Unifying Psychology: Shared Ontology and the Continuum of Practical Assumptions

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Critics have described psychology as a science impaired by disunity. The most recent special issue of *Review of General Psychology* sought to specifically address this concern, seeking perspectives from a wide range of theorists, each of whom offered their tradition's approach to how psychology as a whole may be integrated into a more unified whole. To continue this discussion, this article draws upon examples from the special issue, the disunity crisis literature, and wider writings in the philosophy of science, to explore the theoretical and conceptual divisions that foster ambiguity, confusion, and apparent irreconcilable differences between the disparate fields of psychology. The authors conclude that the majority of contemporary, scientific psychology is oriented toward a shared physical ontology, which can serve as a common grounding point from which the conceptual and theoretical differences of disparate fields may be meaningfully framed and evaluated. To this end, this article proposes that the various research traditions of psychology can be understood through their positions along a *continuum of practical assumptions*, which embodies the inherent conflict between two scientific priorities: metaphysical certainty (the *safe* end of the continuum) and practical experimental predictions (the *risky* end of the continuum). Three theoretical perspectives offered in the unification special issue are examined under this framework: situational realism (a distinctly *safe* approach), developmental evolutionary psychology (an intermediate approach), and the Tree of Knowledge unified theory (a relatively *risky* approach). The authors explore how the recommendations of each approach can be seen as a function of its position on the continuum of practical assumptions, and the implications of this understanding for future integrative efforts is discussed.

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For a period exceeding 50 years (going back at least to Gladin, 1961) recurring criticisms have echoed through the psychology literature raising issue with the lack of integration between different schools of psychology. The central theme of this "crisis" literature frames this disunity as a result of the conspicuous absence of a prescriptive, unifying framework to tie psychology (and the wider behavioral sciences) together (see De Groot, 1990; Goertzen, 2008, 2011; Kantor, 1979; Staats, 1983; Sturm & Mülberger, 2012; Yanchar & Slife, 1997). Mandler (2011) observes that psychology and its historical antecedents have faced several such crises of disciplinary disunity, with the present crisis representing only the most recent step in the difficult transition between speculative philosophy and natural science. Most recently, last year's special issue of the *Review of General Psychology* (July, 2013) was specifically dedicated to reviving and expanding interest in unification, bringing together submissions from a wide

variety of theorists and inviting them each to argue the case for integration from the perspective of, and on the terms of, their respective research paradigms. These 19 short articles, and the problems they each propose to solve, provide an opportune platform from which to compare and contrast contemporary efforts at unification.

One may argue that presenting 19 distinct approaches (that themselves do not constitute an exhaustive list) serves primarily to demonstrate the multitude of disparate approaches that sympathetic theorists must struggle to integrate. However, close examinations of each perspective reveals encouraging and recurring claims to some conceptual common ground. As has been explored in the most recent works of Goertzen (2008, 2010, 2011), those fields within psychology most explicitly dedicated to scientific and experimental inquiries have begun to converge around a small number of highly influential explanatory approaches (notably information-processing, developmental systems and evolutionary theory), whereas more peripheral traditions are clarifying their foundational differences so as to distinguish their efforts from the empirical mainstream (see Goertzen, 2011 for further detail). Despite this progress, it appears that now more so than ever, the goal of integrating psychology seems beyond the plausible reach of individual theorists seeking to court others to their frameworks with promises of comprehensive singular unified theories. Rather, in the contemporary landscape of multiple, differentially viable theoretical approaches, each the product of an established school of thought with their own foundational assumptions and preferred

empirical approaches, the goal of integration seems now to rely most on the slow dissolving of barriers between subdisciplines (Mandler, 2011; Trafimow, 2012). Although attempts to cannibalize entire fields into their stronger contemporaries are not likely to be abandoned (nor necessarily should they be), the literature is primed for the emergence of innovative hybrid perspectives that rely upon an acknowledgment of conceptual compatibility and common definitional assumptions.

The aim of this article is to propose and explore a new means of understanding the conceptual and theoretical disunities of psychology, by reframing the popular Kuhnian (Kuhn, 1962, 1970, 1996) perspective of scientific revolutions to reflect the nuances and interrelations of specific assumptions. Phrased simply, we propose that each subdiscipline is a partial-paradigm, sharing many assumptions with the rest of psychology, while adding additional assumptions that have proved fruitful within their specialized domain of inquiry. In noting that these assumptions do not cluster arbitrarily, but build upon one another in hierarchical arrangements, the authors suggest that all grounding theories in psychology can be arranged along a conceptual continuum of practical assumptions. This continuum, if made explicit, can serve as a guide to resolving conceptual and theoretical conflicts between subdisciplines, in a manner made impossible under the classical Kuhnian framework of incommensurability. To illustrate, this article draws attention to three of the proposed unifying approaches in the recent special issue of *Review of General Psychology*: situational realism (Petocz & Mackay, 2013), developmental evolutionary psychology (Lickliter & Honeycutt, 2013), and the Tree of Knowledge (ToK) unified theory (Henriques, 2013), which are explored as occupying increasingly "risky" positions along the continuum of practical assumptions. In detailing key threads of compatibility between these examples that may foster enhanced interdisciplinary collaboration and theory building, the authors seek to assist in the gradual emergence of a unified psychology.

Paradigms, Assumptions, and Trajectories of Inquiry

Although more specific definitions vary, and are still debated by theoreticians today (see Henriques, 2003, p. 152), the subject matter investigated by psychology can be broadly understood as "the behavior and mental activity of animals, humans in particular." Thus, psychology researchers are, and indeed always have been, faced with the unenviable challenge of attempting to scientifically describe and explain a range of phenomena that are not only among the most complicated in the natural world, but are also almost inexhaustibly open to interpretation (comparable with the engineering conception of a "black box"; see Nairne, 1997; Sober, 1998). Early researchers were able to address this potentially insurmountable challenge by embracing a disciplinary division of labor (Heidbreder, 1933), wherein "complete" models of the mind were eschewed as a task for future generations, leaving researchers to dedicate their careers to understanding particular processes and domains of interest. As the major subdisciplines of psychology emerged from their philosophical prescientific roots, each approach formalized not only their distinctive methodological commitments (be they introspective, behavioristic, etc.), but also the foundational theoretical assumptions that made their methods possible (see Miller, 2003 for an overview). Though continually expanded and occasionally revised, these theoretical frameworks were each largely tailored to the practical concerns and immediate interests of proponents (be they therapeutic, developmental, comparative, etc.), and thus, were only partially shared between researchers on separate topics, if at all. The progress experienced within each subdiscipline has the predictable effect of further entrenching the foundational assumptions that made each success possible (as argued in Stam, 1990), which contributes to the at least partial theoretical insulation of disparate subdisciplines as they each pursue a distinct trajectory of inquiry.

In the conceptual language popularized by Kuhn in his influential book *The Structure of Scientific Revolutions* (Kuhn, 1962; 1970; 1996), distinct research trajectories each supported by their own foundational theories and assumptions are perhaps best understood as paradigms (in the "disciplinary matrix" sense of the word, clarified in the postscript of Kuhn, 1970). The apparent proliferation of distinct research trajectories is what has prompted researchers such as Staats (1983, 1999) to describe the wider science of psychology as "preparadigmatic," as no one major metatheoretical framework had come to dominate all psychological research (as had neo-Darwinism in biological science, and relativity and quantum mechanics in physics), so as to render the findings of disparate subdisciplines mutually conceptually comprehensible. In Kuhn's terms, each field of psychology is engaged in productive "normal science" (the cumulative solving of those problems well-served by one's theoretical assumptions), but in the absence of a shared overarching paradigm, the output of one field is fundamentally incommensurable with the output of other fields with different foundations. The inherent "wastefulness" of this conceptual incompatibility is argued, by many theorists (notably Goertzen, 2008), to be the primary concern of psychology's disunity crisis.

However, despite Kuhnian dilemma described above involving conceptually incompatible founding assumptions, the various traditions in psychology have nonetheless already begun to converge on a serviceable common ground. On this view, each subdiscipline of psychology is best thought of as a partial-paradigm, which shares many core theoretical assumptions with most other fields, but maintains some set of unique, often more tenuous assumptions, that are preserved because of their historical utility in addressing the problems of said field. Identifying the common ground that is shared by the majority of psychology's subdisciplines allows researchers to better address disagreements between fields, and critically scrutinise that theoretical assumptions are best discarded in modern psychological science.

Ontological Common Ground

Although psychological inquiry, by its very nature, threatens to overwhelm researchers with inexhaustible interpretive possibilities, Valsiner (2009) notes that not all starting assumptions are equally arbitrary, and several viable points of convergence have crystallized throughout the literature over its history. As noted earlier, three general and compatible explanatory approaches stand at the focal points of the most successful integration efforts in experimental scientific psychology (Mandler, 2011). Two of these, perhaps understandably, are an inheritance from the integrative successes of the biological sciences, namely, *evolutionary adaptationism* (Buss, 1984, 1995; Cosmides & Tooby, 1989; Tooby & Cosmides, 1989) and *life span development* (Lickliter & Honey-

cutt, 2003; Michel & Tyler, 2007; Richardson, 1998). The third has emerged with the aid of technological insights into physical computation, namely, the *information-processing approach* (Fodor, 1975, 1983). With regards to explanation, each of these perspectives offers researchers a grounding insight into how and why key elements of psychological phenomena exist (i.e., matching organism-environment characteristics, emergence of abilities through maturation, generation of complex responses, etc.). These perspectives, and their pervasive connections to the other natural sciences, offer a definition of the subject matter of psychology that is immediately grounded in a concrete, material ontology (i.e., ontology in the simple sense of "the phenomena thought to exist"). Under this suite of assumptions, the nervous systems of animals, including humans, are comprised of neuronal tissues whose cells connect in dynamic patterns to process information. The basic organization of these structures emerges from an evolved genetic inheritance, which interacts with the environment over the course of ontogeny to produce individual configurations capable of ongoing calibration and learning. The overt reactive behaviors of such organisms are the result of both real-time sensory stimulation, and acquired biases and variations in neural structures owing to past experience. From this increasingly influential perspective, as Gazzaniga (2010) notes, it is these functional patterns and organizations that are the definitive domain of psychological phenomena, over and above what may be considered merely neurobiology.

Although the broad facts of this ontological common ground appear uncontroversial in most of scientific psychology, it is not at this most basic level where disagreements tend to emerge. Rather, disagreements between the disparate schools of psychology tend to focus on the perceived differential relevance of this basic ontology to their respective phenomena of interest. For example, Vul (2011) argues that the hard details of neurophysiology and cognitive computation are understood to form the basis of the interactions studied by social psychologists, but a social psychologist would consider only certain relational activities of these cognitive systems (particularly those expressed between persons) as their relevant subject matter. From a strictly practical perspective, there is merit to the social psychologists' position, but with regards to theory, to adopt the position that the subject matter of other fields should not encroach on your field's subject matter (and is beyond your field's concern), is to handicap the prospect of meaningful integration a priori. Although social psychologists may seek to eschew the details of neurophysiology, and neurophysiologists in turn may seek to eschew the details of social contexts and interactions, each field invariably makes general theoretical commitments concerning the form that these eschewed phenomena are likely to take. Even fields of psychology as conceptually distant as these two examples cannot remain truly "agnostic" with regard to the defining questions of other fields, because their position as part of a larger whole is the key to their founding assumptions (Vul, 2011). Substantial innovations, or perhaps even revolution, within any partial-paradigm of psychology will not only affect the field in question, but will change the character of the assumed intermediaries that grounded the division of subject matter between fields in the first place. As such, it is vital for researchers to remain explicitly aware of the assumptions that tie their field to the empirical status of others, for these shared assumptions offer guidance as to what other areas of psychology do and do not share a conceptual common ground.

Under the assumptions of this ontology, ideally all "intermediary" psychological phenomena would represent hypothetical organizations of neurological structures, defined by either their relevant functions or their literal anatomy. However, the diverse research goals and histories of the various traditions of psychology have given rise to innumerable postulated *psychological* entities that were not conceived to fit this ontological framework (such as "constructs," "traits," and "mental representations"). Indeed, there are many such proposed concepts that may be ill-suited for any ontological specification at all (such as those thought to exist exclusively between-persons, which exist as relations, but have no independent substance). Since different research traditions demonstrate differential degrees of explicit commitment to this aforementioned ontology (or in some cases, to any ontology at all), the current literature is saturated with convenient common terms (such as traits and representations) that are used in distinct, often incompatible senses.

Unseen, Confused, or Ignored Distinctions

To illustrate the problems that can emerge from a lack of ontological grounding, the present authors reviewed a contemporaneous cross-section of published psychology research, to gauge the degree to which each article demonstrated referential vagueness, confusion, or evident contradiction, concerning the ontological status of its subject matter (single issues selected randomly from the year 2012). Terminology was judged as being problematically vague when the ontological status of the phenomena described (i.e., some account of whether it is to be understood as a literal object, a functional abstraction, or a descriptive metaphor) remained unaddressed throughout the length of the article. Similarly, articles that reference or imply multiple accounts of the ontological status of a single term were taken to be confused, or as contradictory when at least two of these accounts were mutually exclusive (as in a tension between literal and metaphorical meanings). In the interest of fairness, the three journals selected were all highest-tier APA or APS publications, each with a strong focus on experimental empirical science: *Psychological Bulletin* (Volume 138, Issue 2), *Psychological Review* (Volume 119, Issue 1), and *Psychological Science* (Volume 23, Issue 7). Focusing only on those articles depicting full research results or reviews, a total of 31 articles were assessed. Of those 31 articles, 13 (or 42%) used key terms or concepts that were used in an ontologically confused or contradictory manner, inconsistently regarding common terms as both literal and metaphorical in separate instances. For example, Freund and Kasten (2012), in their study of self-estimates of cognitive ability, take great care in much of their terminology, but use the general term "cognitive ability level" as sometimes representing an abstract aggregate of tested behaviors and outcomes (e.g., p. 297), and other times representing an actual level of some causative phenomenon within an individual, particularly when generalizing the practical implications of their findings (e.g., p. 314). Beyond this, 23 (or 74%) of the articles cited and built upon at least some previous research articles drawn from both literally and metaphorically defined usages of common terms. A clear example can be found in model proposed by Kruglanski et al. (2012), which uses a conception of "mental resource" that is interchangeably informed by highly nonliteral approaches, such as Lewin's (1951) and Deutsch's (1968), as well as more process-

oriented and materialist approaches such as those in Schmeichel, Vohs, and Baumeister (2003). Finally, perhaps most troubling were the 17 (or 55%) of articles that, in their own descriptions and explanations, identified either no ontological leaning concerning their subject matter, or made ontological references so vague as to permit interpretation in any combination of literal or figurative definitions of psychological terms. These broad trends signify both a lack of attention and a lack of concern among many psychology researchers regarding what the subject matter of their studies is presumed to be, and what underlying assumptions would inform these judgments. Readers should not, however, take these figures as a condemnation of the authors in the journals described, but rather as a conservative indication of the magnitude of this problem. By a considerable margin all three of the journals examined here demonstrate far greater scrutiny and higher scientific standards concerning these and related conceptual issues than can commonly be found in the literature as a whole, making the problem all the more striking.

The Continuum of Practical Assumptions

As the recent special issue of *Review of General Psychology* (July, 2013) demonstrates, many theorists from competing traditions seek to establish the particular suite of assumptions inherent to their approach as a fitting arbiter for most, if not all, of psychology. While all proposals are certainly not equivocal (with some appearing to offer a more comprehensive framework than others), critics such as Goertzen (2008, 2011) note that top-down attempts to convince researchers to abandon their existing assumptions and methods are unlikely to succeed. This is because, as Driver-Linn (2003) observes, adopting the background and practices of a particular field requires that researchers "pick a side (against their colleagues)" (p. 271), and maintain their commitment to the traditions of their fields by perceiving the problems that their framing may yet solve as paramount.

How can disciplinary incommensurability be addressed? Incompatibilities of theory and concept can be understood as differences in the assumptions embraced by disparate fields and traditions, many of which have become implicit and remain unstated to their adherents, and as such cannot be easily called upon to explain and resolve points of confusion. As critics such as Machado et al. (2000) have argued, a greater degree of theoretical and conceptual analysis could allow such clashes to contribute meaningfully to scientific development and the interpretation of findings. However, the first step in such a process requires that every tradition in psychological science closely examine its ontological and epistemological commitments, to make its entire suite of assumptions clear and available to explicit scrutiny. To do so would not merely clarify the true parameters of divergence between any two theories one may wish to compare, but would make the research findings of competing research fields interpretable as the tentative results of an elaborately explored set of conditional hypotheses.

The present authors propose then that many of the unifying frameworks that have been recently offered, and indeed many unrepresented theories in the wider literature, may be brought into a mutually acknowledged common conceptual space via their acceptance of, and commitment to, a shared ontology concerning the subject matter of psychology (as outlined above). To this end, we suggest that the defining distinctions of each theoretical approach be regarded not as dogmatic necessities, but rather as extended tentative hypotheses along a *continuum of practical assumptions*. This notion of a continuum is grounded in the observation that the patterns of assumptions embraced by different traditions in psychology are not arbitrary, but instead can be thought of as hierarchically arranged, with the more complex and tenuous assumptions built upon the more basic and certain ones. For example, branches of cognitive psychology, including the majority of evolutionary psychology, rely on the concept of functionally delimited cognitive "modules" in generating hypotheses about psychological processes (see Barrett & Kurzban, 2006, for an overview of the concept). In doing so, these researchers are relying upon an assumption concerning how neuronal systems are likely to be organized, particularly as a result of natural selective pressures. This assumption does not stand alone, however, as it is inextricably grounded in a range of computational assumptions that are more widely embraced throughout cognitive psychology (Fodor, 1975, 1983), which in turn are based upon a set of assumptions concerning the physiology of the human nervous system that are more widely embraced still (Dewsbury, 1991). These hierarchical connections can be thought to extend in branching paths, from those fundamental assumptions, generally well-supported so as to be regarded as ontologically certain and ubiquitous (such as the facts concerning the physical composition of human beings), through to the most tenuous and niche-specific assumptions embraced only within particular fields.

The conservative nature of scientific practice ensures that any novel assumption advanced by a research tradition is likely to be only an incremental extension beyond what that tradition has taken to be reasonably certain. Furthermore, as Kuhn (1970, chapter 9) reflected upon in his account of framing new paradigms, new assumptions are typically introduced as a possible means of addressing problems that previous framings struggle with. In the aforementioned example, researchers who embrace the assumptions of cognitive modularity gain a powerful new means of structuring their theories and generating testable hypotheses. Furthermore, as is often the case when using hypothesis-testing to chart a vast black box (Sober, 1998), the most productive means of exploring the truth or viability of a logically coherent possibility (such as that of a specific cognitive module) is to tentatively assume its existence, and examine the results derived from this assumption for contradictions and inconsistencies. As such, adhering only to the more basic and well-verified of assumptions entertained helps avoid wasting one's time fleshing out possibilities that may ultimately prove false, it also embraces a relative handicap in the generation of new theories and hypotheses, as compared with traditions that have accrued a more adventurous suite of assumptions within their niche. That said, from an interdisciplinary perspective, is it crucial that these less certain assumptions be embraced as tentative and conditional upon competitive verification, in acknowledgment of the wide range of possible assumptions that could conceivably provide a superior alternative in explaining psychological phenomena. In this sense, diverse traditions that rely on collections of assumptions not shared by their disciplinary alternatives can indeed be regarded as extended, competing hypotheses, only the stronger of which need be preserved and embraced as further evidence emerges.

There is insufficient space here to offer an extended treatment of each of the three examples explored hereafter. As such, each

example shall be addressed primarily with regard to the unique assumptions defining their approach, and both the integrative prospects and implied incompatibilities that commitment to these assumptions suggests. In comparing these examples, we draw attention to the range of conflicts that emerge when the practical assumptions underpinning a theory are rejected (or simply questioned) by others. In this sense, the two opposing extremes on the continuum of practical assumptions can be regarded as the metaphysically *safe* end, characterized by theories that make few uncertain assumptions but incur empirical disadvantages, and the metaphysically *risky* end, characterized by theories built upon many potentially false assumptions but that gain empirical advantages within a theoretical niche. Suffice it to say, a theory's position along the continuum of practical assumptions will prove instructive in understanding both the theory's recommendations for integrative change, and in predicting which other approaches the advocating theorist will likely disapprove of.

A Pull Toward Safety–Situational Realism

As was outlined in Petocz and Mackay (2013), situational realism is a psychological research tradition that has emerged from the intellectual legacy of the philosopher John Anderson (see also, Mackay & Petocz, 2011, for a detailed cross-section of the current state of situational realism). Although there is some degree of conceptual overlap between situational realism and other contemporary philosophically realist traditions in psychology (compare, for instance, Charles, 2013, Heft, 2013, and Tonneau, 2013), the Andersonian approach can be distinguished by its particularly staunch commitment to (a) a strictly monistic (as opposed to dualist) material ontology (a single spatiotemporal universe of infinite complexity), (b) the conceptual emphasis placed on the infinite complexity of real situations, and (c) the centrality of the distinction between objects and relations. In this view, all acts of cognition and knowing in humans (and other animals) are construed to be relations (or complex combinations of relations) between an organism (or relevant systems comprising the organism, e.g., drives and the perceptual apparatus) and a real situation (or specific aspects comprising a situation). Although potentially compatible with organism-environment interaction accounts offered by the other aforementioned realist and ecological approaches (particularly those of the Gibsonian and Holt traditions), this emphasis on relation allows one to conceive of conventionally mental events without a need to postulate ontologically questionable or untenable entities (Maze, 1991). Rather, ontologically real spatiotemporal things (or particular aspects thereof) are understood to be the objects of cognition, constrained and subject to error on the part of the knowing subject by the physical and causal structures that make the relation possible (such as the fallible apparatus of an animal's eyes and ears).

As Petocz and Mackay (2013) note, the approach of situational realism is not well-known in international circles, and has thus far contributed primarily theoretical contributions and conceptual clarifications, rather than empirical findings (though contributions focusing on the issue of measurement are particularly noteworthy; see Michell, 2006). This situation reflects perhaps the most distinctive characteristic of the situational realist approach, an unwavering commitment to strict logical and conceptual forethought, and a subsequent reluctance to embrace theoretical and method-

ological assumptions that stand upon uncertain metaphysical foundations (e.g., Maze, 1991). This commitment is not made purely on principle, but is suggested as a solution to the insidious conceptual problems that abound in psychological research (Michell, 2000), because of the misleading character of popular terms (e.g., "ultimate" causes in evolutionary theory can be construed teleologically; references to mental resources can be taken as subscribing to Cartesian dualism, etc.). According to situational realists, allowing the use of such metaphysically uncertain terms cultivates needless confusion, and offers potentially false findings built upon logically unsupported assumptions (Hibberd, 2009). As such, with regards to the often elusive nature of mental subject matter, situational realism seeks to avoid many of the aforementioned metaphysical risks of postulating hypothetical causal intermediaries, by focusing instead on the logically necessary components of any process that is conceived as a relation (typically, as subject and object terms; see Maze, 1991).

The existing wealth of empirical research findings in psychology would not be discarded, on this view, but rather carefully reexamined and reinterpreted, paying close attention to the set of assumptions under which the original hypotheses were proposed. This approach is considered viable, since regardless of the initial intentions or interpretations of researchers, all empirical findings are ultimately accounts of real spatiotemporal situations (Petocz & Mackay, 2013). Reinterpretation of this sort is widely recommended for the majority of work in cognitive psychology, for as Petocz and Mackay (2013) outline in their article, situational realism recommends a degree of withdrawal from the current prominence of "cognitive neuroscience and information processing" (p. 217) approaches in psychology. This stance reflects a wider rejection of most conceptions of "information processing" and "mental representation" in the realist literature (see McMullen, 2011).

Information, Representations, and Dualism

To the eyes of researchers in more mainstream traditions, this apparent rejection of the conceptual foundations of cognitive psychology, along with the interdisciplinary prominence and empirical achievements of cognitive approaches, can make situational realism appear to be a fringe school overly focused upon spurious issues within an obviously successful methodology (see Maclachlan, 1989). Contrary to this uncharitable characterization, the present authors argue that the situational realist critique of cognitive approaches can best be understood via the realist commitment to logical consistency, as contrasted with the historical legacy of embracing questionable pragmatic assumptions in cognitive approaches. In this sense, the realist view serves as a valuable check on a range of erroneous tendencies in cognitive science, which appear to go largely unnoticed and unpoliced by researchers absorbed in the tradition and its conventions.

Much of the critique is founded in situational realism's staunch rejection of metaphysical Cartesian dualism, a rejection ostensibly endorsed in most of cognitive psychology, though as Michell (2000) demonstrates, its metaphorical baggage has proven difficult to fully discard. situational realism acknowledges that macroscopic cognitive relations are comprised and instantiated by tremendous chains of physical changes (a posi-

tion shared with all of cognitive science), but take issue with the reification of such instantiations as semiotically meaningful representations and information content. This reification is fundamentally Cartesian, grounded in the concept (either literal or metaphorical) of some intracranial subject that the activities of cognition are being "represented" to. This position is not merely only without empirical support (either functional or anatomical; see Dennett, 1991, chapter 5), but is logically incoherent for reasons outlined in Maze (1991).

With regards to acknowledging the problems inherent to this reification, cognitive psychology is deeply heterogeneous and disordered, with many researchers using terms like information processing and mental representation in nondualist senses, as a metaphorical shorthand for the physical changes of the brain summarized on a more abstract descriptive level (akin to how we speak of the virtual transformations of computer programs, rather than the digital binary transformations said programs are physically instantiated as; see Dennett, 1991, chapter 9). This more advanced conception exists in parallel with more naive and intuitively dualist conceptions, which are fundamentally different ontologically, and yet the standard of writing in the discipline treats these details as implicit knowledge, ensuring that researchers cannot reliably identify when they're speaking across purposes. The conceptual tools of situational realism are potentially valuable to all of psychology, if only as a source of more exacting terminology (their use of relations, in particular) that can help researchers realize when they have fallen into the easy traps of unscientific Cartesian dualism.

A Pull Toward the Centre–Developmental Evolutionary Psychology

In sharp contrast to the aforementioned case of situational realism, Lickliter and Honeycutt's (2013) proposal concerning developmental evolutionary psychology does not outline the details of their theoretical framework exhaustively. Rather, their proposal builds upon the presumed existing familiarity of the reader with the adaptationist paradigm of evolutionary psychology, an oft-cited but controversial contender for an indispensible metatheory in unifying psychology (Buss, 2009; Daly & Wilson, 2008; Tooby & Cosmides, 2007; Webster, 2007;). In referencing this paradigm, Lickliter and Honeycutt (2013) have taken several bold steps toward *risky* on the continuum of practical assumptions, when contrasted with cases like situational realism. Evolutionary psychology relies upon a network of conceptions and assumptions which, while presently quite well supported (both empirically and institutionally; see Fitzgerald & Whitaker, 2010), are on far less certain ground than the observable states of affairs discussed above (see, however, Richardson, 2007, for a dissenting position). Beyond reliance upon the computational information processing theories questioned by more conservative approaches, evolutionary psychology uses a specific adaptationist methodology that makes a range of probabilistic assumptions about the necessary role of natural selection in any set of complex biological designs (see Tooby & Cosmides, 2005, for a detailed account).

Building on their earlier work in the same vein (2003), Lickliter and Honeycutt (2013) draw special attention to a set of assumptions that evolutionary psychology has inherited from the "Modern Synthesis" of evolutionary biology, concerning a heavy emphasis on the influence of genetics, to the detriment of the role of development (Mayr, 1982). Stated briefly, the developmental evolutionary psychology approach endorses the entirety of the contemporary evolutionary psychology paradigm, with one key exception. They contend that the standard assumptions of evolutionary psychology separate genetic and developmental influences as distinct sources in organism formation and variation. Subsequently, evolutionary psychology privileges the role of genes as the "primary" influence, with the role of development as supplemental, an assumption that Lickliter and Honeycutt describe as untenably preformationist and genetically deterministic. Citing a wide literature concerning recent discoveries in developmental systems and epigenetics, Lickliter and Honeycutt (2013) assert that these preformationist assumptions have become antiquated, and are now biologically indefensible. They instead propose a fundamental reframing of this component of the adaptationist approach, wherein evolutionary influences and developmental factors must always be considered as a complex whole. Stated directly: "it is not biologically meaningful to discuss gene activity and its influences without also referring to the broader context within which genes are activated and expressed . . . genetic and environmental factors cannot be meaningfully partitioned" (Lickliter & Honeycutt, 2013, p. 185).

Dissolving Dichotomies, in Practice or Principle?

As a unification proposal, the developmental evolutionary psychology submission follows a similar strategy to the situational realism submission, but to a far more moderate degree. Rather than seeking to pull back the practical assumptions and associated conceptions of all other researchers to the far *safe* end of the continuum, Lickliter and Honeycutt (2013) endorse the bulk of assumptions used by evolutionary psychology, seeking only to pull researchers back from those assumptions concerning the distinctness and prioritization of genetic and developmental influences. Just as with situational realism, the suggestion is that the assumptions targeted for redaction are logically and empirically untenable, and that researchers would do well to completely avoid these assumptions, eschewing the related distinctions in all future inquiry. Or, stated differently, this articulation of the Evolutionary Developmental approach seeks to strategically withdraw from several risky, practical assumptions embraced by wider Evolutionary Psychology, drawing closer to the safe end of the figurative continuum.

However, as was argued above, the practical assumptions used in various theories represent a delicate cost-benefit analysis between metaphysical certainty and empirical utility. As Buss and Reeve (2003) explore in their rebuttal to prior claims by Lickliter and Honeycutt (2003), the paradigm of evolutionary psychology is committed, at least in principle, to a "deeply interactionist" conception of genetic and developmental influences. In their later writings on the topic, Lickliter and Honeycutt (2009) reflect on this professed acknowledgment, but insist that gene-privileging dichotomies remain practically entrenched in the concepts and hypotheses of most evolutionary psychology research, despite any theoretical claims to the contrary. The general endurance of at least partial favoring of genetic influences in analysis was attributed by Tooby, Cosmides, and Barrett (2003) as a matter of practicality. They argue

that assuming a simplified, directional interaction between genes and development typically captures the majority of important design details in most situations, and therefore making this assumption is the most practicable option, only warranting reconsideration when contradictory evidence dictates.

Although the theoretical commitments shared by the Evolutionary Developmental position and the mainstream adaptationist are vastly overlapping, the practical and methodological issue of when it is justifiable to make preformationist assumptions cannot be simply resolved by the proviso that the position is easily reversed when contradicted by evidence. This is because the very research practices and hypotheses that would allow one to discover contradictory evidence in most circumstances are shaped by the theoretical assumptions used. Under such an understanding, mainstream evolutionary psychologists would advocate taking a practical path of least resistance in their own research (a riskier but more easy and productive position on the continuum), whereas relying upon researchers using the methods advanced by Lickliter and Honeycutt to perform more painstaking parallel analyses of the same phenomena, so as to "catch them out" on those occasions when moderate preformationist assumptions turn out to be untenable. The wastefulness of such an arrangement underpins the Evolutionary Developmental suggestion that the riskier position on the continuum is better off abandoned, so that all adaptationist resources can be productively dedicated to the demonstrably more logically consistent and metaphysically certain methodology. When framed using the continuum of practical assumptions, the trade-off between the two approaches becomes clear. The wisdom of embracing Lickliter and Honeycutt's proposal hinges on precisely how often developmental influences have radical impacts on psychological phenotypes akin to those described in their key examples. For now this remains an empirical question of some dispute between proponents of the Evolutionary Developmental approach, and those who endorse the adaptationist mainstream (Buss & Reeve, 2003). Should sufficient evidence come to suggest that moderate preformationism is too metaphysically risky an assumption to maintain, it must surely be abandoned, but since the absence of evidence is not evidence of absence, at least some minority of researchers using Lickliter and Honeycutt's methods will likely always serve as a necessary counterpart in the dialog of evolutionary psychology.

An Adventure in Risky Practicality–Tree of Knowledge Unified Theory

In referencing the continuum of practical assumptions, we are able to appreciate the unification strategies central to the prior two examples as revolving around a common theme. Both target particular theoretical traditions in contemporary psychology (though situational realism targets a considerably wider range than does developmental evolutionary psychology), and challenge what are viewed as either the logically or empirically untenable assumptions underwriting them. They also suggest a common solution: the wholesale abandonment of these assumptions to improve the technical and metaphysical accuracy of subsequent investigations. This metaphysical *safety* is brokered at the cost of practical methodologies and the findings gener-

ated, but it is suggested that any lost knowledge can be reacquired all-the-better without the need for *risky* assumptions. Both approaches, in this sense, are deconstructive and antipragmatist, focusing on the perceived and potential errors of a vast existing literature, and concerned more with reversing the missteps of their peers than offering avenues to new discoveries.

In sharp contrast, the ToK unified theory advanced by Henriques (2003, 2004, 2005, 2008, 2011, 2013) focuses less on dissolving problematic distinctions, but instead seeks to harvest and combine the functional cores of many such conceptions (from diverse sources in the literature) into a more focused and inclusive set of practical assumptions. Building upon its characteristic ToK model, which centers on the emergence of complexity in the natural world, Henriques' theory assumes a top-down, but fundamentally pragmatic, approach to scientific discovery within psychology. Although the complete ToK unified theory makes many targeted suggestions and integrative comparisons (covered exhaustively in Henriques, 2011), in using it as an example the present authors wish to draw attention to two components that can be best construed as bold sets of practical assumptions: *behavioral investment theory* and the *Justification Hypothesis*. In reviewing both the practical gains and the metaphysical risks of such propositions, the necessity of tentative assumptions can be better appreciated.

Behavioral Investment Theory: The Hopeful Chimera

Rather than relying upon the wide range of topic-specific assumptions scattered among other research traditions, Henriques condenses and distills the defining insights of many approaches into the six principles of behavior investment theory (BIT). As Henriques (2013) describes,

> BIT starts with the proposition that the nervous system is an action control system that computes the investment of work effort on a cost-benefit ratio that evolves intergenerationally via evolutionary processes and is further molded via experience during the life of the animal . . . integrating evolutionary, neuroscience, behavioral science, and cognitive science perspectives. (p. 170)

In a manner reminiscent of the two approaches discussed above, BIT emphasizes the complex and interactive nature of the organism-environment system. However, rather than insisting on a single, simplified conception of how to describe and analyze such a system, BIT seeks to cultivate the rich diversity of practical assumptions that have underpinned various research approaches (including biological, developmental, and cognitive approaches) and render them as compatible within a common conceptual framework. This approach regards the motivated nature of all cognition as central in framing: (a) the computational and neural constraints; (b) evolved biological drives; and (c) learned and developmental calibrations, of any organism's nervous system (see Henriques, 2011, chapter 3, for details).

While primarily a collection and integration of prevailing assumptions within experimental scientific psychology, the central value of the BIT lies in its organization of these assumptions into a coherent whole, which can serve as a "checklist" of influences that researchers with diverse backgrounds must consider (Geary, 2005; Quackenbush, 2008). However, some critics, most notably Katzko (2008), have observed that this itemized combination of diverse assumptions blurs some

ontological and epistemological distinctions that are more readily appreciated in the fields from which these assumptions emerge. For example, as the Lickliter and Honeycutt (2003, 2013) approach reviewed above emphasizes, genetic and developmental influences are often deeply intertwined, and may interact in nonobvious ways when considering the evolution of a psychological process (see also Viney, 2004, for further discussion). Despite this, for practical purposes, BIT regards its range of assumptions as mostly independent and equally metaphysically certain, but in doing so obscures the interrelations between some postulates, such as the reliance of evolutionary modularity upon a particular conception of neural computation (also discussed in Pinker, 1997). This apparent equivalence is potentially misleading, and misses an opportunity to frame the network of assumptions in a manner that acknowledges their hierarchical interrelations and tentative position on the practical continuum. A more explicit account of the relations and dependencies between the assumptions of BIT would enhance the unifying appeal of the ToK unified theory, by allowing researchers to qualify any particular postulates they deem inappropriate, without having to discard the framework as a whole (see Kirschner, 2006; Yanchar, 2004).

Justification Hypothesis: A Key to Culture

The most bold, and arguably most innovative, contribution of the ToK unified theory concerns the practical assumptions underlying the Justification Hypothesis (discussed in Anchin, 2008; Quackenbush, 2008; Shaffer, 2008). The Justification Hypothesis is proposed as the central heuristic for understanding the social-symbolic characteristics unique to the psychology of humans (in particular, the manner in which humans describe, understand, and communicate beliefs and decisions), by proposing that much of our social–cognitive apparatus are evolved adaptations that address the demands of predicting, coordinating and describing one's actions in a manner that can be justified to others. That is to say, in-line with perspectives in social psychology such as Haidt's Social Intuitionist model (Haidt, 2001, 2012), the Justification Hypothesis regards the primary adaptive function of most forms of deliberate human reasoning, as providing socially defensible justifications and rationalisations for our beliefs and actions, so as to guard the many benefits of cooperation and social status (see Henriques, 2011, chapter 5, for a full account). Thus, in the ToK framework, hypotheses concerning the function and organization of many social psychological processes (particularly those involving self-awareness and intention) can be generated by considering the adaptive demands of social justification, particularly in ancestral environments. Henriques (2011) argues that these guiding constraints provide both a potentially instructive means of understanding reflective and metacognitive psychological systems, and also a unique means of analyzing the emergence and adaptive function of many human cultural phenomena (such as norms, traditions, and historical narratives), which may be regarded as socially distributed "justification systems."

Despite receiving some critical support for the wide sphere of potential insights it affords (Gilbert, 2004; Haaga, 2004; Katzko, 2004; Shealy, 2005; Stanovich, 2004), the Justification Hypothesis serves as an illustrative example of a recent theory

built upon new practical assumptions. Although it is perhaps possible that all of human culture may be best understood as justification systems, constrained and operated by particular psychological mechanisms, counterarguments against such a complete account are already emerging. Both Katzko (2008) and Shaffer (2008), for instance, argue that several social-phenomena require mind-culture bridgings that exceed the projected theoretical role of the Justification Hypothesis. Others, notably Vazire and Robins (2004), argue that the obvious utility of the Justification Hypothesis may be better understood as the result of several distinct adaptations, each with an alternative set of evolutionary origins to those proposed by Henriques (see also Katzko, 2004; Shealy, 2005; Stanovich, 2004). Regardless of which perspective ultimately triumphs, exploring the Justification Hypothesis as an example exposes the value of tentative practical assumptions that the present authors wish to draw attention to. That is, the disagreements concerning the utility and validity of the Justification Hypothesis could only be addressed by tentatively pursuing research based upon its assumptions, and then comparing the value of its findings to those of alternative perspectives (Calhoun, 2004). Any promising assumptions must be tentatively adopted and empirically tested to evaluate their worth, because a priori speculation will always preclude those findings that run contrary to our intuitions, and thus have the most to teach us (Kuhn, 1970, 1996).

Conclusion

Theorists such as Goertzen (2008, 2011) and Trafimow (2012) have openly lamented the lack of attention given to the underlying conceptual and philosophical assumptions that proliferate psychological research. The black box limitations of the subject matter of psychology ensure that traditions built upon ill-acknowledged assumptions invariably lose direction, and gradually become increasingly incompatible with alternative traditions built upon different foundations. By embracing the increasingly accepted physical ontology underlying the organism-environment interactions of psychological phenomena, researchers are in a position to organize their theories and empirical explorations along a continuum of practical assumptions. With a shared definitional basis, the metaphysical certainty of any scientific theory of psychology can be regarded as a tentative postulate in a network of related assumptions, ranging from those with the greatest certainty (but with vague applicability), to those assumed for practical purposes, which must be evaluated by the strength of their results.

The three examples explored above, situational realism, developmental evolutionary psychology, and the ToK unified theory, can be understood as increasingly *risky* increments along the continuum of practical assumptions. The recommendations of their advocates regarding wider unification can be best understood as a function of their position along the continuum, but all three approaches share an ultimate commitment to the realist ontology at the heart of contemporary scientific psychology (Mandler, 2011). We have outlined how the explicit acknowledgment of foundational assumptions, and the appropriate designation of these assumptions as tentative (pending empirical exploration), can permit approaches presently at-odds to integrate and overlap wherever conceptual compatibilities

permit. However, the prospect of this form of unification is contingent upon the expansion of both theoretical development and conceptual analysis in the practice of psychological research (Machado, Lourenco, & Silva, 2000), two practices that grow increasingly neglected in modern academic institutions (Michell, 2003a, 2003b).

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Correction to Andrews, Lilienfeld, and Duke (2013)

In the article "Evaluating an Animal Model of Compulsive Hoarding in Humans" by Jenna G. Andrews, Scott O. Lilienfeld, and Marshall P. Duke (*Review of General Psychology*, Vol 17, No. 4, pp. 399–419. doi:10.1037/a0032261), the affiliation and name of author Jenna G. Andrews of Morehouse College were incorrectly listed in the byline and author note as Jennifer G. Andrews-McClymont of Stephens College. The online version of this article has been corrected.

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