Reasons Things Happen for a Reason:

An Integrative Theory of Teleology

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Abstract

Humans default to functions and purposes when asked to explain the existence of mysterious phenomena. Our penchant for teleological reasoning is associated with good outcomes such as finding meaning in misfortune, but also with bad outcomes such as dangerous conspiracy theories and misunderstood scientific ideas, both of which pose important social and health problems. Psychological research into the teleological default has long alluded to Daniel Dennett's intentional systems theory but has not fully engaged with the three intellectual stances at its core (intentional, design, physical). This article distinguishes the intentional stance from the design stance, which untangles some of the present knots in theories of teleology, accounts for diverse forms of teleology, and enhances predictions of when teleological reasoning is more likely to occur. This article examines the evidence for a teleological default considering Dennett's intentional systems theory, proposes a process model, and clarifies current theoretical debates. It argues that people rationally and often thoughtfully use teleological reasoning in relation to both cognitive and social psychological factors. Implications for theory and future research are discussed.

Keywords: teleology, explanation, meaning, intentionality, purpose

Reasons Things Happen for a Reason: An Integrative Theory of Teleology

Why does the volcanic Mount Saint Helens exist? The current science-minded audience might reply that eruptions of lava cooled and hardened near their source, forming a tall mountain of rock. However, scientific reasoning is just one possible approach to the causal reasons behind existence. Ancestors of the local, indigenous Yakima people took an intentional design approach to explain the once snow-capped cone. They argued that Great Spirit placed a “white maiden” there to protect the Columbia River’s Bridge of the Gods¹ from destruction by two battling brothers—Mount Adams and Mount Hood. Modern scientifically literate high school students might take a purely functional approach, explaining that the volcano exists to relieve geothermal pressure. In contrast to using the first, mechanistic mode of reasoning, the Yakima ancestors and the hypothetical high school students used teleological reasoning to explain the existence of Mount Saint Helens. Their explanations both appealed to purpose or function, but one involved an intentional causal force while the other did not. The current article seeks to distinguish intention-based teleology from that which is not. This nuance can account for diverse findings and promote better understanding of teleological reasoning. This understanding is important because teleological reasoning promotes numerous adaptive (e.g., Banerjee & Bloom, 2014; Bering, 2002, 2003; Casler & Kelemen, 2005; Csibra & Gergely, 2007; Hernik & Csibra, 2015; Kray et al., 2010; Park & Folkman, 1997; Perner & Esken, 2015) and maladaptive (e.g., Barnes et al., 2017; Brotherton & French, 2015; Jolley & Douglas, 2014; Kelemen, 2012; Lewandowsky et al., 2015; Wagner-Egger et al., 2018; Young, 2020) social consequences.

¹ A local landslide caused a natural, ultimately temporary, dam of sediment to cross the Columbia River some centuries ago. Local legends tell of a time when the mighty Columbia River could be crossed without getting one’s feet wet. It came to be known as Bridge of the Gods and was quite important to the lives of local people (Clark, 1952). Local legends have taken several forms beyond the one reported above, which is quite abridged itself.

Psychological researchers have fairly described teleological reasoning as a “developmentally persistent cognitive default” (Kelemen et al., 2013, p. 1075), but there might be more to the story. This article synthesizes psychological research with Daniel Dennett’s well-known intentional systems theory (1987) to present teleology as a rational mode of reasoning that efficiently delivers useful explanations in accord with people’s selected intellectual stance and their available knowledge. Psychological research has long characterized intentional systems theory as a useful and perhaps essential theoretical lens (e.g., Keil, 1995; Kelemen, 1999b), but misses the crucial distinction between the intentional and the design stance. Distinguishing the intentional stance from the design stance means clarifying teleology rooted in perceived intentions from teleology that is not. This distinction promotes better understanding of adaptive variations in teleological thinking across situations.

Integrating Intentional Systems Theory with the Psychology of Teleology

Briefly, Dennett has argued that humans take one of three intellectual stances when attempting to understand a phenomenon. Taking an *intentional stance* means using estimates of a rational agent’s current beliefs, knowledge, and goals to understand and predict its behavior. One assumes that a rational agent “will act to further its goals in light of its beliefs” (Dennett, 1987, p.17). Taking a *design stance* means using knowledge of a target’s function to understand and predict its behavior. For example, one uses the function of D-cell batteries (emitting electrical current) to predict what will happen when they are inserted into a switched-on flashlight (the bulb will emit light). Lastly, taking a *physical stance* means using mechanistic, causal, physical knowledge to explain a target’s behavior. For example, one can explain human behavior by certain electro-chemical processes in the nervous system. This stance most closely reflects scientific thinking.

According to Dennett (1987, 2017), the physical stance is the least epistemologically risky of the three when sufficient knowledge is available because mechanistic causes are more falsifiable than relatively slippery intentions or functions. However, satisfying mechanistic knowledge is often difficult to acquire. A design stance permits bypassing unintuitive physical details in favor of function. It enables prediction and explanation of outcomes according to how artifacts and biological objects should behave given their designs. The design stance enables the prediction that fresh batteries will make a flashlight's bulb shine when switched on without calling up scientific knowledge of the electrochemical and otherwise mechanistic causal processes at work. Dennett argues that when the physical and the design stances are inaccessible, one can take the intentional stance. Importantly, people rationally deploy any one of these three stances according to their available knowledge and perceived circumstances.

The upcoming arguments depend on a few key points derived from engagement with intentional systems theory. First, teleology can flow from a pure intentional stance. For example, the belief that a hurricane was meant to punish a sinful populace indexes the perceived intentions of an intelligent causal agent. Second, teleology can flow from a pure design stance. For example, the belief that batteries exist to supply electricity does not require thinking about any causal intentions. Third, the intentional stance and the design stance can exert mutual influence. The apparent functions of phenomena can be informed by the intentions of causal agents, and the intentions of causal agents can be informed by the apparent functions of phenomena. For example, people infer intentionality from apparent function when a noteworthy and functional coincidence becomes retrospectively "meant to be." Conversely, people infer function from apparent intentionality when an agent's actions lead to a noteworthy but perhaps unintended outcome. For example, the action sequence of someone gazing at a freshly poured sidewalk,

furrowing their eyebrows, and walking right through the wet concrete might signal that the person intended to cause damage. However, that inference depends on perceived intentions that each imply a limited set of possible functions. In support of this, different explanatory stances can co-exist (Busch et al., 2017; Legare et al., 2012), perceived intentions influence perceptions of plausible functions (Bloom, 1996; Diesendruck et al., 2003), and teleological explanations must conform to the apparent function of a target entity in order to be accepted (Liquin & Lombrozo, 2018).

Taking an empirically supported intentional stance is the key to understanding and predicting teleological reasoning. In concrete terms, this means using a target person's beliefs, knowledge, situation, and goals in concert with psychological theory to predict which intellectual stance will they would deem the most useful. Applying this idea to developmental differences in teleology as an example, first-year infants exhibit an intentional stance inasmuch as they preferentially attend to goal-related stimuli (e.g., Aschersleben et al., 2008) and infer goals where none exist (Southgate et al., 2008). The design stance has not been uncovered before the second year or so (Asher & Kemler Nelson, 2008; Kemler Nelson et al., 2000; Grief et al., 2006; Kemler Nelson & O'Neil, 2005; Nelson et al., 2004). Children begin to explain the existence of non-living natural objects with the physical stance at around age nine when sufficient physical knowledge becomes available (Kelemen & DiYanni, 2005).² With their dearth of scientific knowledge, younger children are unable to support taking a physical stance toward existential questions. The primacy and cognitive privileging of the intentional stance, and less so the design stance, mean that these are relatively more effective at generating children's existential

² One could argue that that infants might engage a primitive physical stance (e.g., phenomenological primitives; DiSessa, 2014; DiSessa, 1993) to understand nature. However, most of Kelemen's preschool participants endorsed the teleological explanations even when encouraged to think scientifically, suggesting that a sufficiently rich physical stance is not generally available to younger children for explaining the existence of natural entities.

explanations than the physical stance is, resulting in a relative attraction to teleological explanation. Once an appreciation and knowledge of physical processes develops, older children and adults can take any intellectual stance that seems most likely to provide a satisfying explanation (see below).

Taking an empirically informed intentional stance to predict teleology requires applying psychological theory to a complex array of beliefs, knowledge, goals, and situations. The next two sections of this article are aimed at informing that task with a process model and its theoretically derived modifiers.

A Teleological Thought Process Model

Taking a Stance

People can generate explanations by taking the intentional stance, the design stance, or the physical stance according to relevant knowledge accessibility, a target's features, exogenous cultural and social influences, and other factors soon to be explained (Figure 1). The intentional stance and the design stance are each capable of generating teleological explanations. They also exert mutual influence by creating and constraining plausible hypotheses.

Goal-Related Inductive Inference

The cognitively accessible network of goals, intentions, and functions that appears in relation to reasoning from the intentional stance or the design stance will be called *goals knowledge* for simplicity because the two stances are often codependent. Goals knowledge includes a one-day old infants' expectation of rational goal-seeking behavior and an eighty-year old's rich mental representations of a long-term partner's predictable goals. Goals knowledge includes the intentions or functions of other conscious agents, artifacts, gods, invisible processes, or even the self. Goals knowledge might be informed by prior experience, semantic knowledge,

or pure theory of mind (Tomasello et al., 2005; Wellman et al., 2001). Given that people often rely on effort-reducing heuristic reasoning (Kahneman, 2011) that substitutes highly accessible information for more elusive (and likely more complex) information, more accessible target characteristics are likely privileged when generating explanations. For example, privileged information might include inherent facts about a target. As opposed to extrinsic facts that tend to index relations with other entities, inherent facts are fundamental to the target, such that changing them would change the target itself. Intrinsic facts also come to mind relatively more frequently and more quickly (Cimpian & Salomon, 2014b, 2014a; Hussak & Cimpian, 2018).

Figure 1 about here

Goals knowledge provides an inductive base of potential explanatory purposes that are each subjected to a corrective process until a plausible explanation is reached. This is an example of inductive inference. People use inductive inference to reason about similar intuitive cognitive phenomena such as affective forecasting (D. T. Gilbert et al., 2002), judgmental anchoring (Epley, 2004), anthropomorphism (Epley et al., 2007), and various social biases (Epley, Keysar, Van Boven, & Gilovich, 2004a). The inductive inference process involves interpreting data from mental simulations, verbal reports, and behavioral observations within a known framework of accessible theories and hypotheses (Higgins, 1996). Inductive inference involves the acquisition of knowledge, the activation of stored knowledge, and the direction of the activated knowledge toward understanding a given target (Higgins, 1996). Teleology is an inductive inference associated with taking an intentional stance or a design stance for explanation.

Exogenous Factors

The current theory posits that teleological reasoning is deployed rationally in relation to cognitive and social variables. This section outlines several theoretically derived determinants of teleological reasoning and their relations to the process model.

Structure-Function Fit

Structure-function fit is the correspondence between the structure (e.g., claw length) and the function (e.g., digging for insects) in a proposed teleological explanation. It is considered by infants as young as eighteen months old (Hickling & Wellman, 2001; Madole et al., 1993; McCarrell & Callanan, 1995). Liquin and Lombrozo (2018) found that structure-function fit influences the plausibility of teleological explanations of biological features, and that mechanistic information (e.g., cellular reproduction) is given less weight when satisfactory function information is available. Their final experiment found that participants in both speeded and natural conditions were more likely to endorse teleological explanations of biological features when these were high in structure-function fit. Although this might seem to suggest the primacy of the design stance, they found that structure-function fit was a stronger predictor of endorsing unwarranted teleological explanations in the natural condition. As Liquin and Lombrozo explained, if this finding was not merely the outcome of having less noisy data in the natural condition, assessing structure-function fit could also involve effortful processing, and therefore the design stance is not always synonymous with shortcutting, but rather with efficient explanation generation. Participants roundly reject teleological explanations with poor structure-function fit whether their responses are speeded or not, and across all tested categorical domains (Kelemen et al., 2013; Kelemen & Rosset, 2009; Liquin & Lombrozo, 2017), suggesting that structure-function fit is a primary criterion for acceptable teleological explanations.

A construct analogous to structure-function fit applies to the intentional stance. Behaviors must fit the purposes of any hypothesized intention to be plausibly explained by intention.³ For example, the hypothesis that mandatory vaccinations are a plot to sterilize the population is much more plausible than the hypothesis that they exist to melt the polar ice caps. This reliance on “behavior-goal fit” is evident from infancy. Infants exhibit surprise and interest when observed behaviors deviate from expectations, which appear to reflect consideration of intentions for both humans and machines (e.g., Csibra, 2008; Gredebäck & Melinder, 2011). The intentional stance and the design stance both require evidence that hypothesized goals or functions are consistent with the behaviors or structures that serve them.

Event Characteristics

Unexpected, uncontrollable, or significant events are more likely to elicit teleology than relatively benign events. Consistent with the intentional stance, people often make sense of unpredictable non-human behavior by applying intuitive models of human behavior. Participants attribute more human characteristics and will (agency) to animal targets who behave in unpredictable ways (Epley, Akalis, Waytz, & Cacioppo, 2008) and more intention to life events that are unexpected (Morewedge, 2009). Barrett and Johnson’s (2003) participants attributed more agency to ball bearings when they were randomly assigned to the condition in which an experimenter unpredictably moved the ball bearings around a puzzle board with a covert electromagnet. These metal marbles were frequently described as having dispositions and desires—such as “liking” or “wanting”—but only when their behavior was uncontrollable. This suggests that uncontrollability begets the intentional stance inasmuch as it suggests agency (Kelemen et al., 2013; Kelemen & Rosset, 2009; Liquin & Lombrozo, 2018; Willard &

³ Hypothesized intentions can become profoundly nebulous to make baffling behaviors somewhat explicable (e.g., a god working in “mysterious ways”).

Norenzayan, 2013). Teleological explanations are more likely when events or behavior are uncontrollable or unpredictable.

The personal significance of an event also begets teleological reasoning. Participants often apply teleological “meant to be” explanations to significant life events such as illnesses and chance meetings of subsequently important people (e.g., a future spouse). The meaning of a person-environment transaction is first assessed in terms of personal significance, which is influenced by relevance of the event to the one’s beliefs, goals, and commitments (Park & Folkman, 1997). Especially significant are events that violate one’s global beliefs, and these are more likely to motivate sensemaking, which often involves finding the event’s purpose (Heine et al., 2006; Lazarus & Folkman, 1984; Park & Folkman, 1997). Inasmuch as a meaningful physical stance on life events is undesirable, inaccessible, or unsupportable, increasing motivation for sensemaking via unpredictability or significance will increase reliance on the intentional and the design stances.

Cognitive Reflection

Cognitive reflection is the reappraisal and, if necessary, correction of existing thoughts. It is measured by participants’ endorsement of a correct but theoretically less intuitive answer to a series of seemingly simple problems. For example, one item of the Cognitive Reflection Test (CRT; Frederick, 2005) states that a bat and a ball together are worth \$1.10, and the bat is worth \$1.00 more than the ball. Participants choose whether the ball is worth five cents or ten cents, with the assumption that the incorrect “ten cents” is the more intuitively correct answer. The CRT and its successors seem to capture deductive ability and the motivation to engage it. Higher CRT scores correlate with less teleological views of nature (Zemla et al., 2012), but they also correlate with higher scientific understanding in a broad array of domains (Shtulman &

McCallum, 2014). This suggests that the relationship of cognitive reflection and teleology partially reflects the existence of accessible non-teleological knowledge structures. Relatedly, Boyer and Baumard (2013) argued that while religious beliefs may be rooted in or licensed by lay social intuitions, extensive cognitive reflection enables the elaborate religious beliefs so commonly observed throughout recorded history.

Ignoring the correlation between high CRT scores and the knowledge to support a physical stance, the propensity to engage in cognitive reflection should influence the amount of effort invested in reappraising early teleological intuitions. However, the nature of these corrections should depend on one's selected intellectual stance. Cognitive reflection would refine the application of goals knowledge when perceivers take an intentional or design stance, unlike when they take a physical stance. For this reason, CRT scores and scientifically unwarranted teleology should be relatively less related among those who take an intentional or design stance toward nature than among those taking a physical stance.

Perceived Agency

It is uncontroversial that perception of an intention-driven agent licenses the use of teleology to explain that agent's actions, but the determinants and effects of perceived agency are important to understand in this model's context. The real or imagined presence of intentional beings is largely situational, depending not only on sensory indications of the agents themselves, but often on whether cues of intentional actions, such as orderliness (Ma & Xu, 2013), or extreme unpredictability (Waytz et al., 2010) are embedded in the observed outcome. For example, in the absence of other clues, the presence of a roof shingle in the backyard on a windy day does not necessitate causation by intentional agent, but a roof shingle leaning against the celery in the refrigerator probably does.

Religious beliefs are not required to perceive intentional agency behind the natural world and life events. Many who prefer and claim to understand evolutionary biological explanations likely still carry their innate intentionality bias (Shtulman & Valcarcel, 2012), as evidenced by participants considering natural processes such as evolution to be quasi-agentic (Shtulman, 2005). Religious and non-religious people credit vaguely agentic forces such as karma or fate with causing personally significant outcomes (Banerjee & Bloom, 2014). Non-religious and atheistic people are prone to perceiving agency behind natural things and events, which in turn licenses teleological reasoning.

Regarding scientifically unwarranted teleology, the current theory predicts that the perception of agency makes teleology relatively more compelling because agency suggests that intentional design might explain the existence of the target stimuli. Using warranted teleology to illustrate, one would correctly interpret an unexpected stack of freshly cut cedar logs as evidence of human agency, and logically would use knowledge of human goals to understand why the pile exists, but the only plausible goals would be those that benefit from a pile of cedar logs. These hypotheses would be constrained and corrected considering both agent intentions and structure-function fit—large logs might suggest the intention to build a cabin, while smaller logs might suggest the intention to build a fire. The intentional stance likely combines with the design stance to hypothesize the log pile’s purpose, or the function of any other “artifact”⁴ where agency is considered.

Another key prediction is that the perception of an intentional agent will aim correction more toward finding the most plausible teleological explanation and away from finding non-teleological explanations. In a recent study, controlling for belief in supernatural agents’

⁴ Scare quotes indicate that artifact loosely refers to things created by physical or non-physical beings. Strictly, artifacts are made by physical beings.

existence, participants who believed that supernatural agents intentionally interact with the world were more likely to hold explicit teleological beliefs than those who did not (Roberts et al., 2020). The authors also used a speeded responding method that has demonstrated higher acceptance of teleology when participants are rushed (Kelemen et al., 2013; Kelemen & Rosset, 2009). They found that participants with pre-existing intentional agent beliefs showed a larger difference in accepting scientifically unwarranted teleology between speeded and unspeeded conditions than those who did not believe in intentional agents. Furthermore, the teleology acceptance difference between theists and the others was in the unspeeded condition, where everyone had time to correct their intuitions. This vaguely suggests that “believers” given time to reflect are less likely to seek non-teleological answers, though it is possible that group differences in cognitive reflection drove this effect (Zemla et al., 2012), which would indicate that “believers” are less likely to correct intuitions. In summary, the current theory predicts that the perception of intentional agency will license the intentional stance which may lead to a complementary design stance, eliciting agent-situation goals knowledge and aiming corrective reasoning at finding the most plausible teleological explanation for a target stimulus.

Cultural Influences

People can choose to identify with numerous cultural groups beyond ethnicity or nationality, following the distinct norms of entities like workplaces, schools, or sports fan bases (Cohen, 2009). Researchers continue to find that people act on the beliefs that they perceive as common within a salient group of others (e.g., Asch, 1951; Cialdini & Trost, 1998; Jetten, Postmes, & McAuliffe, 2002; Latane & Darley, 1968; Mead, 1934; Paluck, 2009; Sherif, 1936). The ideas and sensibilities perceived to be widely shared among the salient group tend to influence everyday interpretations of perceptions (Moscovici, 1976). Tam and colleagues (2009)

found that cultural differences in causal attributions—two constructs known to vary between these two cultures (Miller, 1984; Morris & Peng, 1994; Nisbett et al., 1999; Norenzayan et al., 2002)—are mediated by perceived cultural patterns and not by personal belief. By the current theory, people decipher which intellectual stance and attendant knowledge base a salient culture would expect in response to a given problem and adjust their own reasoning to match cultural norms when harmonizing with the culture is a priority.

Culture has enough influence to restrict the intentional stance even when explaining human behavior. Numerous Pacific cultures promote the belief that intentions and thoughts are unknowable (i.e., opacity of mind; Besnier, 1993; Duranti, 1992; McKellin, 1990; Robbins, 2008; Robbins & Rumsey, 2008; Schieffelin, 2008). For example, the Korowai people of Western New Guinea explain others' actions with the broad idea that each person has their own thoughts, paying no apparent heed to specific causes, functions, or goals (Stasch, 2008). They extend this reasoning to natural phenomena (e.g., the sun takes a straight and orderly path through the sky because the sun has its own thoughts). Indigenous Fijians are less likely than Indo-Fijians or North Americans to predict an agent's behavior by inferring their false beliefs when performing an adult version of the False Belief task (McNamara et al., 2018). Priming indigenous Fijians to think about others' thoughts caused them to shift their thinking toward others intentions (McNamara et al., 2019). If they were merely keeping their mentalizing to themselves, the priming would not have changed their thought process. These results suggest that cultures influence whether one takes an intentional stance to explain human behavior.

Culture should influence teleological reasoning by directing explainers to reason from culture-specific intellectual stances and knowledge bases. For example, when a scientific culture is salient, taking a physical stance toward nature might seem especially attractive, but when

religious culture is salient, an intentional design stance might seem especially attractive. Culture should also determine which intentional agents, functions, or physical processes are brought to bear on a given problem. The landslide that created the Bridge of the Gods can be explained as creation of a good or an evil deity, to create a bridge or to punish downstream peoples, by geological or meteorological forces.

Implications for Psychology

This section discusses some of the ways that the current theory might influence psychologists' understanding of teleology more broadly.

Theoretical Commitments and the Teleological Bias

Whether the teleological bias that is observed in educated adults stems from agency detection is a key debate in the literature that has implications for both theory and lay conceptions of the human condition. A universal teleological bias rooted in agency detection would suggest that humans default to teleological explanations because they intuit that nature was purposefully created, as distinguished from other accounts that do not posit such an intuition. The promiscuous teleology (PT) account posits that humans apply design-based thinking to domains beyond its scientifically warranted purview because they attribute natural phenomena to an intentional creative force, consistent with an intentional stance. Though PT has garnered substantial support for many of its central claims, its assertion that agency detection undergirds the teleological bias—which would mean that participants adopt an intentional stance—has been challenged by arguments and empirical findings that teleological explanations of nature do not require belief in supernatural agency (Keil, 1995; Lombrozo et al., 2007, 2018; Lombrozo & Carey, 2006; ojaletto et al., 2013). Several studies indicate that plausibility (e.g., structure-function fit) is a necessary component of an acceptable teleological explanation, and

that while agentic nature beliefs do predict more scientifically unwarranted teleological endorsements, such explanations can make intuitive sense without them (Kelemen et al., 2013; Kelemen & Rosset, 2009; Liquin & Lombrozo, 2018; Lombrozo et al., 2007).

Disentangling the intentional and the design stances resolves some of the tension inherent to the coexistence of these two theoretical viewpoints. People can adopt any combination of intellectual stances to arrive at a satisfying explanation in accord with cognitive and social variables. People with strong beliefs in supernatural agency can adopt an intentional stance, evolutionary biologists can adopt a design stance without appealing to purposeful intentions, and participants under a time constraint can adopt the stance that offers efficient explanation. Which default explanatory stance might underlie the teleological bias remains at issue. Although research has demonstrated correlations between supernatural agency beliefs and unwarranted teleology (e.g., Kelemen et al., 2013; Kelemen & Rosset, 2009), as well as a bias to see nature as intentionally created (Järnefelt et al., 2015), it has not drawn a causal link between the teleological bias and a default belief in supernatural agency. However, disentangling the intentional from the design stance permits understanding and prediction of teleological explanation across underlying theoretical commitments (e.g., supernatural agency, natural selection). It also promotes understanding of some seemingly puzzling research findings. For example, people with no supernatural agency beliefs sometimes endorse scientifically unwarranted teleological explanations for nature and the uncontrollable events in their lives, even when given unlimited response time (e.g., Banerjee & Bloom, 2015; Kelemen et al., 2013).

Hydraulically Related Stances

Evidence exists that intellectual stances can be hydraulically related to one another such that finding an acceptable explanation via the intentional or the design stance reduces the need to

find an explanation via the physical stance. Liquin and Lombrozo (2018) found that when participants evaluated two explanations for the existence of a hypothetical biological feature (e.g., Why do pomahs have sharp teeth?) that varied in the level of mechanistic and functional detail, their natural preference for more mechanistic detail dropped significantly when the competing explanation included more function information (e.g., sharp teeth serve an important function for pomahs). The preference for more mechanistic detail dropped further when that function information also included specific function information (e.g., sharp teeth are better for defending against predators.)

Similarly, Alter, Oppenheimer, and Zemla (2010) found that participants primed to reason in terms of functions decreased their calibration of their mechanistic understanding of causal processes. For example, participants in one study were asked to explain either *how* (i.e., mechanism) or *why* (i.e., teleology) they perform three everyday behaviors (getting dressed, driving a car, backing up a computer). Following these open-ended responses, they estimated how well they believed they could explain the operation of a sewing machine, a bicycle lock, and a zipper. Participants in the teleological condition (why) overestimated their knowledge of the three operation processes more than those in the mechanistic condition (how), suggesting that teleological stances and mechanistic stances can contribute to a common epistemic pot with a setpoint for satisfaction. Rozenbilt and Keil (2002) proposed that an illusion of explanatory depth—an overestimation of one's knowledge on a particular subject—is caused when people confuse having a higher level understanding (i.e., purposes and functions) with having a lower level understanding (i.e., mechanism). Some neurological evidence that social cognitive brain areas have a reciprocal inhibitory relationship with physical cognitive brain areas (e.g., Jack et al., 2013) also supports the hydraulic proposition. In Jack et al.'s fMRI study, participants told to

focus on the social aspects of a video showed deactivation of brain regions used in mechanistic reasoning, and vice versa for participants told to focus on the spatial aspects of the video.

The proposed hydraulic relation of stances has important implications for how psychologists theorize teleological thought. People might lose interest in mechanistic explanations once “overly” satisfying teleological explanations are accepted. This means that non-teleological knowledge competes for cognitive hardware with more intuitive, and therefore potentially prepotent, teleological knowledge. This suggests an even larger challenge for educators working to instill and encourage scientific thinking potent enough to overcome cognitively privileged teleology.

Social Situations Determine Teleology Above and Beyond Worldview and Education

Current teleology research looks for comparative cultural differences in explanatory preferences (e.g., Järnefelt et al., 2019; Kelemen, 2003; Rottman et al., 2017; Sánchez Tapia et al., 2016; Schachner et al., 2017), but has not addressed the situational social psychology at play when people search for explanations. The consideration of social influences has significant implications for psychological theory because teleology has been thought to serve purely epistemic purposes. Teleology also enables social positioning by aligning (or misaligning) one’s beliefs with perceived cultural or group norms. In real world terms, one might express that life serves an ultimate purpose (or no purpose) because of social motives or because it solves a disturbing existential problem, or both. The currently accepted paradigm posits that adults’ scientifically unwarranted teleology reflects unexamined beliefs, a lack of cognitive reflection, a lack of education, and so forth. This ultimately suggests that acceptance or expression of a scientifically unwarranted teleological explanation is an epistemic failure. While scientifically unwarranted teleology is not falsifiable, it might sometimes reflect social imperatives rather than

a purely epistemic need for cognition. Future research into its social determinants might disentangle the perhaps overstated relationships of teleology with cognitive reflection, secular education, and scientific worldview.

Teleology is Intuitive but Not Always Unreflective

The current theory suggests that applied cognitive reflection does not necessarily dampen the teleological imperative. As proposed earlier, when people situationally commit to the intentional or the design stance, cognitive reflection will be relatively more likely to refine the application of goals knowledge than to suppress it. Taking an intentional stance to explain the existence of nature is completely rational when there are strong beliefs that intentional agents with determinable goals caused nature to exist. Ignoring teleological thoughts could be considered maladaptive in a divinely purposed world where eternal life flows to those aligned with God's will. Teleology taken from a design stance is also rational because it produces the functional information that satisfies humans' epistemic needs so powerfully (Greif et al., 2006; Lombrozo et al., 2019; Lombrozo & Carey, 2006).

Evolutionary biologists search for the functions of traits in order to form hypotheses about adaptations, but this teleological reasoning reflects bona fide scientific theorizing rather than elaborated intuition. That a natural teleological propensity might promote such reasoning does not suggest lack of cognitive reflection or scientific rigor because a design stance is the right tool for the job. Different situations call for different intellectual stances with varying amounts of elaboration and correction. The notion of effortful, reflective teleology is currently underrepresented in the current psychological literature and beckons further research.

Teleology and Meaning-Making

Humans are motivated to make meaning out of their experiences (Frankl, 1963; Heine et

al., 2006; Klinger, 1998; Park et al., 2013; Rubin, 2017). Teleological explanations of life can be powerful sources of meaning, such as when challenging situations are believed to serve an important purpose (Martela & Steger, 2016; Park, 2010; Park & Folkman, 1997). Teleology provides otherwise random or unplanned phenomena with an attractive explanation that intuitively makes sense because humans have a deep and primitive understanding of intentions, purposes, and actions (e.g., Csibra & Gergely, 2007). Modern humans can attribute completely mystifying phenomena to a supernatural agent's goals with relative ease, allowing them to find meaning in otherwise "senseless" tragedies and suffering, which can provide a feeling of effectance in relation to one's environment through a sense of understanding.

The psychological construct Meaning in Life (MIL) measures the sense that one's existence is related to things, places, and people beyond itself and is comprised of three factors: Comprehension, significance (or mattering), and purpose (George & Park, 2016; Martela & Steger, 2016). Comprehension denotes the ability to make sense of one's life, significance denotes the belief that one's life matters on a larger scale than self, and purpose refers to one's life having direction and goals. Teleology can satisfy needs in any one of these domains. If we conceive of comprehension as an ability, then the primacy of teleological intuitions allows a wider range of people to make sense of their lives, and thus teleology provides comprehension. Teleology provides significance when one's experiences connect to larger purposes, such as those of supernatural agents or a political party. Teleology provides purpose when the goals one connects to their lives motivate planned behavior toward achieving them. Future research might well test these hypotheses, but there is little doubt that finding the purposes of personal losses and tragedies can restore meaning after they disrupt it (Park, 2010; Park & Folkman, 1997)

Teleology is Rationally Deployed

The overarching theme of this article is that people use teleology when it appears to serve an epistemic or social function better than mechanistic or other explanation frameworks would. In terms of intentional systems theory, people deploy the intentional, design, or physical stance in line with their beliefs about which one will best satisfy their needs (Dennett, 1987, 2017). The intentional stance and the design stance are both associated with teleological reasoning. Taking the intentional or design stance means that corrections to intuitions will be more likely to involve refinements of goals knowledge application, and less likely to suppress it. Taking the physical stance means that corrections will be aimed at finding the most plausible non-teleological, mechanistic explanations.

Taking the empirically based intentional stance can explain much of the developmental course that the teleological bias seems to follow. Young children lack a scientific knowledge base from which to explain natural phenomena, so the prepotent teleological knack is by default the most useful cognitive tool for generating explanations of natural phenomena. As children accrue scientific knowledge and experience how adults value non-teleological explanations, the relative usefulness of teleology decreases, and so development often increases generation of non-teleological explanations for mysterious phenomena. People more selectively apply teleology as other sorts of knowledge bases become available. Thus, teleology is deployed when it appears to be the rational explanatory tactic, but it is more often rational for children than for scientifically educated adults.

Teleology can likely also perform social functions, suggesting that interpersonal concerns would influence the perceived rationality of an intellectual stance and its outputs. In religion-infused environments where deep teleological reasoning marks wisdom and probably higher social status, there are likely implicit and explicit social pressures to find maximum purpose in

nature, meaningful life events, and even coincidences. Given the powerful drives to make sense of one's environment and to fit into a salient social group, people plausibly would devote significant cognitive resources to finding the best teleological explanations at the expense of potentially available scientific reasoning. This would be a rational choice in environments where scientific explanation is relatively devalued.

Considering the functions of teleology, rather than just its cognitive primacy, explains why it is preferred early in life, why it is relied upon even in the face of new evidence, why it can come along with causal-physical explanations, why people are teleological in some situations but not others, and why teleology can result from extensive cognitive reflection. Teleological and causal-physical explanations can easily come along without logical issues, and so people can choose which set of explanatory frameworks is most useful in each situation. Situations can be governed by social pressure, need for meaning, lack of causal-physical knowledge, or any other variable that makes teleological explanations more attractive. Worldviews that include an intentional creative force are apt to make teleology generally more attractive, especially when situational conditions like those above are present.

Conclusion

This article provides a framework for predicting when and from whom teleological reasoning will flow. Properly separating the intentional stance from the design stance clarifies some of the debate over whether scientifically unwarranted teleology indexes an assumption of supernatural agency or a purely functional perspective. More research is needed to pinpoint whether the sense of intention or function is primary. Teleological reasoning can lead to positive or negative life-altering outcomes, it does not necessarily index belief in supernatural agency, and it is rationally deployed according to various needs, proclivities, and social influences,

sometimes after extensive cognitive reflection. It is hoped that psychologists may come to view teleological reasoning as not just a primitive cognitive bias to overcome, but as a highly adaptable cognitive tool that people use in differing ways and amounts to help them understand, predict, and control their perceived environments in ways that seem functional.

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Figure 1. Diagram of the proposed process components.

Note: Diagram shows expected uses for each intellectual stance. All outputs are subject to reappraisal in line with an individual's situation and available knowledge. The intentional stance seeks to find the most plausible "psychological" explanations for a given phenomenon. The design stance seeks the most plausible functional explanations. Purpose requires both intention and function. Hypotheses flowing from the intentional stance are corrected and constrained by knowledge of agent goals, and often by knowledge of function, which flows from the design stance. When intentional agency is sensed, design stance hypotheses are constrained by knowledge of agent goals. Design stance hypotheses are primarily constrained by structure-function fit. Bio. = Biological