

Does Functionalism Offer an Adequate Account of Cognitive Psychology?

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The majority of cognitive psychologists, when pressed, would hold for scientific realism as their philosophy of science and ontological position. However, it is functionalism which undergirds the ontology of scientific realism. Moreover, functionalists claim that cognitive psychology, including sensation, perception, memory, and the higher cognitive functions, can be fully accounted for by functionalism. The question is then: Is functionalism up to the task? Recently, Spalding and Gagné (2013) made the case that concept formation, a key element in all aspects of higher order cognition, can be better accounted for by an Aristotelian–Thomistic (A–T) meta-theory, and Stedman (2013) pointed out parallels between Aristotle’s model and current cognitive psychology. This essay argues that the A–T viewpoint is a better model for all elements of cognitive psychology.

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Confidence in logical positivism and operationism waned in both philosophy and psychology during the 1960s. At about the same time, psychology experienced the cognitive revolution, which reinstated mental states and processes as central to theory building and explanation. As Levin (2013) points out in her review, cognitive psychologists turned to the functionalist theory of mind (Putnam, 1975) as a philosophical underpinning for all aspects of cognition. This interchange produced psycho-functionalism, as described by Levin:

A second strain of functionalism, psycho-functionalism, derives primarily from reflection upon the goals and methodology of “cognitive” psychological theories. In contrast to the behaviorists’ insistence that the laws of psychology appeal only to

behavioral dispositions, cognitive psychologists argue that the best empirical theories of behavior take it [behavior] to be the result of a complex of mental states and processes, introduced and individuated in terms of the roles they play in producing the behavior to be explained. . . . All versions of functionalism, however, can be regarded as characterizing mental states in terms of their roles in some psychological theory or other. (p.7)

Hence, as Levin sees it, functionalism in all its aspects is intertwined with cognitive psychology at both the philosophical and psychological levels.

The purpose of this essay is as follows: (a) to describe the philosophical roots of functionalism; (b) to present an overview of functionalism as it currently operates in cognitive psychology; (c) to review objections to functionalism; and (d) to examine an alternative account, the Aristotelian–Thomistic (A–T) model, recently proposed in cognitive psychology itself (Spalding and Gagné, 2013; Spalding, Stedman, Hancock, and Gagné, 2014) and within the philosophy of mind (Feser, 2006, 2014; Madden, 2013).

Analytic Philosophy and Functionalism

Analytic philosophy, spawned in Britain as a reaction to idealism, dominates English-speaking philosophy to the present time. As Preston (2007) demonstrates in his review of the history of analytic philosophy, the movement was initiated by Russell and Moore, refined as logical atomism by Russell and Wittgenstein (see Wittgenstein, 1922), elaborated by the Vienna Circle as logical positivism (Ayers, 1952), seriously questioned by Quine (1951), and later reinvented by Wittgenstein (1953). Preston characterizes contemporary analytic philosophy, the home of the philosophy of mind, as eclectic and interested in limited metaphysical problems, as still grounded in language analysis and semantics, and as interested in the kinds of thought experiments often used by philosophers of mind. Although current philosophers of mind are split along property dualism (Chalmers, 1996, 2010; Nagel, 1974) and materialist lines (Churchland, 1986; Lewis, 1966), all agree that cognitive processes, from sensation and memory through all of the higher order phenomena of thinking, reasoning, categorization, planning, etc., can be explained by the doctrine of functionalism. In fact, Chalmers (1996), though a property dualist, asserted this about functionalist cognitive models:

Cognitive models are well suited to explaining psychological aspects of consciousness. There is no vast metaphysical problem in the idea that a physical system should be able to introspect its internal states, or that it should be able to deal rationally with information from its environment, or that it should be able to focus its attention first in one place and then in the next. It is clear enough that an appropriate functional account should be able to explain these abilities, even if discovering the correct account takes decades or centuries. (p. 31)

In her review, Levin (2013) points out that functionalism has antecedents (Ryle, 1949; Turing, 1950; Wittgenstein, 1953) but emerged as a definitive philosophical position in the last 35 years of the twentieth century. Feser (2006, ch. 3) provides a brief and readable explanation of how functionalism developed in response to problems with other strictly materialist philosophies, such as philosophical behaviorism and identity theory. Several major strains of functionalism developed: machine functionalism, psycho-functionalism, and analytic functionalism. So, far from being monolithic, functionalism itself is divided, with arguments in favor of and attacking the various strains.

Machine functionalism (Putnam, 1975) was the first of the three developed and appeared to answer a number of problems with behaviorism, for example, critiques pointing out that behaviorists seemed to undervalue internal mental states, such as beliefs and desires, when those constructs contributed implicitly to their theories. Machine functionalism postulated that any "mind" can be regarded as a finite digital computer, one that receives inputs (1), while in a certain state (S1), goes into other states (Sx), and produces output (0). The person with a mind is viewed as a probabilistic automaton, so for each state and sets of inputs, the machine (mind) will enter a subsequent state and produce output according to certain probabilities. These internal mental states were called representations, and the nature of these representations was and is disputed. Over time, early machine functionalism's ties to a "machine table" or program came to be seen as inadequate. However, the basic idea involving inputs, lawful interactions of internal states, and final outputs has been retained in later functionalist approaches.

Psycho-functionalism is closely tied to the emergence of cognitive psychology in the late 1960s and maintains that mental states and processes are entities (constructs) that are defined by the role they play in cognitive psychological theories. They may be tied to brain structures and processes but this is not a requirement. However, there does seem to be a trend toward attempting to ground these constructs in neuroscience (see Stedman, Hancock and Sweetman, 2009). These constructs can include mental states and processes easily identified with common sense (folk psychology) or can go beyond common sense to incorporate more refined constructs identified by laboratory findings, thus replacing folk psychology constructs.

Analytic functionalism, developed by Lewis (1966) and Armstrong (1968), asserts that all mental states, such as pain, hunger, belief, desire, consciousness and so on, are constituted by their functional role, that is, to quote Chalmers (1996): "On this view, a mental state is defined wholly by its causal role: that is in terms of the stimulation that tends to produce it, the kind of behavior it tends to produce, and the way it interacts with other mental states" (p. 14).

Advocates of functionalism hold for the following: (a) functionalism offers a comprehensive ontological account either of all mental states or at least the psychological portion of mental states but not the phenomenal (Chalmers, 1996,

2010); (b) some mental states, according to Chalmers and others, are primarily psychological and are fully accounted for by functionalist ontology, including learning, memory, categorization, perception, and higher-order cognitive processes; (c) some mental states, such as belief, desire, and hope, are referred to as intentional mental states in that they refer to something about the world. Many functionalists regard these states as primarily psychological and, hence, fully accounted for by functionalism. Chalmers (1996) views mental states as mixed. However, whatever in these states is psychological, he asserts can be accounted for by a functionalist ontology.

As mentioned above, the models of cognitive psychology rest on functionalism as a philosophical foundation. Psycho-functionalism may carry a slightly different connotation, but it is really a variety of analytic functionalism. Hence, psycho-functionalism is subject to all the ontological strengths and weaknesses of analytic functionalism.

Functionalism in Current Cognitive Psychology

Contemporary cognitive psychology theories are grounded in psycho-functionalism, expressed as models and/or mechanisms: for example, perceptual binding (John, 2002), working memory (Baddeley and Hitch, 1974), category formation (Smith, Patalano, and Jonides, 1998), and so forth. Some theories incorporate brain structures and processes and others do not. All postulate multiple, interacting mental states and processes that play definite roles in the theory. All are grounded in stimuli at the beginning and behavioral outcome at the end. Various psycho-functional cognitive theories compete, and their truth claims are established by empirical observations.

For example, consider the exemplar model of concept formation. The exemplar model claims that category (concept) formation occurs when people compare new information to exemplars stored in memory. This version of concept formation states that exemplars are learned through repeated presentations and naming of category members and the repeated naming allows the pairing of a common name with a set of exemplars, which in turn allows generalization over those exemplars when the name (or other similar cue) is presented. The exemplar model requires a number of psychological constructs: sensation, perception, learning (of exemplars), many constructs in the area of memory and recall, some mechanism accounting for comparing new stimuli to exemplars, an account of language to perform the response. Because cognitive psychology is increasingly linked to neuroscience, interactions with brain structures must also be factored in. Similar examples could be offered for all content areas of current cognitive psychology, and psycho-functionalism is expected to serve as the ontological and epistemological underpinning for all of cognitive psychology.

Problems with Psycho-Functionalism and Functionalism in General

As mentioned earlier, both property dualist and materialist philosophers of mind agree that functionalism is sufficient to account for all the "psychological" components of cognitive psychology. However, functionalism, as a philosophical position, has been challenged by philosophers of mind almost from its inception. Two of these objections will be presented in some depth.

A general objection to functionalism, well known in the philosophy of mind, is the "damn/darn problem," brought forth by Block and Fodor (1972). Their objection lies within the broader theory of mental holism, which claims that the meaning of a belief (or a sentence expressing that belief) is determined by its place in a network of beliefs (or sentences) making up a whole theory or even a group of theories. Block and Fodor point out that a functional account of mental states must take into consideration any difference in stimuli or responses. Joe smashes his finger in the door and says, "Darn"; Clyde smashes his finger in the door and says, "Damn." We have two equivalent stimuli but different responses. However, functionalists claim that outputs are related to all or many of the agent's internal mental states, so two people who have pain but produce different outputs must share little, if any, common mental states. But this conclusion appears absurd. Hence, Block and Fodor believe that functionalism leads to an extreme and undefendable version of mental holism.

This critique is also important in that one of the presumed advantages of functionalism was that it would allow one to avoid the type/token problems that arose in identity theories. In particular, a problem with identity theories is that, if the mind/thought is taken to be identical to the brain/brain state, then there must be lawful relations between given brain states and thoughts, but there seem clearly to be logical relations among thoughts, but only physically (efficiently) causal relations among brain states. This difference calls into question rather strongly the whole notion of identity between brain states and types of thought. Functionalism works around this problem by defining states with respect to their functional (including logical) relations to other states. However, if, as Block and Fodor (1972) claim, differences in response (including between individual tokens of a particular type of thought) dictate large differences in mental states, the mental holism implied by this removes this purported advantage of functionalism. In short, functionalism does not avoid a similar kind of problem as that identified in identity theories.

A second, and perhaps more damaging, critique asserts that functionalism, as an ontological claim, is trivial, that is, that functionalism's internal structures (constructs), anchored by stimulus inputs and behavioral outputs, are not unique but can be present in many complex and less complex systems. This criticism was stated earlier by Putnam (1988), Searle (1990) and others and has been reworked recently by Godfrey-Smith (2008). These arguments all point out that

the functionalist realization of a complex mental system is present when the set of mental states maps or corresponds to physical states of the system. These systems are known as combinational state automatons (CSA) and can occur in a large number of formats, including a properly manipulated bucket of water! Godfrey-Smith (2008) asserts the following:

If a normal human's functional organization over some interval is represented by a CSA, then our designer could build a transducer device that perturbs the bucket of water in specific ways in response to every possible sequence of inputs that a human might receive, and another transducer device that maps the water's responses to appropriate behaviors. So a bucket of sea water could act as control system for a humanoid robot, provided that our designer was extraordinarily knowledgeable about the object's contingency tree and skilled in the building of input and (especially) output transducer devices. (p. 23)

The triviality argument, as mentioned, is very complex and only this brief sketch will be presented here. It is important to recognize, however, that the import of the critique goes beyond the fact that it seems to lead to strange outcomes in which a bucket of water might have a mind. In particular, the issue is that if these kinds of arguments go through, then there is no guarantee, in functionalist terms, that any mental or intentional state actually bears the meanings that we ordinarily assign to them (see, e.g., Madden, 2013, ch. 5). In sum, there is a real possibility that a consistently functionalist account of thought collapses upon close inspection (see also Feser, 2006). For example, functionalist treatments of intentionality tend to lead to a denial of, or eliminative reduction of, intentionality. But the functionalist treatment itself is presented and argued for in intentional terms. Similar problems arise in functionalist treatments of logical reason and other topics.

Other general objections to functionalism include how to characterize the inputs and outputs of a functional system (Block, 1990), problems in accounting for what appear to be the causal effects of our mental states (Kim, 1989), and introspective belief (Armstrong, 1968). All of these objections and more have been put forward, many from functionalism's early days. In summary, functionalism as a philosophical ontology has met with serious objections. It should be noted that these objections apply to all functionalist positions, including psychofunctionalism and analytic functionalism.

Within psychology, functionalism has failed in the task of theory building and theory discrimination. A recent example of this failure was presented by Spalding and Gagné (2013). They pointed out that none of the three predominant models of concept formation (exemplar, prototype, and theory-theory) has emerged as superior, and all have approximately the same amount of empirical support (this problem occurs in many areas of psychology). In fact, they note that recent studies of psychological essentialism, generics, K-properties, and perceptual

symbol systems/embodied concepts challenge the validity of all three probabilistic models mentioned above.

It should be noted that all three theories of concept formation meet the criteria demanded by functionalism. All commence with stimulus conditions, postulate interacting internal cognitive constructs, and produce behavioral outcomes. However, years of research have not led any of the three theories to dominance. In fact, Spalding and Gagné (2013) made this comment about the current state of affairs:

Given the diversity of representations and processing systems suggested by recent research results, it is unclear whether there can be a theory of concepts at all (e.g., Machery, 2009). How can concepts be both essentialist and yet not involve necessary and sufficient features? . . . How can they be both sensory-based and abstract/universal? (p. 71)

Hence, we see that this level of theory building and theory discrimination has failed. Of course, it is possible that there will be a new, functionalist-based, theory that will account for human concepts, though Machery (2009) makes a strong case that this is unlikely. However, this conspicuous failure can also be taken to suggest that a more fundamental re-thinking of concepts is in order, and, since failure of theory discrimination is common in most areas of cognitive psychology, perhaps functionalism is simply not up to the task of theory building.

The A–T Alternative

As mentioned in our statement of purpose, both philosophers of mind and psychologists have recently proposed Aristotelian–Thomistic alternatives to functionalism. We will consider philosophers of mind first. Madden (2013) has written a thorough review of the major approaches to the philosophy of mind, including functionalism. In fact, he is rather enthusiastic about functionalism, as noted in the following quote:

Functionalism is a powerful theory. It seems to provide an account of psychological states without even a hint of anything left to be explained by supposed nonphysical states, while at the same time allowing for mental causation without raising problems of mind–body interaction. . . . It is, whatever its vices, a very good idea. (p. 131)

Although Madden concedes that functionalism has many merits, he argues that its shortcomings outweigh its merits as a philosophy of mind. His arguments against functionalism are those covered in the previous section, plus issues regarding intentionality, beliefs, and thoughts in general.

As an alternative, Madden proposes Aristotelian–Thomistic hylomorphic theory as applied to human (and animal) sensory and cognitive processes, as the best solution to the observed phenomena of mind. His argument for this position is indeed complex and is marshaled against materialist positions, property dualism, and substance dualism; all fail as explanatory systems for mind. For the purposes of this essay, we will not present any further detail regarding these purely philosophical arguments raging among the philosophers of mind but will leave it to the reader to investigate the arguments in the works cited below.¹

Returning to our primary question regarding functionalism’s adequacy as an account of cognitive psychology, we have seen that functionalism has deficits as an ontological system. These deficits also apply to functionalism as an underpinning for cognitive psychology. Recognizing problems with functionalism and particularly incoherence in cognitive psychology’s account of concept formation led Spalding and Gagné (2013) to propose an Aristotelian–Thomistic alternative model to account for concept formation. At about the same time, Stedman (2013) published a paper demonstrating parallels between modern cognitive psychology and neuroscience and Aristotle’s hylomorphic theory. He showed that these parallels exist at all areas of interest to cognitive psychology and neuroscience, including sensation, perception, memory, and higher-order cognitive functions, such as concept formation, theory of mind, reasoning, and so forth.

The details of the A–T model have been elaborated in three recent publications (Spalding and Gagné, 2013; Spalding, Stedman, Hancock, and Gagné, 2014; Stedman, 2013) and so will be outlined here only briefly. The A–T framework commences with sensory information regarding objects in the environment. This information is organized by the “internal senses,” including the common sense (*sensus communis*), which receives and arranges all sense data, the phantasm, which retains the sense data, the imagination, which combines and reassembles images from the phantasm, and the memory, which retains sensory level images for later use. The intellect, by the process of abstraction, then acquires the universal form of the object. The A–T model calls for a second movement. For a concept to be finalized, the universal, held in mind, must be predicated. In this process, there is movement from the universal back down the internal senses, the phantasm in particular. This act, known as the existential

¹As mentioned in our statement of purpose, both philosophers of mind and psychologists have proposed an Aristotelian–Thomistic (A–T) account as an alternative to functionalism. Readable recent descriptions of A–T approaches to metaphysics (Feser, 2014), philosophy of mind (Feser, 2006; Madden, 2013), and other specific relevant topics, such as induction (Groarke, 2009) or essences (Oderberg, 2007), as well as overall systematic descriptions of Thomistic philosophy (e.g., Feser, 2009; Stump, 2003), and older descriptions specifically relating to the application of A–T ideas to philosophical and experimental psychology (e.g., Brennan, 1941; Maher, 1909), are available. Feser (2014) is particularly interesting in the current context as he takes a compare/contrast approach with many recent developments in analytic philosophy.

judgment, affirms the existence of the particular, as in "This man (universal) is Joe (particular man)."

To date, the most detailed presentation of the A–T model as an alternative to functionalism is that of Spalding and Gagné (2013) with regard to concept formation. Spalding and Gagné are careful to distinguish between the A–T and the classical cognitive psychology understanding of concepts at each step in their presentation of the A–T model. They do so in order to demonstrate that rejection of the classical cognitive psychology understanding of the concept has no implications for the A–T model. They summarize three crucial differences:

1. In the A–T model, concepts are "essences shared by all members of the category" and involve external and internal sense involvement of particulars at the outset and at the return to particulars, whereas as cognitive psychology's classical view considers the concept to be only a definition, composed of a bundle of properties.

2. In cognitive psychology's classical view, concepts are definitions of necessary and sufficient features and this view cannot deal effectively with exceptions, whereas the A–T model does not view concepts as constituted by necessary and sufficient bundles of features but by the abstracted essence, and the A–T model manages exceptions by the theory of privation or lack of actuation of essential characteristics in a particular individual.

3. In cognitive psychology's classical view, what "nests" in the concept are bundles of necessary and sufficient features; whereas in the A–T model what nests are capacities of the essence. In fact, the A–T model of concepts reflects the full A–T metaphysics: act and potency, substance and accidents, four-cause understanding, and the faculty psychology of Aristotle and Aquinas, a much more elaborate ontology than a bundle of features gathered by sense observation.

Having differentiated the A–T view from classical cognitive psychology, Spalding and Gagné next consider the current probabilistic models of concept formation. They mention three: (a) exemplars, (b) prototypes, and (c) theory–theories. The exemplar model states that concepts consist of the representations of the individual members of the categories covered by the concepts. The prototype model claims that concepts consist of single summary representations that, in one way or another, are summaries of the whole set of members of the categories covered by the concept. The theory–theories model asserts that concepts consist of explanatory "theories" that use existing background knowledge to identify and explain the categories covered by the concept. Although there is overlap among these models, all have somewhat different views regarding the nature of these probabilistic representations; and all three models have strong support from empirical research. Hence, no particular model has been able to establish itself as the superior.

Spalding and Gagné analyzed problems with each model. Regarding the prototype model, they point out that the model's primary advantage relative to

the classical view is that it includes features beyond the necessary and sufficient, and furthermore, that those features that are more frequent tend to be more important to the concept. They then note that the A–T view makes distinctions between features that are always true versus those that are there on a less frequent basis (basically the distinction between substance and accidents) and, furthermore, that the frequency effects identified in the prototype model result from the A–T view's use of sensory-based representations (i.e., phantasms) that contribute to the concept. Spalding and Gagné claim that this flexibility solves the problem of prototype match. However, the prototype model has great difficulty explaining the effects of particular individual category members, as the concept is only the prototype.

The strength of the exemplar model, compared to the prototype model, is that it provides a natural way of understanding how individual instances of a category can come to exert particular influence in the use of a concept. Spalding and Gagné believe that the A–T view also solves this issue through the phantasm model of the internal senses. In the A–T view, a particular exemplar or combinations of exemplars from memory (i.e., phantasms) must always be recruited when processing a particular category member. Hence exemplar-specific effects are expected in the A–T view. However, the exemplar model has serious difficulties in explaining how one can reason about a concept as a whole. For example, if one learns that whales are mammals, how does one incorporate this into the concept of mammals? Must one retrieve each stored exemplar of whale and attach the property? If there is some one representation where one can attach the new property, then how is that representation related to the supposedly diffuse representation of the concept via the exemplars? The A–T view solves this difficulty by predicating the property to the whole category via the intellectual concept.

The A–T view solves the concern about background knowledge as that affects concept formation. In particular, concepts seem to be much more than simply a statistical accumulation of features. We have many ideas about why certain features might co-occur, for example. In the A–T view, causal analysis of concepts by means of efficient, formal, material, and final causes (the hylomorphic theory) is parallel to modern theory–theories formulations of concepts and generalizations from those concepts. A weakness of the theory–theory, though, is that there is no obvious explanation for how the theory–theory, as a representation of the concept, also accounts for the statistical effects that gave rise to the probabilistic understanding of concepts in the first place. In the A–T view, on the other hand, the relation of the reasoning about causes to the understanding of the concept (and the category members captured in the phantasms) is spelled out. Spalding and Gagné (2013, p. 82) summarize their discussion of the three main theories of concepts in the following way, "The A–T view combines elements of each of the three main views that have developed within the probabilistic consensus

on concepts. Thus, from the A–T view, it is not surprising that there should be empirical evidence in favor of each of these perspectives."

Finally, Spalding and Gagné note that more recent research on psychological essentialism, K-properties, and perceptual symbol systems/embodied concepts challenge the notion that concepts are simply structures consisting of statistically aggregated features defining the concept. Recent work on each of these topics points to something more than frequentist (i.e., statistical) explanations of conceptual structure, and each has strong links back to the A–T claims about concepts.

Psychological essentialism (e.g., Gelman 2003, 2004) refers to the fact that people bring to bear beliefs about the cause and essential nature of the category covered by the concept, and that features playing a role in that belief are more important to the concept than they should be, based on statistical considerations. Research on K-Properties (e.g., Prasada and Dillingham, 2006, 2009) is closely related to psychological essentialism (and very closely related to the notion of essential vs. accidental properties in the A–T view). Again, K-Properties, those that are directly related to the "kind of thing" the concept covers, are more important than other, statistically equivalent properties. Finally, most concepts research has assumed, as a kind of default, that concepts are amodal. That is, both in terms of the conceptual representations themselves and in the representations of their features, concepts are not specifically linked to or grounded in sensory information. Yet, recent research (e.g., Barsalou, 1999) has shown important effects suggesting modality-specific information playing an important role. Again, this recent work harks back to the close linkage of the concept to sensory information, and the phantasms, in particular.

In sum, Spalding and Gagné (2013) surveyed several varieties of concepts research and showed that the results, though seemingly completely incompatible from the viewpoint of modern concept theories, all appear to be at least compatible with, and in most cases directly expected by, the A–T view of concepts. On the basis of this strong correspondence between the A–T view and the empirical results, Spalding and Gagné suggest a serious investigation into the A–T view as a possible high-level framework within which the scientific investigation of the psychology of concepts can proceed. Most importantly for the present purposes, Spalding and Gagné's presentation of the A–T view should be taken as a kind of existence proof that an A–T approach is compatible with modern scientific psychological research (see also Gagné, Spalding, and Kostelecky, in press, and Spalding and Gagné, 2015, for examples applying an A–T approach to a specific experimental research program within the field of concepts research).

Even more recently, Spalding, Stedman, Hancock, and Gagné (2014) examined the problem of intentionality in concept formation. They pointed out that cognitive psychology currently counts on functionalism, specifically psycho-functionalism, to explain the process of concept formation, including intentionality (what the concept is about). They note that the psycho-functionalist model acknowledges

the stimulus as a starting point; however, the primary explanatory focus of the functionalist paradigm is on the interactions of internal cognitive mechanisms and the behavioral outcomes:

However, psycho-functionalism's focus of explanation is on the mechanisms mentioned above and their interaction. The response element is more important than the stimulus because it is the empirical demonstration that the model has predicted correctly. Hence, with regard to intentionality, the "what the concept is about," the psycho-functionalist epistemological/ontological account has little to say. (p. 251)

Spalding et al. (2014) then turn to the A–T model and demonstrate that intentionality is totally achieved via the existential judgment cited above. Recall that in the existential judgment, there is a movement from the universal, back down through the internal senses, to affirm the existence of a particular, a "what the concept is about." For example, "The man (universal) is my friend, Joe (the existent person)." Again, the A–T model offers a better explanation than the functionalist model because of a definitive connection to the stimulus.

In sum, we have reviewed the philosophical origins of psycho-functionalism, discussed psycho-functionalism as the current philosophical underpinning of cognitive psychology, and pointed out its shortcomings at both the philosophical level and at the level of psychological theory building. We have proposed the A–T model as a positive alternative. In the next section, we will consider some objections to the A–T model.

Objections to the A–T Model

We are asserting that the A–T approach deserves a serious look by cognitive psychology, and we have argued that functionalism, the current meta-theory underpinning cognitive psychology, cannot withstand serious scrutiny. Thus, it is important to at least consider some of the potential objections to the A–T view.

One potential objection to the A–T view has been addressed by Spalding and Gagné (2013), namely, that the A–T view was ruled out by work on the so-called classical view of concepts in the 1970's and 1980's. It is worth noting that several recent presentations of A–T ideas have done something similar with respect to A–T philosophy more generally (see particularly Feser, 2008, 2009; Oderberg, 2007). This is quite important, as there is a fairly common, though unjustified, belief (a) that A–T philosophy has been shown to be wrong in some deep sense, and (b) that A–T philosophy is somehow inconsistent with modern science. But these claims are mostly the result of a kind of pious myth of progress and scientific revolution that disproved a bad philosophy and replaced it with a much better philosophy (see, e.g., Brown, 2006; Burt, 1925). Indeed, Feser (2014) explicitly argues that the A–T approach provides a superior philosophical

underpinning for science in general (see, particularly, pp. 9–25). In addition, Spalding and Gagné have argued that the A–T philosophical approach can serve as a meta-theory for concept formation, and, by extension, other areas of interest in cognitive psychology, including sensation, perception, memory, and the higher-order cognitive processes (see also, Stedman, 2013). Thus, there is no apparent fundamental incompatibility with the science of psychology.

A major concern some may have is that the A–T model reintroduces the Cartesian mind–body interaction problem full bore. This issue of substance dualism was covered in a previous essay (Spalding, Stedman, Hancock, and Gagné, 2014) but is so important it is worth very briefly restating: the mind–body distinction of Descartes and the A–T form–matter distinction are entirely different kinds of distinctions. There are (at least) two critical differences between this Cartesian understanding and the A–T view. First, the A–T view is very clear that mind and body are not two separate substances. Instead, the person is one substance made up of form (soul) and matter. The A–T view is clear that "primary substances" are ordinary individual things, all of which are made of form and matter, so this is not something unique about humans. Second, the Cartesian interaction problem arises due not just to Descartes' view of the soul but also to his mechanistic view of matter, such that only efficient causes are to be admitted. Thus, the soul must have some way of acting as the efficient cause of bodily actions and effects. Indeed, it is the adoption of Descartes' view of matter that necessitates a separate "thinking substance" and hence creates the problem of how that immaterial substance can affect the material "extended substance." However, if, with the A–T view, one understands the soul as a formal rather than efficient cause, the soul–body composite becomes a unity. Instead of the human person consisting of two distinct entities, whose interaction becomes a puzzle, the person is a unified entity, consisting of soul and body. The soul (the form of the body) actualizes the body to be species-specifically human. In light of this formal causality, the soul and body become two aspects of a single, unitary human being. Thus, the problem of interaction is avoided. There is one entity actuated by its form (soul or life principle), instead of two altogether different substances trying to interact. Rather than a substance dualism, the hylomorphic A–T approach is a kind of "uniformism" due to this distinct causal and metaphysical analysis.

One final point that might be made against adopting the A–T view is the following. Many psychologists will go about their work with little thought to its ontological underpinnings, and while we have shown that the A–T view would serve as a more satisfying underpinning, we suspect most psychologists will not regard ontological underpinnings as important. Our answer to this is twofold. First, a better philosophical underpinning for psychology is simply a better philosophical underpinning and should be preferred for that reason! But, second, most philosophical approaches since Descartes have tended to collapse into either a strictly materialist approach or into a purely idealist approach, both

of which have severe problems dealing with much of psychology. We would suggest that a similar collapse will occur over time (indeed, to a large extent has already occurred) within the discipline of psychology. Some areas move toward a pure, mechanistic materialism (e.g., many neuroscientists, medically-oriented clinicians, and even cognitive psychologists), while others move toward a more phenomenal approach (e.g., many people interested in personality, some clinicians, and others who reject purely mechanist materialism). Of course, if one is a true believer in either of these approaches, then one sees the other side as simply wrong-headed and perhaps does not regret this break. This requires, in some sense, the psychologist to dismiss not only the specific work done in the other tradition, but even to reject the interests in those areas entirely. An historic example of this is behaviorism's rejection of all mental phenomena. But many psychologists would likely wish for an ontology that breaks down this bifurcation, even as many psychologists rejected the behaviorist's rejection of the mental while still believing that the study of behavior and learning (for example) was a valid and important area for research. Indeed, one of the prime promises of functionalism (albeit a promise that we have argued is not actually fulfilled) is precisely to find a way to account for "mind things" without eliminating them. The A-T approach does not collapse into either materialist or idealist approaches, and potentially provides a philosophical underpinning to psychology that would allow psychology to remain an integrated discipline.

The A-T approach, by its adherence to a moderate realism and to hylomorphism, avoids both the pure materialist and pure idealist positions. It is particularly worth noting that the A-T approach has these advantages, not by inventing clever new ideas about the mind, but by consistently applying its own metaphysical concepts. For example, Madden (2013) contends:

As we turn to the implications of hylomorphism for the philosophy of mind, remember that the Aristotelian does not arrive at this view as an ad hoc attempt to gerrymander an account of nature around our commitments in the philosophy of mind. Rather, the Aristotelian takes this view in order to solve broader philosophical problems. (p. 251)

Conclusions

The major outlines of A-T and functionalism as ontological and epistemological systems have been presented here and in the recent publications mentioned above. We have also considered some of the philosophical strengths and weaknesses of both functionalism and the A-T model. While much thought has been devoted to philosophical critiques of both systems, we have not attempted to summarize that material in a few lines. We simply assert that, in a head to head comparison, the A-T hylomorphic model is better than functionalism as a scientific realist account of human cognition. Arguments for this assertion are found throughout

this essay, in the three recent publications cited (Spalding and Gagne, 2013; Spalding, Stedman, Hancock, and Gagne, 2014; Stedman, 2013). Functionalism claims to be an adequate ontology to explain all cognitive events from sensation to all higher-order cognition. However, as pointed out above, functionalism has been seriously challenged as an adequate general ontological theory. Spalding and Gagné (2013) and Stedman (2013) both make a reasonable case for A–T ontology as a meta-theory that provides at least as good a philosophical underpinning for cognitive psychology as functionalism does, in that (a) the A–T approach is compatible with the existing cognitive psychology research results, and (b) the A–T approach is capable of accounting for many aspects of the concepts literature that are deeply surprising if one takes a functionalist approach. Finally, we have shown that there are also philosophical reasons to prefer the A–T approach, and have shown that some of the common objections to such an approach are misguided, and often based on a misunderstanding of the approach.

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