As stated before, many of the cognitive functions that autism impairs seem to be based upon making inferences, particularly psychological inferences. Autistic children have difficulty understanding figurative language, which according to Sperber's relevance theory is due to an inability to infer relevant information (Happé 1993). Autistic children also frequently fail to identify intentional physical displays of communication. For example, they may be able to imitate a gesture, but cannot infer its meaning (Atran & Norenzayan, 2004). This indicates a lack of ability to detect purpose and meaning in the actions of others.

Autistic children also exhibit an impaired ability to recognize faces, relying primarily on individual features, particularly the mouth, rather than the face as a whole (Joseph & Tanaka, 2003).

Research comparing pattern detection in normal and autistic children found that while autistic children were frequently good at rote memorization tasks, their ability to remember meaningful material was significantly inferior to that of normal children. For example, normal children were far better at recalling material arranged in sentences or containing an underlying pattern. The author explained this difference as, "a failure of feature extraction" in autistic children which results in an inability to perceive meaning (Frith, 1970).

Though significantly more research is obviously required, I would argue that observation of the capabilities which are lacking in people with autism suggests that autism also impairs ability to detect purpose. It would be interesting to conduct an experiment like Deborah Kelemen's to see if autistic children prefer teleological or physical explanations for phenomena in the natural world. I predict that they would prefer physical explanations. However, even in the absence of hard evidence showing autism impairs purpose-detection, I believe examining theories about the neurological basis of autism can still tell us something about the neurological basis of our ability to detect purpose, as purpose-detection relies on inferences in much the same way as the processes impaired in autism that I've discusses above. Therefore, in the following section I will first discuss theories about what physical abnormalities underlie autism.

Neurological Basis

One theory about the cause of autism argues that autistic people have a "weak central coherence" cognitive style, in which they process information locally rather than globally. Proponents argue that this would account for the savant behavior evident in some autistic individuals due to increased ability to perceive and attend to details (Happé 1999; Frith 1989). An interesting aspect of this theory is that rather than presenting autism as a deficit or impairment, it is instead viewed as a different cognitive style or method of processing.

In global processing, information is pulled together and processed to obtain higher-level information—or in other words make inferences, however the details of the original information is largely lost for the sake of overall meaning. When information is processed locally, the details are maintained and can be attended to closely, however no upper-level information is produced, and no inferences are made.

While proposing this theory, Happé cites evidence that the brains of autistic individuals generally weigh more and have more cell density in certain areas than those of non-effected individuals (Piven 1995). She suggests that in the brains of autistic people during development there is decreased selective cell-death, or "pruning" of neurons than normal which leads to an increased number of neurons overall and a decreased ability to generalize.

Other research on the causes of autism has focused on the impairment of "theory of mind" and therefore on attempts to determine brain regions responsible for the ability to infer thought and emotions in others. Areas that appear to be especially important include the frontal cortex, particularly the orbitofrontal cortex as damage to this area has the most direct effect on social behavior, and also the amygdala which is responsible for emotions including fear, and linking sensory input to these emotions (Stone 2000).

Research on macaque monkeys has determined that the cortex in the anterior section of the superior temporal sulcus within the temporal lobe is responsible for perceiving face and body appearance, and that one particular region of this cortex is responsible for understanding and interpreting actions. Different types of cells encode specific types of movements in relation to other objects, while still others are triggered when an observed motion is not a predictable outcome following the monkey's own action. The researchers argue that these sorts of mechanisms responsible for interpreting the actions of others may be one component of the brain that is damaged in autism (Emery & Perrett 2000).

What these theories of causes of autism are tied to are overall theories of how the brain functions. If damage to specific areas is found to cause autism, then that would suggest that the cognitive abilities impaired by autism are controlled locally, while if it is found to be a condition resulting from a different style of cognitive processing, then that would suggest that the impaired abilities are more a result of whole-brain global processing.

Boyer (2001) compares the mind to the running of the household in a large manor from a Jane Austen novel: specific servants responsible for specific tasks arranged in a complex hierarchy, yet the whole thing appears from the outside to operate simply and smoothly. He says, "What makes the system work smoothly is the exquisite coordination of many specialized systems, each of which handles only a fragment of the information with which we are constantly bombarded." This is a fairly general statement that I feel most psychologists and neurobiologists would agree with, however conflicting ideas emerge when we try to define *how* specialized these systems are, and what they're specialized for.

When discussing how the brain is organized and functions, there is great debate over the concept of "modularity." Fodor (1983) argues that the brain is organized into domain-specific independent units which are responsible for the lower-level processing of different types of information. He calls them "input systems" to emphasize the fact that they relay information about the world to our central-processing area, yet still rely on inference to represent "the character and distribution of distal objects." His examples include mechanisms for color perception, shape analysis, melody and rhythm detection, and grammatical assignment to utterances.

Though he argues for the modularity of input systems, Fodor also claims upper-level processing, which he distinguishes as "central systems" or cognitive processes are not modular, and that this is where input systems interface. Other researchers, like Steven

Pinker (1997) argue for a massive modularity of the brain which would account for everything from language, to falling in love, to laughing and that these modules are innate and shaped by evolution.

Fodor disagrees strongly with this concept of "massive modularity," arguing that if we did indeed have specific modules shaped by evolution for each of our unique cognitive abilities, then we would expect our brains to look very different from those of the apes to whom we're closely related. However, our brains are in fact extremely similar, so a very small physical change has led to an extremely large increase in cognitive capabilities, which undermines the idea that each of these capabilities is represented by a module (Fodor 1998). Nicastro argues from a similar viewpoint in his commentary on Atran & Norenzayan's article (2004) saying, "although it is widely accepted that modularized functions emerge in brain development, that these functions are pre-specified is not."

I would not go so far as to say we have a specific "purpose-detection module." That strikes me as far-fetched and in itself teleological. I would argue rather that we do indeed have a "purpose detector," however it is an emergent property of our large associational cortex, and is not a specific entity, but instead is a result of the same cognitive systems that allow us to make inferences regarding the world around us. When we input sensory information from the natural world, our automatic inferential output is that there is purpose, and thus we view the world teleologically.

Accuracy

So how accurate is our intuitive sense of purpose? How often does it turn up false positives? We all frequently attribute incorrect thoughts to others, perhaps thinking they are judging us, assuming they hold certain opinions. All horror movies directly play off our "hyper-active agency detector," building up suspense and making us jump. Atran & Norenzayan argue that all superstitious belief in ghosts and other supernatural beings is a result of false positives as well.

There is also evidence that accuracy improves as we age. Children are far more prone to infer purpose than adults. The tendency of children to be scared of the dark and to be deeply effected by ghost stories attests to this fact. As discussed earlier, studies have shown that children infer purpose in objects far more frequently than adults, and prefer teleological explanations over physical ones for all sorts of natural phenomena, while adults tend to prefer teleological explanations only for biological phenomena (Keleman, 1999). Other studies have shown that children also tend to be far more sensitive to religious beliefs than adults, believing that God's presence is pervasive, but these beliefs tend to wane with age (Atran & Norenzayan, 2004).

Obviously it would be difficult to measure the accuracy of our purpose-detecting ability, and making an estimate is far beyond my capabilities, but I believe it is a question deserving further research, especially as it is very relevant to the debate about whether it is correct to view the natural world teleologically. In other words, is this tendency toward teleology in biology simply a false-positive?

Conclusion

Though the question of whether teleology in evolutionary biology is valid is one of contention, it's obvious that whatever the correct answer, we have a natural tendency to view the world teleologically. The cognitive underpinning of this tendency is an innate disposition to infer purpose, which is closely linked to other cognitive processes which allow us to make inferences about the world. Many of these processes are impaired in autistic individuals, and while no research has been done to determine whether autism effects the ability to hold teleological views, I suspect that it does. This type of research could be extremely valuable because I believe it could provide greater insight to both autism and purpose-detection.

While determining the neurological basis of an ability to detect purpose is extremely problematic and pretty much beyond the scope of this paper, I would very tentatively suggest that it is the result of global processing used to infer motives for things in the natural world based upon what we know about ourselves, and our prior knowledge about what the motives of living things tend to be. Just as we witness a series of events and our brain then strings them together into cause and effect, we witness organisms, actions, and functions and then put them together to see design and purpose.

The question of the reliability of our purpose-detection ability and what will cause it to produce false-positives deserves more attention. However, I doubt there is a final answer to whether our detection of purpose in the natural world is a false-positive. Personally, I think when you get into philosophical questions like that it all comes down to semantics and the eye of the beholder. However, whether or not it is the correct way for a scientist to view the world, I believe there is sufficient evidence to conclude that we are innately biased to view and talk about things teleologically, and that our cognitive processes lead us to see purpose almost constantly in the world surrounding us.

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