

eScholarship

International Journal of Comparative Psychology

Title

Aristotelean-Thomistic Approach of Comparative Psychology

Permalink

<https://escholarship.org/uc/item/74d658bt>

Journal

International Journal of Comparative Psychology, 32(0)

ISSN

0889-3675

Authors

Brown, Erika A.
Abramson, Charles I.

Publication Date

2019

DOI

10.46867/ijcp.2019.32.00.12

Copyright Information

Copyright 2019 by the author(s). This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed



Aristotelean-Thomistic Approach of Comparative Psychology

Erika A. Brown and Charles I. Abramson

Oklahoma State University, U.S.A.

The field of psychology has witnessed an increase in its reliance on empiricism to the point that many researchers operate with a complete disregard for the role of philosophy in their pursuit of knowledge. The resultant segmentation of the field and decline in such important areas as comparative psychology can be attributed to this trend, indicating the need for the role of both philosophical and scientific knowledge to be rightly applied and understood. A return to a proper utilization of philosophy in guiding empirical questions and interpreting results is offered as a means of revitalizing the field of comparative psychology. The philosophical approach of Aristotle and Thomas Aquinas is discussed as a means to do so, as it provides a valuable perspective in guiding research and enabling the scientist to interpret results in an integrated and informative manner, whereby the phenotypic comparisons of humans and nonhumans can be understood coherently.

Keywords: Comparative psychology, Aristotle, Aquinas, philosophy

This article is the second of what we expect to be several articles on the role of philosophy in comparative psychology. The first described Arthur Schopenhauer's (1788-1860) views on evolutionary thought (Baptista, Aldana, & Abramson, 2019). Comparative psychology has a rich tradition in addressing some of the more interesting and far-reaching topics (e.g., human-animal interactions, whether animals possess souls, and levels of behavior). Rightly applied, philosophy enhances the comparative psychologist's pursuit of this knowledge by providing a proper framework upon which theories can be refined and expanded. Philosophy is also critical to developing holistic¹ and well-defined hypotheses, which are then tested using the appropriate methodology and interpreted in a fully integrated manner.

In earlier articles addressing the need to invigorate comparative psychology, it was suggested that one approach would be to focus on the philosophical questions raised by comparative psychology (Abramson, 2015a, 2015b, 2018). Philosophical discussions related to comparative psychology can be incorporated into introductory

¹ As the term *holistic* has increased in use, its definition has likewise become somewhat vague. Its definition here refers to the researcher's efforts to consider the subject matter as a whole, integrated entity, as opposed to only investigating one aspect of the subject that is uninformed by its other traits. For example, when humans are the topic of investigation, a holistic approach would consider the complexities of the individual as they relate to him or her as a complete being, rather than considering these observations in isolation. That is to say that a person who behaves in a particular manner cannot be understood completely by investigating those behaviors in isolation - the researcher must always bear in mind the other aspects of the individual that make him or her similar to and also distinguishable from other humans or other species.

psychology, history of psychology, psychology of learning, and related courses, including various courses offered by philosophy departments. The purpose, of course, is to increase the visibility and student interest in comparative psychology. For example, philosophical discussions of behaviorism versus cognitivism have enriched both areas (e.g., Kemp & Fletcher, 1993; Manning, Cassel, & Cassel, 2013; Muckler, 1963; Verhave, 1967), and we expect similar discussions related to comparative psychology would do the same.

Effects of Abandoning Philosophy

Dewsbury summarized one of the primary reasons the once prominent status of comparative psychology has fallen to near extinction: “Perhaps the major internal threat to the continued advancement of comparative psychology is growing fractionalization” (1990, pp. 447-448). As the whole of psychology has become increasingly divided into various subfields, comparative psychology has been subsumed into these other disciplines (Abramson, 2015a, 2015b). This abandonment of viewing comparative psychology as a valuable science in its own right comes at the cost of losing the foundational components of comparative psychology that make it both distinct and informative.

To absorb comparative psychology into other disciplines in the name of progress is to lose the rich history upon which the psychological field was built. The behaviorist techniques employed through comparative psychology have been vital in providing a useful framework for investigating complex human behavior throughout the history of the psychological discipline, and they continue to do so amid the uninformative cognitive zeitgeist within which we currently find ourselves (Abramson, 2013). The unfortunate state of affairs that results from an attempt at absorbing comparative psychology into various disciplines is not only that the substantial impact of the field is lost but the field is taught in a limited capacity and often misrepresented and therefore misunderstood. Eventually, the effects are that behaviorism is vilified and pegged as an outdated approach at best or even as a toxic perspective from which to operate at worst.

With the staunch criticism received by the behaviorist perspective in favor of a heavy reliance on the cognitive approach, cognitivism has supplanted behaviorism with absolutely no credit to behaviorism’s historical contributions and no mention of its current relevance (Abramson, 2013). Despite the broad and inconclusive definitions cognitivists use, its prominence leaves students believing that there are no alternatives which might better equip them to investigate and determine scientific truths about the complex human behaviors they are studying. Why must cognitive theory reign to the detriment of behaviorism, when in fact both perspectives can be studied and reconciled? When both are taught in full, it has been shown that they can be reconciled (Denny, 1967; MacCorquodale & Meehl, 1953; Miller, 1959).

It seems prudent to utilize the strengths of both approaches rather than turning a blind eye to the entire behaviorist approach. Cognitive behaviors are behaviors after all, and behaviorists are still interested in internal mental processes (Abramson, 2013). Standing in isolation, cognitive psychology is incapable of truly providing a framework within which the cognitions of animals can be studied due in large part to a lack of a coherent and consistent definition of what cognition is.

This ambiguity arises naturally when the philosophical approaches that guide the research are ignored. In effect, the constant proliferation of research surrounding these topics seems only to breed more confusion and questions when the pursuit of knowledge is characterized by the abandonment of thought processes and methods that have proven themselves to be fruitful. There have been numerous attempts to define and discuss the comparative mentality of humans and nonhumans (e.g., Boesch, 2007; Muckler, 1963; Rasmussen, Rajecki, & Craft, 1993). In each instance, the importance of first understanding the philosophical assumptions of the researcher is paramount before any attempt can be made at understanding the posited empirical similarities and differences between humans and nonhumans.

Need for a Return to Philosophy

The current status of psychology as a whole is one that highly values what is empirical and verifiable. Although this is indeed important, it has resulted in the ever-increasing segmentation of the field into each school's perspective and has thereby developed a view of science that operates out of a "complete independence from philosophy" (Adler, 1941, p. viii). In order to gain a complete and unified conception of humankind, Adler insists that both philosophical and scientific knowledge are essential, whereby philosophical knowledge sets forth the essence and the underlying nature of the topic, and scientific knowledge expands upon this by investigating specific relationships and abilities. In other words, the philosophical knowledge forms the basis upon which scientific knowledge is founded. Without the philosophical backing, it is no wonder that psychology has experienced an epidemic of disjointed, uninformative, and even competing results.

Brennan (1941) further expands on the complementary roles of philosophy and science when he illuminates that the differences of both approaches offer critical components in the joint quest for a comprehensive knowledge of the same subject matter. The principles of philosophy are used to guide the scientist in formulating hypotheses and designing studies that lead to appropriate conclusions and also provide the context within which the conclusions can be rightly interpreted. The scientific principles allow the philosopher's theories to be expanded and refined, yielding a richer understanding of the subject matter through the details of the scientific evidence.

Philosophy and science, separately, only possess partial truths. When they are allowed to operate together, they inform one another, producing a comprehensive understanding of the topic (Brennan, 1941). It is fascinating that this complementary relationship between philosophy and science is understood in the early experiences of children developing basic exploration and critical thinking skills. Children begin with the essence of what they are interested in learning, and, when questions arise, they use this information to develop methods for answering those questions, interpret why they achieved the results they did, and determine how to integrate their findings into their overarching understanding. Yet along the path to adulthood and in pursuit of the latest scientific discoveries, science is often pitted against philosophy and heralded as the sole approach, the one that produces observable results. All the while, what is forgotten is that the same guiding principles of pursuing truth and obtaining a more complete and accurate understanding of the subject matter is central to both approaches.

Invoking philosophy enables the researcher to do more than simply develop a local theory to account for some specific effect. The grand theories developed through the use of philosophy are comprehensive in nature, describing the essence of the person or object of study while being refined by continually developing a deeper understanding of the principles already known. Clark Hull, like other early learning theorists, recognized the shortcomings of localized theories, methodologies, and interpretations that are developed only in terms of a specific experimental study, and instead attempted to develop a comprehensive behavior theory (Webster & Coleman, 1992). Similarly, the use of general mathematical models have been demonstrated as a means to contribute to the development of comprehensive learning theories (DeCarlo & Abramson, 1989; Stepanov & Abramson, 2008). Beginning with a philosophical understanding provides a bigger picture of the topic of investigation and prevents the research team from drawing rash conclusions in the name of progress.

In comparative psychology, this has resulted in an entire history of philosophical thought and its robust method of comparison, along with the accompanying scientific discoveries and contributions, being lost, leaving the researcher ill-equipped to fully understand the topic at hand (Abramson, 2015a). The term “comparative psychology” appeared 21 years prior to psychology being formally founded as a scientific discipline (Weinland, 1858), and comparative psychologists have played a central role in the development of the scientific discipline of psychology (Abramson, 2015a). The scientific methods of comparative psychologists equip researchers with a distinct manner of thinking and a unique set of experiences that are valuable in developing broad skills with multiple species that can be used across disciplines in both applied and academic capacities (Abramson, 2015b). The critical thinking skills developed by comparative psychologists result in them “cultivating a comprehensive view of the world” (Abramson, 2015b, p. 1), which, in turn, allows them to conduct research with a more complete and accurate understanding of the entity as a whole.

The general philosophical approach encompassed in the thought processes of comparative psychologists informs the specific empirical methodologies they use, enabling them to make comprehensive interspecies phenotypic comparisons

(Abramson, 2015a). Interestingly, the presence of a natural order was discussed by the philosopher Lucretius (99-55BC), who posited a hierarchy from lower organisms to those organisms that possess higher levels of behavioral sophistication. Yet, despite the rich history of thought and research that has developed these principles, scientists today often rely instead on underdeveloped theories. The result is a plethora of research that cannot be reliably replicated and terms that are not consistently defined or applied (Crain, Giray, & Abramson, 2013; Open Science Collaboration, 2015; Sayers, 1947). The immense influence that philosophers, such as Augustine and others, have had on our current ways of thinking is often dismissed or ignored, despite their continued relevance and contributions as a valuable source of information (Henley & Thorne, 2005; Manning et al., 2013). It is ineffective to jettison this traditional approach in favor of the incomplete modern conceptualizations put forth today.

Stedman, Kostelecky, Spalding, and Gagné (2017) chronicle the troubled path that psychology has taken while attempting to understand the similarities and differences between human and animal cognition, citing that researchers have typically tended toward the extremes (e.g., complete anthropomorphizing of animals vs. viewing humans as indistinct). As both human and nonhuman behaviors are of interest to comparative psychologists, it is entirely within their wheelhouse to study the similarities and differences in the behaviors of various organisms, both animal and human alike (Abramson, 2015a; Stedman et al., 2017).

The Lives of Aristotle and Aquinas

Aristotle (384-322 BC) was born in the small Macedonian town of Stagira (hence his nickname - the Stagirite). He began his life and education as the son of a court physician. Shortly after the death of both parents, his caretaker sent him to Plato's Academy in Athens at the age of 17, where he remained for the next two decades as pupil and eventually teacher (Cooper, 2007; Corbett, 1984). It was there, under the mentorship and inspiration of Plato, that Aristotle became "the first real scientist" (Cooper, 2007, p. 29). He spent his time thinking and observing objects as they existed in nature. After the death of Plato, Aristotle left Athens and later spent two years as tutor to Alexander the Great before returning to Athens and founding his Peripatetic School of Philosophy (Corbett, 1984). It was there that the majority of his surviving lectures and written works were delivered and produced. In his lifetime, Aristotle established himself as one of the most distinguished classical Greek philosophers and scientists, and he retains this high level of influence today through several of his works and lectures. Many of his ideas and contributions have formed the foundations of modern philosophy and science.

Saint Thomas Aquinas (c. 1225-1274) was born the youngest of seven boys in Roccasecca, near Naples (Hutchins, 1952). While at the University of Naples, he was introduced to the order of the Dominicans and was impressed by their devotion to study and teaching (Feser, 2009). Much to the chagrin of his family, he joined an order of the Dominicans and eventually studied under the tutelage of Albert the Great, a "champion of Aristotle" (Hutchins, 1952, p. v). Though the teachings of Aristotle were controversial within the realm of Christianity at that time, Aquinas, resolute in his

belief, sought to demonstrate that Aristotle's works were not only compatible with the Christian doctrines but were in fact an effective apology of the faith when rightly understood (Feser, 2009). Aquinas became a highly influential thinker and prolific writer, who reportedly ate only one meal a day to allow himself to be more fully devoted to his work. His writings are rooted in and expound upon the philosophical realism of Aristotle and, as such, stand in sharp contrast to the positivist views heralded today (Adler, 1941). In Brennan's (1941) well-respected work on Thomism, he illuminates the parallel between Aristotle and Aquinas by saying that "the psychology of both thinkers is woven of one cloth....The genius of Aristotle discovered it. The genius of Aquinas integrated and developed it" (p. 4).

Aristotelean-Thomistic Philosophical Perspective

The philosophical perspective of Aristotle and Thomas Aquinas provides an approach upon which the comparative analysis of humans and nonhumans can be understood coherently and reconciles the opposing tendencies that have arisen throughout history to categorize humans and nonhumans as either completely continuous or completely discontinuous (Stedman et al., 2017). Humans and nonhumans are not entirely separate from one another in their abilities, and yet, their abilities are not entirely conflated either. This Aristotelean-Thomistic perspective provided "fertile ground for the birth of comparative psychologies," within which humans are understood to be rational animals (Stedman et al., 2017, p. 194). There are in fact similarities between humans and nonhumans, but these areas of continuity do not warrant researchers anthropomorphizing animals or viewing humans without consideration of their rational capabilities. As such, the Aristotelean-Thomistic approach largely demonstrates continuity between animals and humans but also shows areas of discontinuity. In other words, this philosophical explanation provides a foundation upon which the similarities and differences observed between animals and humans can be understood in a clear and consistent manner.

Specifically, Aquinas discussed the natural hierarchy that exists in living beings (continuity) and distinguished between the types of souls² possessed by each kind of being (discontinuity; Brennan, 1941; Feser, 2009). Continuity exists insofar as the power (i.e., ability) is possessed within the soul of organisms. Plants, for example, possess a *vegetative* (or *threptic*) soul that has nutritive, growth, and reproductive powers. The *sensory* (or *aesthetic*) soul of animals possesses the same powers as that of plants but also the ability in animals to sense their environment and move toward stimuli that are desirable and away from those that are aversive. Humans have the additional powers of the intellect and the will within their *rational* (or *dianoetic*) soul, allowing them to think critically and abstractly about an issue and to choose what

² Aquinas understood the concept of one's soul within the context of Aristotle's doctrine of hylomorphism – the notion that objects or beings consist of both matter (material) and form (immaterial). In line with this, the soul is the substantial form of the (living) being. In short, the organism exists as one inseparable integer that consists of both the material (body) and immaterial (soul). Both body and soul can only be rightly understood in relation to one another within the context of the organism as a whole. For a more detailed discussion, see Brennan (1941) or Feser (2009).

course of action to take in light of the information considered. See Table 1 for a summary of these beings' types of souls and their respective powers.³

Table 1
Summary of Types of Souls and Powers for Material Beings

Being	Type of Soul	Powers (Abilities)
Plants	Vegetative (Threptic)	Nutritive Growth Reproductive
Animals	Sensory (Aesthetic)	All powers of plants Sensation Locomotive Appetite
Humans	Rational (Dianoetic)	All powers of animals Intellect Will

The specific abilities possessed by a particular being (whether plant, animal, or human) are deducible from how it interacts with specific formal objects (Brennan, 1941; Stedman et al., 2017). For example, if an animal responds to a stimulus by moving away from it, it can be inferred that the being has sensitive powers. When interpreting a behavior, Morgan's canon warns against inferring higher powers if the behavior can be interpreted fairly with lower powers (Morgan, 1894). That is, psychological processes should be interpreted in the simplest terms possible, using only those abilities which have been convincingly demonstrated rather than anthropomorphizing speculative abilities. These very concepts are central to behaviorism in determining how empirical results should be interpreted. If the observed behavior can be explained satisfactorily using lower powers, the researcher need not infer the behavior as an outcome of powers higher in the hierarchy. Only when the lower abilities do not fully explain the behavior, should the more complex ability be assumed in the organism (Karin-D'Arcy, 2005). For an application of Morgan's canon to contemporary dolphin research, see Hill, Dietrich, Cadena, Raymond, and Cheves (2018).

Continuity between humans and animals is demonstrated in that they share the vegetative and sensitive powers. These sensitive powers, regardless of the organism using them, are always operational within the immediate environment that can be sensed using tactile, visual, gustatory, olfactory, and auditory senses (Brennan, 1941). Although it would be "a serious misreading of both Aristotle and Thomas [Aquinas] to

³ Beyond the three material beings, Aquinas notes two immaterial beings - angels and God - that exist above humans in the natural hierarchy. Both possess the powers of material beings as well as increasingly perfected abilities resultant of their lack of dependence on matter, with God being the ultimate example, the pinnacle of the hierarchy, whose attributes all other beings are directed toward in a teleological sense.

focus solely on the ‘rational’ part of the ‘rational animal’ if one wishes to understand the human in its totality,” discontinuity arises when considering the higher powers possessed by humans that are absent in nonhumans, namely the will and the intellect (Stedman et al., 2017, p. 209). Humans and nonhumans do indeed share in their ability to perceive, remember, and respond to their environment, but their intellectual abilities do not match. While the sensitive powers are foundational and requisite to the rational powers, their function in humans is subordinate to the rational abilities, which allow them to handle universal concepts beyond singular objects (Feser, 2009).

The Aristotelean-Thomistic approach can benefit comparative psychology and the teaching of comparative psychology in several ways. First, it provides a framework or context to conduct comparative investigations on phyletic differences and similarities. This approach was a hallmark of such comparative psychologists as Gregory Razran (1971), Morton. E. Bitterman (1965), and Theodore C. Schneirla (1949) and appears all but forgotten in our rush to interpret almost all behavior in cognitive terms (Whissell, Abramson, & Barber, 2013). In our view, students (and professors) can benefit from knowing the philosophical underpinnings of research programs. Moreover, such an approach can guide research questions.

Second, the Aristotelean-Thomistic approach, by specifying “levels,” should make researchers and students consider other interpretations before applying cognitive concepts indiscriminately. There seems to be a “mad dash” for researchers to interpret almost any behavior as cognitive. This occurs despite the fact that there is no generally accepted definition of cognition and no set of independent guidelines for a researcher or student to independently assess whether a behavior is cognitive or not (Abramson, 2013; Abramson & Calvo, 2018; Abramson & Wells, 2018). In our view, this state of affairs is hurting psychology as a science. On the other hand, when the philosophical implications are considered, results can be interpreted in an appropriate manner consistent with the complete nature of the species.

Third, the Aristotelean-Thomistic approach will stimulate students and researchers to identify inconsistencies in the behavioral literature. For example, in our studies of invertebrate learning, and despite the cognitive zeitgeist, we have shown that individual honey bees do not show timing. Craig and Abramson (2015) looked at seven different methods of analyzing timing. There was little or no evidence for timing whether we analyzed cumulative response curves, response bins, quarter life, post-reinforcement pause, inter-response times, response duration, or trial duration.

In addition to showing the inability of individual bees to form a representation of time, the benefit of interpreting results in accordance with the natural hierarchy and types of souls described by the Aristotelean-Thomistic approach is illuminated by our results with ants, bees, crabs, and earthworms in signaled avoidance experiments. In light of this philosophical understanding of the various species, our results show that it is not the omission of an expected event but the fact that an aversive stimulus is presented that causes the avoidance behaviors. The central problem of an avoidance experiment is, “How can the omission of an event be reinforcing?” The answer for those applying cognitive concepts indiscriminately is that the “event must be

expected.” These results show that it is the presentation of the aversive event that produces avoidance performance, not the expectancy of an event (reviewed in Abramson & Wells, 2018).

Finally, in another series of experiments in which bees uncovered a hidden food source, our results showed that bees solved this problem only when they had prior experience of pushing objects. They did not use “reasoning ability.” If bees do not have the experience of pushing objects, they will fly away after a few moments. Moreover, if the bees are trained to push a cap to uncover the food source and the cap is replaced with a cross, the bees will search for the cap rather than push the cross even though the cross is directly over the food source (Abramson, Dinges, & Wells, 2016). Without considering the philosophical implications of our work, we may have been tempted to interpret the results as support for a cognitive mechanism despite any universally accepted definition of cognition or any independent rules that determine what behaviors should be considered cognitive. Instead, the rich history from philosophy of the nature of bees guided our interpretation and the results were understood and fully explained in light of the sensitive and locomotive powers they possess, as opposed to unnecessarily inferring the presence of more complex reasoning abilities.

More could be said about the details of the Aristotelean-Thomistic philosophical foundation and how it relates to comparative psychology (e.g., Augros & Stanciu, 1987; Brennan, 1941; Feser, 2009; Wallace, 1996). As demonstrated in each of the above mentioned examples, the natural hierarchy and the types of souls highlighted by the Aristotelean-Thomistic perspective illuminate the importance of relying on this philosophical understanding as a means to inform scientific discoveries. It allows the comparative psychologist to formulate well-defined and holistic hypotheses about such topics as human-animal interactions, levels of behaviors, or the nature of humans and animals. The researcher can continue to investigate a hypothesis using an appropriate methodology and interpret the results in a consistent and comprehensive manner, whereby the theory is then able to be refined and expanded as needed. This approach allows the researcher to make comparisons that can be understood coherently and in a manner that acknowledges the nature of the complete being.

The importance of how the philosophical view can and should be used to inform the empirical work of scientists cannot be understated. Relying entirely on the specific experimental findings while abandoning the philosophical basis within which those findings are best understood is not only short-sighted but effectively thwarts any attempts at truly understanding the subject and how that subject relates to its environment in a holistic and integrated manner. It is no wonder that psychology has grown to be as fragmented as it currently is considering that the quest for the latest scientific discoveries has rendered philosophy and historical context as ancillary. It is our hope that the continued relevance of comparative psychology in understanding both humans and animals in their totality can be revived through the proper application of the philosophical approach of Aristotle and Aquinas as it is used to enlighten the empirical work of psychologists.

Acknowledgements

Preparation of this article was supported in part by a Lawrence L. Boger and National Science Foundation grant DBI 1560389.

References

- Abramson, C. I. (2013). Problems of teaching the behaviorist perspective in the cognitive revolution. *Behavioral Sciences, 3*, 55-71.
- Abramson, C. I. (2015a). A crisis in comparative psychology: Where have all the undergraduates gone? *Frontiers in Psychology, 6*, 1500. doi: 10.3389/fpsyg.2015.01500
- Abramson, C. I. (2015b). A crisis in comparative psychology: Where have all the undergraduates gone? Additional comments. *Innovative Teaching, 4*, 1-10.
- Abramson, C. I. (2018). Let us bring comparative psychology back. *International Journal of Comparative Psychology, 31*, 1-14.
- Abramson, C. I., & Calvo, P. (2018). General issues in the cognitive analysis of plant learning and intelligence. In M. Baluska, F. M. Gagliano, & G. Witzany (Eds.), *Memory and learning in plants*, (pp. 35-49). New York, NY: Springer.
- Abramson, C. I., Dinges, C. W., & Wells, H. (2016). Operant conditioning in honey bees (*Apis mellifera* L.): The cap pushing response. *PLoS-ONE 11*(9), e0162347. doi:10.1371/journal.pone.0162347
- Abramson, C. I., & Wells, H. (2018). An inconvenient truth: Some neglected issues in invertebrate learning. *Perspectives on Behavior Science, 41*, 395-416.
- Adler, M. J. (1941). Introduction. In R. E. Brennan (Ed.), *Thomistic psychology: A philosophic analysis of the nature of man* (pp. vii-xiv). New York, NY: Macmillan.
- Augros, R. & Stanciu, G. (1987). *The new biology*. Boston, MA: New Science Library.
- Baptista, T., Aldana, E., & Abramson, C. I. (2019). Arthur Schopenhauer and the current conception of the origin of species: What did the philosopher anticipate? *SAGE Open*, January-March, 1-15. doi: 10.1177/2158244019837467
- Bitterman, M. E. (1965). Phyletic differences in learning. *American Psychologist, 20*, 396-410.
- Boesch, C. (2007). What makes us human (Homo sapiens)? The challenge of cognitive cross-species comparison. *Journal of Comparative Psychology, 121*, 227-240.
- Brennan, R. E. (Ed). (1941). *Thomistic psychology: A philosophic analysis of the nature of man*. New York, NY: Macmillan.
- Cooper, S. K. (2007). *Aristotle: Philosopher, teacher, and scientist*. Minneapolis, MN: Compass Point Books.
- Corbett, E. P. J. (1984). Introduction. In Aristotle, *The rhetoric and the poetics of Aristotle* (pp.v-xxvi). New York, NY: Random House.
- Craig, D. P. A., & Abramson, C. I. (2015). A need for individual data analysis for assessment of temporal control: Invertebrate fixed-interval performance. *International Journal of Comparative Psychology, 28*, 1-39. <http://escholarship.org/uc/item/847557dt>
- Crain, B. J., Giray, T., & Abramson, C. I. (2013). A tool for every job: Assessing the need for a universal definition of tool use. *International Journal of Comparative Psychology, 26*, 281-303.
- DeCarlo, L. T., & Abramson, C. I. (1989). Time allocation in carpenter ants (*Componotus herculeanus*). *Journal of Comparative Psychology, 103*, 389-400.
- Denny, M. R. (1967). A learning model. In W. C. Corning & S. C. Ratner (Eds.), *Chemistry of Learning* (pp. 32-42). New York, NY: Plenum.
- Dewsbury, D. A. (1990). Comparative psychology: Retrospect and prospect. In D. A. Dewsbury (Ed.), *Contemporary issues in comparative psychology* (pp. 431-448). Sutherland, MA: SinauerAssociates, Inc. doi: 10.1037/11525-019

- Feser, E. (2009). *Aquinas: A beginner's guide*. Oxford, England: Oneworld.
- Henley, T. B., & Thorne, B. M. (2005). The lost millennium: Psychology during the middle ages. *Psychological Record, 55*, 103-113.
- Hill, H. M., Dietrich, S., Cadena, A., Raymond, J., & Cheves, K. (2018). More than a fluke: Lessons learned from a failure to replicate the false belief task in dolphins. *International Journal of Comparative Psychology, 31*. <https://escholarship.org/uc/item/5sk2n3g6>
- Hutchins, R. M. (Ed.). (1952). *Great books of the western world* (Vols. 19-20). Chicago, IL: Encyclopaedia Britannica.
- Karin-D'Arcy, M. R. (2005). The modern role of Morgan's Canon in comparative psychology. *International Journal of Comparative Psychology, 18*(3), 179-201.
- Kemp, S., & Fletcher, G. J. O. (1993). The medieval theory of the inner senses. *American Journal of Psychology, 106*, 559-576. <http://www.jstor.org/stable/1422969>
- MacCorquodale, K., & Meehl, P. E. (1953). Preliminary suggestions as to a formalization of expectancy theory. *Psychological Review, 60*, 55-63.
- Manning, L., Cassel, D., & Cassel, J. (2013). St. Augustine's reflections on memory and time and the current concept of subjective time in mental time travel. *Behavioral Sciences, 3*, 232-243. doi:10.3390/bs3020232
- Miller, N. E. (1959). Liberalization of basic S-R concepts: Extension to conflict behavior, motivation, and social learning. In S. Koch (Ed.), *Psychology: A study of a science*, Vol. 2, (pp. 196-292). New York, NY: McGraw-Hill.
- Morgan, C. I. (1894). *An introduction to comparative psychology*. London, England: W. Scott.
- Muckler, F. A. (1963). On the reason of animals: Historical antecedents to the logic of modern behaviorism. *Psychological Reports, 12*, 863-882. doi: 10.2466/pr0.1963.12.3.863
- Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science, 349*. doi: 10.1126/science.aac4716
- Rasmussen, J. L., Rajewski, D. W., & Craft, H. D. (1993). Humans' perceptions of animal mentality: Ascriptions of thinking. *Journal of Comparative Psychology, 107*, 283-290.
- Razran, G. (1971). *Mind in evolution: An east-west synthesis*. Boston, MA: Houghton Mifflin.
- Sayers, D. (1947). The lost tools of learning. Retrieved from <http://www.gbt.org/text/sayers.html>
- Schneirla, T. C. (1949). Levels in the psychological capacities of animals. In R. W. Sellars, V. J. McGill, & M. Farber, (Eds.), *Philosophy for the future* (pp. 243-286). New York, NY: Macmillan.
- Stedman, J. M., Kostecky, M., Spalding, T. L., & Gagné, C. L. (2017). Animal cognition: An Aristotelean-Thomistic perspective. *Journal of Mind and Behavior, 38*, 193-214.
- Stepanov, I. I., & Abramson, C. I. (2008). The application of the first order system transfer function for fitting the 3-arm radial maze learning curve. *Journal of Mathematical Psychology, 52*, 311-321.
- Verhave, T. (1967). Contributions to the history of psychology: IV. Joseph Buchanan (1785-1829) and the "Law of Exercise" (1812). *Psychological Reports, 20*, 127-133.
- Wallace, W. A. (1996). *The modeling of nature: Philosophy of science and philosophy of nature in synthesis*. Washington DC: Catholic University of America Press.
- Webster, S., & Coleman, S. R. (1992). Contributions to the history of psychology: LXXXVI. Hull and his critics: The reception of Clark L. Hull's behavior theory, 1943-1960. *Psychological Reports, 70*, 1063-1071.
- Weinland, D. F. (1858). A method of comparative animal psychology. *Proceedings of the American Association for the Advancement of Science, 12*, 256-266.
- Whissell, C., Abramson, C. I., & Barber, K. R. (2013). The search for cognitive terminology: An analysis of comparative psychology journals. *Behavioral Sciences, 3*, 133-142. doi: 10.3390/bs3010133

Financial conflict of interest: No stated conflicts.

Conflict of interest: No stated conflicts.

Submitted: November 27th, 2018
Resubmitted: March 23rd, 2019
Accepted: March 29th, 2019