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The future of cognitive science is pluralistic, but what does that mean?

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Abstract We imagine the future of cognitive science by first considering its past, which shows remarkable transformation from a field that, although interdisciplinary, was initially marked by a narrow set of assumptions concerning its subject matter. In the last decades, multiple alternative frameworks with radically different ontological and epistemic commitments (e.g., situated cognition, embodied cognition, extended mind) found broad support. We address the question of how to understand these changes, noting as logical alternatives that (1) newer approaches are not properly *cognitive*; (2) that newer approaches are cognitive but not *science*; and (3) that cognitive science has become pluralistic. We endorse the third position and venture to guess that the future of cognitive science is also pluralistic. We are left, however, with the question of what this *means.* After noting the polysemous nature of the term "pluralism", we attempt to add clarity by distinguishing three forms: ontological, epistemic, and ethical. We then consider what each form might imply for the future of cognitive science.
KEYWORDS: Cognitive Science; Pluralism; Relativism; History of Science; Philosophy of Science

Riassunto *Il futuro della scienza cognitiva è pluralista, ma che vuol dire?* – Pensiamo al futuro della scienza cognitiva in primo luogo considerando il suo passato, il quale è notevolmente cambiato rispetto al presente. Per quanto si proponesse come un campo di studi interdisciplinari, la scienza cognitiva delle origini era caratterizzata da un insieme ristretto di assunzioni riguardanti il proprio oggetto. Negli ultimi decenni hanno trovato supporto diverse cornici teoriche in reciproca competizione e con impegni ontologici ed epistemologici radicalmente differenti (si pensi, per esempio, alla cognizione situata, alla cognizione incarnata, alla mente estesa). Proveremo a dare risposta alla domanda su come intendere questi cambiamenti, prendendo atto che ci troviamo di fronte a una serie di posizioni che sono logicamente alternative fra loro: (1) gli approcci più recenti non sono propriamente *cognitivi*; (2) oppure che gli approcci più recenti sono cognitivi, ma non *scientifici*; (3) la scienza cognitiva è diventata pluralista. Noi crediamo che la terza posizione sia corretta e scommettiamo su un futuro della scienza cognitiva che sia anche pluralista. Resta aperto, tuttavia, il problema di cosa questo *significhi*. Dopo aver preso atto della natura polisemica del termine "pluralismo", cercheremo di far chiarezza distinguendo tre forme di pluralismo: ontologico, epistemico, ed etico. Considereremo quindi ciò che ciascuna può comportare per il futuro della scienza cognitiva.
PAROLE CHIAVE: Scienza cognitiva; Pluralismo; Relativismo; Storia della scienza; Filosofia della scienza

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IN *THE MIND'S NEW SCIENCE,* Howard Gardner identifies the key features, core assumptions, or "symptoms" of cognitive science as he found it in the mid-1970's, the period during which he first encountered the term.[1] These features include, (1) analysis of *representations*, a distinct level of analysis between input and output focusing on relations between symbolic/syntactic entities.[2] The important idea is that this symbolic realm contains not only «acceptable scientific constructs» but is the appropriate focus for a science of mind; (2) a central relationship to the *computer*, both symbolically, as a model of human mentation, and procedurally, as a basis for designing and testing simulations of human mental processes; (3) in an attempt to limit analysis to what is clear and practical (i.e., not hopelessly complex), an *avoidance of "murky" concepts*, or more specifically a «de-emphasis on affect, context, culture, and history»;[3] (4) commitment to and faith in the investigatory advantages of *interdisciplinary* cooperation, with the idea that «more powerful insights» are thus attained; (5) "rootedness" in philosophy, or rather, «classical *philosophical* problems» inherited from classical Greek and Enlightenment philosophers.[4] By this last point Gardner means not that cognitive scientists actively engage in writing philosophical works but that long-standing philosophical questions serve as a «logical point of departure for investigations in cognitive science».[5]

We note that this set of core assumptions is descriptive only, as indicated by Gardner's project in the first two sections of his book of offering a historical account of cognitive science in the latter half of the 20th century (to the mid-1980s). Moreover, he qualifies several of the assumptions he includes (e.g., by noting that cognitive scientists have nothing against context or affect in principle, or that the philosophical grounding of cognitive science is a contentious matter for some). In doing so Gardner implies that he offers only his own analysis, his view of what is essential to the emerging discipline, as a response to the fact that he found nothing systematic written on cognitive science prior to that time. Nevertheless, the core assumptions reflect his professional association with cognitive scientists of many stripes and his deep familiarity with the literature, thus it is reasonable to treat his postulates of cognitive science as reflecting real features of the "new science",[6] even if only strong trends.

Moreover, these trends and features are easily identified in the literature of the time. Although an abundance of exemplary references might be given, Fodor's *Language of thought* and Newell and Simon's physical symbol system hypothesis[7] are among the best-known exemplars of the essential or definitive understanding of cognitive science within the period in question, illustrative of the received view Gardner conveys. Fodor was clear in his effort to develop the appropriate conceptual substrate for the rapidly expanding cognitive science, and although his original *Language of thought* proposal (LOT) included the additional controversial inclusion of nativism, the central, most coherent argument is for the computational metaphor and stipulation that the computation in question takes place over a vast syntactical system of content according to rules. Thus, although Gardner's project was historical, Fodor's is conceptually foundational, with the features of cognitive science not regarded as arbitrary. On the contrary, the features appear to be binding and constitutive of the subject matter, most famously expressed in Fodor's depiction of computation over representation as «the only game in town»,[8] followed by the even bolder assertion that «there aren't any alternatives which seem to be even remotely plausible».[9]

Of course, alternatives have since been forwarded and regarded by their proponents as highly plausible. By the later 1980s the emergence of "cognitive neuroscience" all but eviscerated the neglect of bodily processes in cutting edge cognitive science.[10] Yet one fallout of the shift in focus to the cognitive neurosciences was diminishing collaboration with some of the efforts that were originally part of the broadly conceived interdisciplinary project of cognitive science (e.g., linguistics, cognitive anthropology, learning and education). Simultaneously, opposition to traditional representationalism and the related neglect of context (bodily and environmental) provoked a resistance movement at least in some such cognate disciplines. There we find a set of interrelated approaches that maintain a primary focus on cognition but offer models of cognition as blatantly interpenetrated with context – bodily, social, and environmental. With this difference in emphasis, epistemic priorities are also shifted, for example from concepts to activity. As one example, «A theory of situated cognition suggests that activity and perception are importantly and epistemologically prior – at a nonconceptual level – to conceptualization».[11] By the end of the 20th century, one can see only an expansion of alternatives united in opposition to *Good Old Fashioned Artificial Intelligence* (GOFAI): emerging, to some extent overlapping frameworks including situated cognition,[12] distributed cognition,[13] embodied cognition,[14] enactivism,[15] extended cognition,[16] neurophenomenology,[17] and ecological psychology,[18] among others.[19] (Let us call these for convenience, the "dissenters," because they depart from an orthodox cognitive science discernable in Gardner's key features and Fodor's swagger). As Buckner and Fridland put it: «virtually every aspect of this initial sketch of the nature of cognition and cognitive explanation has now been challenged».[20]

In addition to posing challenges, new frameworks also introduce new concepts, such as "affordance"[21] which has itself undergone a series of important changes over time.[22] They also make possible an extension of the range of phenomena

considered to be within the province of cognitive science.[23] That the alternative frameworks also continue to evolve in response to academic challenges and technological advance is clear. For example, Gallagher describes three waves of development of the extended mind hypothesis since its first appearance at the end of the 20th century.[24] Important too is that some approaches appear to offer a bridge or middle ground between orthodox and newer perspectives on cognition. Some retain a principal role for representations and mental models while recognizing the participation of social, historical, or cultural processes in the broader systems within which cognition is accomplished,[25] or maintain that computation can be important in newer frameworks.[26] Thus, it is not a matter of one orthodox alternative currently positioned against one radical form of dissent; it is rather a broad array of options offered in attempt to address age old questions concerning means by which knowledge is acquired, problems are solved, and new innovations achieved. These problems are, of course, at once philosophical and psychological, concerning the nature of knowledge and the human processes by which it is accomplished. We may add that the (in)compatibility between divergent approaches is a matter of ongoing discussion and debate, though it is in large part beyond the scope of our present task.[27]

Instead, the problem that orients this paper is this: how best to conceptualize the transformation from a single plausible alternative (computation over representations) to a range of options that do not share its most fundamental assumptions? We offer three logical possibilities for making sense of such a development in relation to cognitive science. The first is that the newer approaches are not part of *cognitive* science; the second that they are cognitive but not representative of cognitive *science*; the third is that *cognitive science* itself is *pluralistic*. We then defend the third alternative and discuss its broader implications in terms of the focus of the special issue – the future of cognitive science.

1 Ways of understanding transformations in cognitive science

There are certainly different ways to understand or to account for the transformations in cognitive science that have occurred in the past decades. Here, we focus on those views that seem to represent the best logical alternatives.

1.1 Alternative/dissenting approaches are not part of cognitive science

A claim to the effect that dissenting approaches are not part of cognitive science proper might be based on demonstration that "cognitive" has a narrow range of references and that these provide a standard for censure. The idea that the dissenters are not part of cognitive psychology or cognitive science because they are not properly cognitive is promoted both explicitly and indirectly in various contexts, both on the part of the cognitive science orthodoxy and among the dissenters themselves.[28] An example from the orthodoxy is Adams and Aizawa,[29] who seek in part «to keep cognitive psychology on track»[30] by limiting its scope to genuinely, exclusively cognitive processes, a cause which in their view requires proposal of a distinguishing "*mark of the cognitive*". Their question, in other words, concerns «what regions of spacetime contain cognitive processing?».[31] Their answer advances two claims, the first that the cognitive is marked by the presence of at least *some* non-derived (non-normative) content. Derived content is that with social meaning: «traffic lights, gas gauges, and flags are paradigm cases of items bearing derived content. Thoughts, experiences, and perceptions are paradigm cases of items bearing non-derived content», but only if they include non-derived content as «original representations»,[32] which they view as needed to enable explanation of a hypothetical "lone thinker" deprived of social interaction. A human born and raised with no social interaction and in a world with no socially determined symbols would still have thought (assuming we would call the person human); that thought would be representational like any other, but the representations in question would be not derived from social meanings. Because language is inherently social, non-derived contact would be non-linguistic thought, or at least non-linguistic aspects of linguistic thought. Adams and Aizawa further identify "the cognitive" with the «many forms of information processing that manipulate and transform information in ways unlike those found in processes spanning the brain, body and environment»,[33] with vision, memory, and attention serving as examples of processes of this kind.

Adams and Aizawa are explicitly critical of dissenting approaches, especially the extended mind theses, their primary target. The extended mind thesis offers a direct challenge to individualistic frameworks, replacing it with a strong version of externalism that conceives of mind and environment as not merely coupled but co-*constituted*, and distinguished from philosophical externalism by the additional claim that the environment is actively involved in processing on an ongoing basis. It is, therefore, part of the very processing system that produces knowledge.[34] Adams and Aizawa's main goal is to eliminate from the cognitive science orthodoxy extended mind frameworks that regard the cognitive system as inclusive of the material and social environment. Yet we find definitions of "cognitive" that would exclude dissenting frameworks also among the dissenters themselves. As one example, in a reply to an author he

accuses of making claims that answer the wrong questions, James Greeno identifies the situative approach as a perspective that contrasts with the cognitive, differing at the level of both concepts and explanatory schema. He notes:

> The cognitive and situative perspectives differ in this. The cognitive perspective's basic concepts and explanatory schemata are about processes and structures that are assumed to function at the level of individual agents. These processes and structures include knowledge as well as perception, memory, inference, decision, and so on. The situative perspective adopts a different primary focus of analysis. Situativity focuses primarily at the level of interactive systems that include individuals as participants, interacting with each other and with material and representational systems.[35]

Note that Greeno's contrast between cognitive and situative perspectives includes a difference in the unit of analysis "only".[36] He does not suggest that environmental or bodily factors are unimportant to cognition. Neither does the situative approach ignore representation, but the primary attention is to systems: persons in interaction with other persons and meanings they co-create and propagate.

Although Greeno focuses on the individual unit of analysis as essential to the cognitive perspective, for Adams and Aizawa "the cognitive" is defined more restrictively. Accordingly, in one case (for Greeno) "cognitive" is implicitly problematized as narrow in focus; in the other case (for Adams and Aizawa), the narrow focus of "cognitive" is affirmed and deemed necessary. We see, however, that even with these two initial examples representing two very different starting points, there are divergent views on the meaning or necessary parameters of "cognitive", and by extension cognitive science. Adams and Aizawa's effort to exclude extended mind is based in part on appeal to what has been traditionally regarded as "cognitive" or included in our understanding of "cognition". But this is less straightforward than might be imagined from their project. We are hardly the first to point out the inherent difficulty of narrowly defining "the cognitive" or restricting it to a slender range of processes. Indeed, the effort to define cognition and specify its referents is a problem that dates at least to early efforts to organize a distinct branch of cognitive study, at least two decades before the emerge of cognitive science as Gardner describes it.[37]

We consult as an example an essay by Egon Brunswik titled *Scope and aspects of the cognitive problem*, published in 1957 and prepared for a *Cognition Symposium* held at the University of Colorado in May of 1955: «the first one in the field of psychology to concern itself with the important and difficult area of cognition».[38] Brunswik defines the problem of cognition simply as «the problem of the acquisition of knowledge»,[39] with perception of space and perception of personality characteristics (so called "social perception") as representative subproblems within this broad and enduring focus. His conclusion stresses that

> only by detailed analysis of ecological [environmental] textures can the cognitive problem be restored from mere utilization problems to its full scope of achievement problems and thus again become the key to the core question of psychology, that of the adjustment of the organism to a complex environment.[40]

We see here in an early effort to define the scope of cognitive psychology, at least, an emphasis on the environment, in stark contrast to the *de*-emphasis on environment Gardner had underscored as a key feature of the emergent cognitive science of the mid-1970s, cognitive science proper, he might say. Commenting on Brunswik's remarks and other papers in the symposium, Osgood acknowledges that although the authors are concerned with «the common problem of cognitive process», they exhibit «quite different emphases and with quite different levels of analysis in the constructs employed».[41] Perhaps most telling is that despite the core features he had discerned among its representatives, Gardner himself defines cognitive science as «a contemporary, empirically based effort to answer long-standing questions, particularly those concerned with the nature of knowledge, its components, its sources, its development, and its deployment».[42] Assuming Gardner's depiction of the field in the mid-1970s is accurate (which we do), it is perhaps most fitting to say that the definition of "cognitive" in psychology was originally broad, then narrowed with the advent of "cognitive science" as an interdisciplinary specialty, becoming more explicitly associated with on the processing of information and computational metaphor. However, by the early decades of the 21th century, the meaning appears to be broadening again. We find this to be affirmed elsewhere: «over time, the understanding of what it is to be cognitive has expanded, diversified, and become more contentious».[43]

Additionally worth noting is that there is an important distinction recognized between "cognitive" and "cognitiv*ism*," the latter implying a set of assumptions which range from the individual level of analysis Greeno cited and the doctrine of computation over representations alleged by an insistent Fodor. Various early critics of cognitivism in psychology make an implicit distinction between "cognitive" and cognitivism by emphasizing that the target of criticism is the *ism* itself – the doctrinaire stance, the dogmatic commitment to a

focus on internal representation and information processing, along with the assumption that all psychological processes should be understood from such a grounding.[44] Wertz, a methodologist and phenomenological psychologist, criticizes what he calls the "narrowly homogenous" group relying on cybernetics as a basis for psychology.[45] Moreover, Bruner, one of the participants of the cognitive revolution, denounces the reductionist framework of traditional cognitive science, and calls for the rescue of meaning and culture in cognitive psychology.[46] To these examples we may add the very long line of thinkers who preceded or kept pace with behaviorism and focused on a broad range of mental processes including thinking, attention, perception, and imagining.[47] We see nothing sound or productive about questioning whether such thinkers are properly cognitive in orientation or focus.

1.2 Alternative/dissenting approaches are not cognitive science

A second possible strategy is to exclude alternative or dissenting approaches to cognitive science from the science aspect of cognitive science. That is, it is possible to grant that even though all approaches that focus on reasoning and problem-solving are at least broadly concerned with *cognitive* processes, their ways of *investigating* it are not properly scientific. Evidence in favor of this argument might point to the fact that some of the alternative approaches (e.g., extended mind theory) began as philosophical frameworks, offering conceptual models for cognition that introduce new concepts and procedures out of step with the practices of orthodox cognitive scientists or cognitive psychologists.

Such a view might be levied either from the standpoint of a scientific purism that defends the epistemic priority of a narrow conception of science *or* from the perspective of those who disparage science as inadequate to the task. For example, Gardner notes that some critics of cognitivism «hold that factors like affect, history, or context will never be explicable by science: they are inherently humanistic or aesthetic dimensions».[48] Gardner also acknowledges that other critics of cognitivism target a limited conception of science that would exclude context and affect, an «antiseptic cognitive science» as he puts it.[49] In either case, the concern is not only with definitions of science but with methods and epistemic validation, of epistemology rather than ontology.

We find the possibility that dissenting positions are not part of cognitive *science* even less viable than the first. This point does not deserve a long discussion; thus, we note only a few obvious reasons here. Leaving aside the fact that there is no settled opinion on the nature and limits of science itself, the rootedness of alternative or dissenting perspectives in philosophical frameworks can hardly disqualify them as contributing to the science, either by precedent or logic. As Gardner makes clear, cognitive science is if anything a contemporary extension of philosophical problems of ancient origin. The whole enterprise may be conceived of as inherently and ultimately philosophical. Of course, as Gardner also notes, an empirical approach to these long-standing questions, the reliance on empirical data of various forms has also characterized the field. Thus, we might legitimately question the relation of the foundational philosophical argument to the collection or possibility of collection of empirical data to test the implications of the theoretical model.

But philosophical sophistication can hardly be used as grounds for questioning the empirical basis of a dissenting framework. To remain with the example of Clark,[50] he does not "collect data" in a sense traditional to psychology or cognitive science yet relies on evidence through thought experiments (e.g., the "Otto and Inga" problem) to draw the reader into appreciation of the theoretical affordances of the extended mind view and its superior fit for the complexities of a contemporary, technology dependent society. Indeed, we might characterize his approach as guided by the assumption that cognitive science frameworks require an upgrade precisely because they do not adequately fit the data generated by thought experiments.

Importantly, in seeking to theorize the nature of scientific reasoning, other cognitive scientists use case-based historical analysis.[51] Practice-based approaches make use of ethnography.[52] Thus, the second reason to avoid questioning the scientific legitimacy of these approaches is that although they make primary use of insight-based interpretive analysis rather than calculation, alternative models of cognition rely on data of different forms but are no less empirically grounded for so doing. As a final, not trivial point we may look at the self-identifications of those who advance alternative perspectives, not so much at specific disciplinary identity or job title (e.g., philosopher) but at the aims of the overall project to which they are contributing. For example, Greeno characterizes the situative perspective as «a broad collection of scientific work being developed by many people».[53] If the broader goal is to offer systematic analysis of any of the total range of psychological and interactive processes that contribute to phenomena we would label cognitive, we find it difficult to take seriously any claim that would position these efforts outside of science.

1.3 Cognitive science is pluralistic

Rejecting the first two options, we are left with the problem that several ways of understanding learning and reasoning and problem solving have been refashioned into something almost unrecognizable from the field Gardner described as emerg-

ing in the mid-1970s. Cognitive science is altered ontologically, now including views that construe the cognitive processing system itself as broadened beyond the individual mind or brain, that regard cognition as an interactive phenomenon inclusive of the social and cultural worlds. It is also open to a new range of investigatory procedures, requiring a movement from principal reliance on computer simulation to field observation, interviews, case studies, thought experiment, and other modes of inquiry. Our position is that we should understand cognitive science as increasingly pluralistic over the past several decades, and further, that we see no reason to believe that this situation is likely to change in any future we can foresee. Hence our thesis is present in the first part of our title: the future of cognitive science is pluralistic.[54]

The second part of our title sets the agenda for the remainder of the paper. That is, having made the claim that the future of cognitive science is pluralistic, what does that mean? What are the various ways in which this pluralism might be understood? What are the implications both for making sense of the dissenting and alternative frameworks within cognitive science over the past several decades and any additional alternatives likely to appear or evolve over decades to come? We begin to answer this question by first providing a brief historical overview. We will then describe several versions or forms of pluralism, including epistemic, ontological, and ethical, and discuss the ways and extent to which these forms are present in cognitive science in its current form and as we dare to predict its future. We will then attempt to add further clarity by discussing what pluralism is not. Doing so will include two main distinctions: (1) A distinction of pluralism and interdisciplinarity, and (2) a distinction of pluralism from relativism. We will then offer a tentative conclusion pointed to the future of cognitive science.

2 Meanings of pluralism: A brief history and overview

"Pluralism" is a polysemic term. Over the years it has evolved in so many directions that it is quite infeasible to present a single historical account of it. Nonetheless, it is possible to indicate some of its major features.[55]

The common roots of all forms of pluralism can be traced back to the beginnings of Greek philosophy when the question about "the one and the many" was raised as a philosophical problem. Pre-Socratic philosophers disputed over the underlying unity or multiplicity of the world, although the term "pluralism" did not appear in this context.[56]

As a philosophical term, it first appeared in the eighteenth-century German tradition, especially in the writings of Wolff and Kant.[57] For Wolff, pluralism is a metaphysical position, which admits the existence of several beings in the world: «The idealists either admit more than one being or hold themselves to be the one real being. The former are called *pluralists*; the latter, *egoists*».[58] Kant, on the other hand, understands pluralism as an ethical thesis: «The opposite of egoism can only be *pluralism*, that is, the way of thinking in which one is not concerned with oneself as the whole world, but rather regards and conducts oneself as a mere citizen of the world».[59] From the beginning, then, we see that the term points to distinct concepts.

In the nineteenth century, the concept of pluralism gained new contours. It was extended beyond the purely metaphysical or ethical domain to grasp also the psychological, cosmological, and theological realms, resulting in a tripartite classification of pluralism.[60] In the second half of that century, debates over pluralism appeared in Britain and the United States. In this context, the great enemy to be faced was monism, after the influence of the German metaphysical tradition:

> Coleridge, following Schelling sang of the "miraculous all," the "omnific" spirit, the unity apprehended by reason and imagination, the human soul annihilated in God. De Quincey had studied Kant and Herder. Later on, Carlyle advised British youths to "open their Goethe" and offered for their silent admiration the indivisible nature of German philosophy.[61]

It happens that the battle over monism was not only a metaphysical, but also a theological, ethical, and political one, which led to the dissemination of pluralism as a philosophical label in religion and politics.[62] Not surprisingly, in the first decades of the twentieth century, distinct concepts of pluralism were widespread in Europe and America.[63]

After some decades of lying dormant, pluralism has reemerged over the past several decades. However, it remains poorly understood for the most part, largely because it emerges in very divergent contexts and in connection with a wide variety of phenomena in and out of psychology and philosophy.[64]

By appealing to this brief overview, we just want to indicate that pluralism is not a fixed and static concept, or one that can be easily understood independently of the context in which it appears. On the contrary, the history of the concept shows that both unity and multiplicity have been conceptualized in different ways, giving rise to different concepts of monism and pluralism, which invite some kind of classification or systematization.

3 Forms of pluralism

Out of several ways in which a field may invoke pluralism, we want to highlight three special forms: ontological, epistemic, and ethical. We consider each

of these in a general way before turning to the question of what each form would mean for cognitive science, present and future, and thus what is entailed in our suggestion that the future of cognitive science is pluralistic in each of these ways.

3.1 Ontological pluralism

Traditionally, ontological pluralism is associated with the assertion that the world is not an organic unity; instead, there are in a sense multiple fields that may or may not interact at any given time. According to William James, pluralism means that «the substance of reality may never get totally collected, that some of it may remain outside of the largest combination of it ever made».[65] Thus, he continues, «things are "with" one another in many ways, but nothing includes everything, or dominates everything [...] Something always escapes».[66] In this sense, ontological pluralism implicates not only ontological diversity, but also dynamism and transformation.[67]

We noted the variety of positions represented by contemporary frameworks that dissent from the orthodoxy of the computation over representation (GOFAI) model (e.g., situated, embodied, embedded, enactive, extended cognition, neurophenomenology). Yet despite the fact that cognitive science displays a set of ontologically diverse positions,[68] explicit philosophical commitments to ontological pluralism as specifically relevant to cognitive phenomena are not common.

Contemporary descriptions of ontological pluralism are more prominent in philosophy of biology, and from these we may draw out its relevant features and reflect on how they apply to cognition in the broad sense we advocate. One of the most comprehensive recent articulations of pluralism in biology is Sandra Mitchell's *Unsimple truths*.[69] Mitchell begins her argument with an appeal to complexity as a primary characteristic of the natural and human worlds. Although Mitchell focuses principally on epistemic pluralism, which we discuss in the next section, we can glean from her discussion that a contemporary version of ontological pluralism is expressed in any philosophical position that emphasizes the nature of reality as a vast array of complex *systems*: material, social, and temporal in structure and composition.

Mitchell provides examples of natural phenomena (a honeybee colony, an eukaryotic slime mold that exhibits two different states of existence, psychiatric disorders) that exhibit different forms of complexity: «compositional, dynamic, and evolved».[70] These forms, in other words, reflect (respectively) complexity in organization, and complexity in causal interactions, both internal to the system and with context variation, the latter representing what she calls «evolved contingency».[71] This latter form of complexity refers to the «uniqueness as a characteristic of complex biological systems» that distinguish them from the complexity of physical structures unaffected by evolutionary mechanisms.[72] Thus, important to Mitchell's analysis is that we must understand complexity as «variegated in kinds».[73] Complexity of organization alone is further variegated by forms of organization evidenced at different levels, such as genetic and biochemical.

3.1.1 Ontological pluralism and cognitive science

Given the dynamic nature and neurological substrate of cognitive phenomena, biological complexity is a more fitting analogy for the subject matter of cognitive science than is physics. The analogous framework provided by philosophy of biology enables us to analyze what pluralism as the ontological foundation of cognitive science would seem to imply and require.

First, it would foreground the complexity of cognitive phenomena by virtue of the natural and social systems within which cognitive phenomena emerge, and, drawing from Mitchell's distinctions, it would entail differentiation of various kinds of complexity in cognitive systems, including different levels of organization and differences between systems owing to evolutionary diversity (e.g., between minds of humans and other animals, or between minds of different representatives of a species). The important element in this assertion is "foreground", how the relation between cognition and context is theorized, to what extent context is regarded as figure or ground, or whether a figure-ground organization is even applicable. We find very few, if any, contemporary positions that would deny that context is important to cognition, even those that promote more traditional approaches. For example, Adams and Aizawa,[74] although seeking to limit the definition of cognition, assert that it is now uncontroversial as to whether cognition is impacted by bodily or social context, and, as noted, Gardner acknowledged the acceptance of this fact on the part of cognitive scientists even in the mid-1970s. In the case of Adams and Aizawa, the question is not whether cognition is impacted by context but instead whether there is at least in principle some aspect of cognition *not* impacted, something pure and original to an individual mind, without social influence of any kind.

It is important to acknowledge that there are two different ways of understanding pluralism as a foundation for cognitive science that arise at this juncture. The first concerns the nature of cognition itself, emphasizing the inherent complexity of the phenomena, the variegated nature of the complexity itself.

The second concerns the theoretical frameworks that in some sense compete to organize our

understanding of cognitive phenomena, the pluralism of the science that endeavors to make sense of the phenomena. Thus, the second sense concerns cognitive science as a field. We bring this up in part to underscore that pluralism can be understood in different ways, complicating the task of offering an account of the meaning and implications of pluralism in cognitive science. However, that these senses overlap is also indisputable. For example, an important question that arises is whether pluralism in the first sense (pertaining to the subject matter or referent) can accommodate pluralism in the second sense, that of acknowledging that different frameworks make sense of cognitive science in different ways. For example, the dynamical approach to cognition is among those which suggest that it cannot. In this case the focus is on the irreducibly temporal structuring of cognitive systems, for which reason computational models are inadequate:

> Cognitive processes and their contexts unfold continuously and simultaneously in real time. Computational models specify a discrete sequence of static internal states in arbitrary "step" time (t1, t2, etc.). Imposing the latter onto the former is like wearing shoes on your hands.[75]

In short, an ontology emphasizing complexity and interacting systems at the level of the subject matter (ontological pluralism) also has unavoidable epistemic (and relatedly, methodological) implications, to which we turn next.

3.2 Epistemic pluralism

Acknowledging the inordinate complexity of the world does not require the world is unknowable, only that the task of knowing it is itself complex. Epistemic pluralism is thus an attempt to deal with such complexity, by accepting that there are several ways to make sense of it, and that none is capable alone to do the job. According to James, «when we reach more complex facts, the number of ways in which we may regard them is literally countless. They are perfect well-springs of properties, which are only little by little developed to our knowledge».[76] Epistemic pluralism thus rejects the idea of unification of science around a single explanatory model.[77]

For Mitchell, a complex world begets complex representations of it, which we may understand in part as representations (models, theories) aimed at different levels or different aspects of the phenomenon of interest. Important to note, however, is that the existence of divergent models of a phenomenon, and correspondingly, different schools of thought in relation to a discipline does not itself constitute epistemic pluralism. The broad history of philosophy and psychology, including cognitive science, may be seen as a panoply of alternative conceptions of the mind and world and their relations, both over time and at any given period. Epistemological pluralism concerns the *stance* we should take toward the alternatives, more specifically, «the appropriate stance we should take toward the models, theories, and explanations proffered by scientists».[78] In turn, there are closely related methodological implications, concerning the type and range of methods accepted as appropriate to the level of analysis or framework employed. Epistemic pluralism also implies that any given starting point for making knowledge claims is not absolute, that is, it is limited by inherent constraints, by which the vantage point offers a necessarily limited view. A central question seems to concern whether the relationship between alternative models/theories/explanations/methods must be one of competition or whether they may be fruitfully regarded as complementary. Epistemic pluralism suggests complementarity is possible, but such an assumption leaves certain questions unanswered, such as whether alternative frameworks can be sufficiently "commensurable" to enable true complementarity.[79] To this question we will return in relation to cognitive science and its future. First, we consider some of the statements of epistemic pluralism that have appeared in recent decades in psychological literature.

3.2.1 Epistemic pluralism and cognitive science

In cognitive science, the term "explanatory pluralism" is more common than "epistemic pluralism," but the meaning is essentially same:

> [w]e use many theories to understand the universe. This basic idea, often called explanatory pluralism, derives from the diverse levels of organization in the universe, and the equally diverse explanatory goals of human beings.[80]

Like Mitchell, however, we would note that pluralism traditionally includes more than the observation that different humans use different explanations and includes the further assumption that this multiplicity is beneficial in the pursuit of knowledge. For example, a special section of *Theory & Psychology* concerns the relevance of explanatory pluralism to psychology. The editor's introduction presents explanatory pluralism as «an alternative to reduction and eliminativism, on the one hand, and methodological dualism on the other».[81] The key to this alternative is to regard theories as not mere rivals in competition for dominance but as aimed at different levels, different units of analysis of the same complex phenomena. Explanatory pluralism «holds that theories at different levels of description, like psychology and neuroscience, can co-evolve and mutually influence

each other, without the higher-level theory being replaced by, or reduced to, the lower level one».[82] Similarly, McCauley and Bechtel find in explanatory pluralism «a middle ground between the theoretical and ontological parsimoniousness of reductionists, on the one hand, and the metaphysical extravagances of antireductionists, on the other».[83]

Does such a middle ground fit the challenges of cognitive science's history of orthodoxy and dissent and its and contemporary debates and alternative frameworks? Although no longer regarded as the only game in town, reductive approaches to cognitive science continue in a position of some prominence, now more frequently in relation to brain-base processes and neurological explanations. Can one reconcile reductionist approaches with those that foreground context, culture, and temporality? As earlier noted, both insistent individualist and reductionist frameworks[84] and those that oppose computational models[85] seem to find no room for compromise between the extremes. Yet elsewhere one finds positive statements that such reconciliation is possible, both in Mitchell's account and in relation to cognitive science specifically. Mitchell claims that reductive strategies have a place in pluralism as she conceives it. That is, some of the world's causal structures may afford description in terms of reductive accounts and offering such accounts may serve certain purposes to advance knowledge.

For cognitive science, we may draw as an implication from Mitchell's allowance that there is room for reductive models of some mental phenomena, including the conception of "nonderived" cognition, for example, however far removed from the complex, context-sensitive models more fitting to cognition "in the wild".[86] Fabry for example, considers recent predictive processing (PP) accounts (which emphasize «continuous attempt to minimize prediction error»)[87] and seek to limit explanation to internal, neural-based processes at the exclusion of the kinds of processes theorized in 4E approaches (that theorize cognition as cognition is embedded, extended, embodied, and enactive). Obviously the ontological and epistemological assumptions characteristic of internalist and 4E frameworks display radical differences. They entail divergent models for understanding cognition, have radically different theoretical starting points, and invite very different modes of inquiry. But Fabry believes a form of reconciliation is possible through explanatory pluralism, understood as «careful combination of these distinct scientific explanations» to move in the direction of ever more complete models of cognitive phenomena, which in turn increases explanatory potential.[88] Similarly, McCauley regards pluralism as a more comprehensive approach:

> [p]luralism underscores how the sciences integrate information about patterns that systems exhibit not just with that available at lower levels about those systems' parts but also with that at higher levels. Inquiry at those higher levels takes up factors influencing those parts' organization and workings and examines both the settings in which a system may be situated and the various external factors that constrain its shape and inputs.[89]

However, reduction becomes problematic if used exclusively and reflexively, independent of specific goal or for phenomena that do not lend themselves to reductive models. The important question for cognitive science is to determine what aspects of cognition are best suited to reductive models and which are not, relating always to a specific goal rather than as a binding framework imposed on all its phenomena and sanctioning its modes of inquiring.

We note, however, that such complimentary and co-participatory harmony in the name of progress may not be embraced by those who forward reductive strategies, or perhaps by those who oppose them. Can we assume that those who currently forward reductive frameworks will invite relegation to the status of offering a limited, purpose-tied role in explanation of cognitive phenomena? Will concession be made to context in such a way that new models and methods are openly embraced by reductionists? What evidence suggests that this is likely? And if not, is tolerance for reductionistic accounts on the part of those who emphasize complexity likely to be reciprocal, and what are the epistemic consequences if it is not?

Another way of posing the question is that if divergent approaches are complementary, what such complementarity might mean and how it might be achieved. This has not yet been settled within cognitive science; that must remain the task of its future. Mitchell's answer is that it involves overall progress in knowledge, and she favors what she identifies as a pragmatist framework conceptualizing the goal of pluralistic inquiry. A great many implicit assumptions are raised by an appeal to *pragmatism* as a framing for the pluralism most relevant to cognitive science and its future. As one example, classical articulations of pluralism[90] incorporate an emphasis on constraints on knowledge imposed by the limitations of the vantage point or perspective from which one views the world, a vantage point that is impacted by many things including disposition and *values*, both on an individual and collective level. Moreover, an appeal to *progress* requires us to define not only our starting points but also our eventual endpoint, especially when the phenomenon to be understood concerns the nature and functioning of human thought. How is progress to be conceptualized, and what are to be used as markers against which it may be measured?[91] We

cannot address such questions without reference to broader goals and to the values that inflect the very goal of epistemic progress. Therefore, to invoke pragmatism and progress it is also necessary to conceptualize ontological and epistemic pluralism as overlapping with a third form: ethical pluralism.

3.3 Ethical pluralism

Ethical pluralism is the view that there are several valid moral values and, accordingly, several ways to act rightly in the world. For example, Isaiah Berlin claims that «there are many objective ends, ultimate values, some incompatible with others, pursued by different societies at various times, or by different groups in the same society, by entire classes or churches or races, or by particular individuals within them».[92]

Although implicated by explanatory pluralism for the reasons noted, explicit discussions of ethical pluralism relevant to science are not easy to locate. Therefore, we will say less on this form of pluralism than we have said on the others. Even in our analogous study of philosophy of biology we must search a bit for the proper context. Mitchell does not openly extol ethical pluralism but she devotes a chapter to discussion of policy, equates policy and decision making with concern for "how we act in the world" as well as the consequences of actions and the values that guide appraisal of those consequences.[93] The question of "how we act in the world" (or should act) brings us into the realm of ethics; by linking this issue to complexity, by extension we come close to an implication of ethical pluralism. The point is that if we understand our subject matter as ontologically and epistemically pluralistic, there are ethical implications of this view. Thus, Mitchell identifies such a pursuit (policy, understood as relevant to action in the world) as «perhaps the most important way in which an understanding of complexity may revise our thinking about the world».[94] On her account, attunement to ontological complexity requires revisiting standard strategies for policymaking by more centrally encompassing an emphasis on «eliminable risk»,[95] emphasizing the challenges that accompany such an emphasis.

3.3.1 Ethical pluralism and cognitive science

Relevant policy making dilemmas confronting cognitive science may seem more remote than those applying to biology, but this can hardly be the case on closer examination, wherein we recognize cognitive science as involving knowledge production itself, and indirectly its seemingly unbounded set of possible applications. More directly, the overlap of cognitive science with value-laden pursuits such as education and climate science brings a focus on values glaringly into view. That is, the way we understand cognition and cognitive systems and how this knowledge might be applied to policy implicates values. Values are expressed in and through policy, that is. A specific set of values that should structure and limit the applications of cognitive science is beyond the scope of our analysis. We hope only to make clear that ontological and epistemic pluralism ultimately overlap with questions concerning ethical pluralism, and we hope to bring emphasis to the importance of this implication. At a minimum, to acknowledge that the future of cognitive science is pluralistic calls for more open attention to and discussion of value - cultural, moral, personal, and political - in all the ways these impact our understanding and application of the subject matter. We find this to be in keeping with comprehensive recent analyses of the place of values in relation to science and policymaking more generally, such as the excellent work by Heather Douglas.[96] We also consider ethical pluralism in cognitive science to encourage a value of epistemic humility or modesty, given the inherent limitations and constraints on all representations (models and theories) of what may be an infinitely complex world, and thus to be clearer as to the limited aims each model might support.

4 What pluralism is not

After offering our assessment that the future of cognitive science is pluralistic, we endeavored to provide a broad account of what that might entail and imply, that is, to address the question raised in our paper's title, "but what does that mean"? We hope that in so doing, we have added some clarity, but also perhaps underscored that the meaning of pluralism is itself complex, that it is not one thing but many. In the interests of attempting to clarify pluralism's meanings, one final task is to acknowl-edge two things it is not. That is, we briefly discuss two concepts with which pluralism may be conflated.

4.1 Pluralism vs. interdisciplinarity

Cognitive science has always been an interdisciplinary effort, but it has not always been pluralistic. This obviously implies an important difference between the two concepts, which we will attempt to describe here.

As we have seen, interdisciplinarity is a defining feature of cognitive science.[97] In saying that cognitive science was originally interdisciplinary, Gardner's main point was that it involved collaboration and conceptual input from various fields from its earliest stages of development. Yet his analysis of the core features of cognitive science (again, as found in the 1970s), is rather essentializing, highlighting a set of shared ontological and epistemological assumptions upon which the original disciplinary starting points eventually con-

verged. The implication is that the various disciplines contributing to cognitive science, or rather, in his term, "cognitive sciences" – philosophy, linguistics, anthropology, neuroscience, artificial intelligence, and psychology[98] – share the set of core assumptions or features named. Whether or not this assumption holds, we make this point only to note that interdisciplinarity alone is no guarantee of pluralism. Similarly, a single discipline may exhibit ontological and epistemic pluralism without explicitly promoting interdisciplinarity, as Mitchell so powerfully demonstrates for biology, and has been claimed in relation to the discipline of psychology.[99]

In recent years research and theory on interdisciplinarity has exploded, along with the cognates of multidisciplinarity and transdisciplinarity,[100] so ongoing conversation about *both* overlap and distinctions between interdisciplinarity and pluralism gains new significance. This topic is thus too large to analyze in detail here. We only note that pluralism as an ontological and epistemic stance is conceptually distinct from disciplinary practices and configurations, whatever their aims.

4.2 Pluralism vs. relativism

Finally, we must point out, as does Mitchell,[101] that pluralism is properly distinguished from relativism and should not be understood as entailing or requiring relativism. We acknowledge, first, that relativism remains for many a dirty word, yet it has appeared in varied forms historically and with different historical starting points,[102] which complicates any attempt at a universally valid distinction between pluralism and relativism. However, this does not mean that we should not even attempt it.[103] For example, a first cut may be made between a form of relativism that rejects the privilege of *any* vantage point, leading to skeptical conclusions, and a form of relativism based on an assertion that *all* vantage points (and their knowledge claims) are equally valid – "anything goes" or passes as valid knowledge. In this sense, neither of these forms is required or implied by pluralism.[104]

Instead, pluralism underscores the inherently limited nature of all claims to knowledge and a commitment to viewing knowledge as in eternally in progress. As Mitchell emphasizes, the world's complexity does not mean that it cannot be understood in principle, or to greater degrees, or that we lack the tools to understand it in practice.[105] Similarly, it does not imply that one claim to knowledge is no more valid than another. Instead, pluralism entails the much less problematic assumption that our knowledge is necessarily limited, that our models of its nature should be complex, tentative, and qualified, but more optimistically, that our knowledge of the complex world is ever evolving, empowered by multiple methods of inquiry and levels of analysis.

With regards to cognitive science specifically, Colin Alen uses the label "relaxed pluralism" to describe his "stance" toward the field, implicitly drawing a contrast to at least extreme forms of relativism:

> It is pluralistic in the sense that it tolerates different ways of selecting which natural phenomena are appropriate targets for investigation within the science, even when they make incompatible judgments about cases. And while relaxed it is not "lazy" – that is, not just anything goes. Rather, the point is that enquiry should not be stifled by a conservatism about terms and their meanings that insists on stipulating what we are studying before we study it, especially when this conservativism is coupled with an introspectively-based claim to knowledge of the subject of enquiry that is highly resistant to empirical adjustments. Nevertheless, the relaxed but industrious pluralist must offer an explanation for why these apparently incompatible ways of carving up the phenomena do cohere, rather than driving the discipline toward disintegration.[106]

Admittedly, a wide variety of definitions and classifications of both pluralism and relativism add complexity to their relationship and require finer-grained analysis of the stances or arguments defended than we are able to offer here. Our principal point is that facile conflation of pluralism with relativism is problematic.

5 Summary and conclusions

In contemplating the future of cognitive science, we are drawn to consideration of its past. Fritz Heider, assigned the role of discussant for the papers comprising what was framed as the first symposium on cognition in contemporary psychology in 1955,[107] was asked to offer comment on the "whence, what and whither" of cognition:

> The first question – whence? – concerns the history of the problem of cognition; the second – what? – refers to some present orientations toward the problem; and the third – whither – is asked in order to stimulate some considerations about its possible future fate.[108]

Although he offered analysis of the current state of the study of cognition (the "what") and pronounced it in good form, he refrained from making predictions about its future, calling such a task one of «making prophecies».[109]

We have been more willing than was Heider to make prophecies in this paper, in asserting our view that the future of cognitive science is pluralistic. We do so, however, with the benefit of the

"whence", that is, with a view of the historical path from the computational framework as the only robust alternative to a contemporary landscape of alternatives with different ontological and epistemic foundations. In seeing no signs of diminishing appreciation for the complexity of the matter, we see no reason to regard the future as anything but pluralistic in turn.

In addition to making our pronouncement that the "what and whither" is pluralistic, we also used the opportunity of this paper to offer a bit of clarification as to what this might mean. We considered ontological and epistemic pluralisms in turn. Although we acknowledged that explicit discussions of ethical pluralism as relevant to cognitive science are in short supply, we were able to draw implications from analogous discussions of pluralism in other fields, especially philosophy of biology. We hope to be forgiven for preaching that the time for such reflection was seldom more apparent. With this emphasis, the intent of our paper is only to encourage further reflection, not to offer a final word on pluralism or more precisely focused analysis of the future, which remains open.

Notes

[1] H. GARDNER, *The mind's new science*, p. 38.
[2] Note that there are several variations of representational theory positing different relations to that which is represented (e.g., D. PITT, *Mental representation*; N. SHEA, *Representation in cognitive science*; B. VON ECKARDT, *The representational theory of mind*).
[3] H. GARDNER, *The mind's new science*, p. 41.
[4] *Ibid.*, p. 42.
[5] *Ibid.,* p. 43.
[6] H. GARDNER, *The mind's new science*, p. xiii.
[7] Cf. J.A. FODOR, *The language of thought*; A. NEWELL, *Physical symbol systems*; H.A. SIMON, *Studying human intelligence by creating artificial intelligence*.
[8] J.A. FODOR, *The language of thought*, p. 27.
[9] J.A. FODOR, *Methodological solipsism considered as a research strategy in cognitive science*, p. 63.
[10] Cf., e.g. R.P. COOPER, T. SHALLICE, *Cognitive neuroscience*; M.I. POSNER, G.J. DI GIROLAMO, *Cognitive neuroscience: Origins and promise*; D. STANDAGE, T. TRAPPENBERG, *Cognitive neuroscience*.
[11] J.S. BROWN, A. COLLINS, P. DUGUID, *Situated cognition and the culture of learning*, here p. 41.
[12] Cf. J. LAVE, E. WENGER, *Situated learning: Legitimate peripheral participation*.
[13] Cf. E. HUTCHINS, *Cognition in the wild*.
[14] Cf. G. LAKOFF, M. JOHNSON, *Philosophy in the flesh*; F.J. VARELA, E. THOMPSON, E. ROSCH, *The embodied mind: Cognitive science and human experience*.
[15] Cf. C. BAERVELDT, T. VERHEGGEN, *Enactivism*.
[16] Cf. A. CLARK, D. CHALMERS, *The extended mind*.
[17] Cf. F.J. VARELA, *Neurophenomenology: A methodological remedy for the hard problem*.
[18] Cf. J.J. GIBSON, *The ecological approach to visual perception*.
[19] For more detail, cf. L. OSBECK, *Transformations in cognitive science*.
[20] C. BUCKNER, E. FRIDLAND, *What is cognition?*, p. 4191.
[21] Cf. J.J. GIBSON, *The theory of affordances*; J.J. GIBSON, *The ecological approach to visual perception*.
[22] Cf. A. CHEMERO, *An outline of a theory of affordances*; E. COSTA, *Affordances-in-practice: An ethnographic critique of social media logic and context collapse*; R. WITHAGEN, H.J. DE POEL, D. ARAÚJO, G.J. PEPPING, *Affordances can invite behavior: Reconsidering the relationship between affordances and agency*.
[23] For example, a forthcoming edited volume on the topic of ignorance proceeds from an embodied, extended mind framework (S. ARFINI, L. MAGNANI, *Embodied, extended, ignorant minds. New studies on the nature of not-knowing*).
[24] Cf. S. GALLAGHER, *The extended mind: State of the question*.
[25] Cf., e.g., A. CLARK, D. CHALMERS, *The extended mind*; E. HUTCHINS, *Cognition in the wild*; N.J. NERSESSIAN, *Interdisciplinarity in the making: Models and methods in frontier science*.
[26] Cf. M. VILLALOBOS, J. DEWHURST, *Why post-cognitivism does not (necessarily) entail anti-computationalism*.
[27] Cf. M. MAIESE, *Can the mind be embodied, enactive, affective, and extended?*; A. SCARINZI, (2020). *4Es are too many: Why enactive world making does not need the extended mind thesis*.
[28] We should note that the orthodoxy has evolved from the mid-1970s, most notably by incorporation of neuroscience but also to theorize the contribution of the environment. Adams and Aizawa acknowledge these developments yet still seek a principled basis upon which to identify genuinely cognitive phenomena, and to portray the mind as interacting with the environment but not "constituted" by it (cf. F. ADAMS, K. AIZAWa, *The bounds of cognition*).
[29] Cf. F. ADAMS, K. AIZAWA, *The bounds of cognition*; F. ADAMS, K. AIZAWA, *Why the mind is still in the head*; F. ADAMS, K. AIZAWA, *Defending the bounds of cognition*.
[30] F. ADAMS, K. AIZAWA, *The bounds of cognition*, p. ix.
[31] *Ibid*., p. 6.
[32] *Ibid*., p. 32.
[33] *Ibid*., p. 31.
[34] Cf. A. CLARK, *Natural-born cyborgs: Minds, technologies, and the future of human intelligence*; A. CLARK, *Intrinsic content, active memory and the extended mind*; A. CLARK, D. CHALMERS, *The extended mind*; R. MENARY, *Introduction: The extended mind in focus*.
[35] J.G. GREENO, *On claims that answer the wrong questions*, p. 7.
[36] We say "only" in quotation marks because this is a fundamental and transformative difference between the two perspectives.
[37] We could say that recent debates illustrate not only the complexity of the problem, but also the growing disagreements about how to solve it (see, e.g., A. JANSSEN, C. KLEIN, M. SLORS, *What is a cognitive ontology, anyway?*; R. PAIN, *Phenomenology and cognitive neuroscience: Can a process ontology help resolve the impasse?*; C.J. PRICE, K.J. FRISTON, *Functional ontologies for cognition: The systematic definition of structure and function*).
[38] K. MUENZINGER, *Introduction*, p. 1.
[39] E. BRUNSWIK, *Scope and aspects of the cognitive problem*, p. 6.
[40] *Ibid*., p. 30.
[41] C.E. OSGOOD, *Discussion of paper by Egon Brunswick*, p. 33.

[42] H. GARDNER, *The mind's new science*, p. 6.
[43] A. ABRAHAMSEN, W. BECHTEL, *History and core themes*, p. 9.
[44] Cf., e.g., B. DE GELDER, *The cognitivist conjuring trick or how development vanished*; R. MONK, *Cognitivism and cognitive psychology*; A. STILL, A. COSTALL, *Introduction: In place of cognitivism*, pp. 1-11; A. STILL, A. COSTALL (eds.) *Against cognitivism: Alternative foundations for cognitive psychology*.
[45] F. WERTZ, *Cognitive psychology and the understanding of perception*, p. 104.
[46] Cf. J. BRUNER, *Acts of meaning*.
[47] Cf. W. WUNDT, *Erlebtes und Erkanntes*; J. DEWEY, *How we think*; W. JAMES, *The principles of psychology*; M. WERTHEIMER, *Produktives Denken*.
[48] H. GARDNER, *The mind's new science*, p. 42.
[49] *Ibid.*
[50] Cf. A. CLARK, *Intrinsic content, active memory and the extended mind*; A. CLARK, D. CHALMERS, *The extended mind*.
[51] Cf., e.g., R.D. TWENEY, *Faraday's discovery of induction: A cognitive approach*; N.J. NERSESSIAN, *Faraday's field concept*; N.J. NERSESSIAN, *Creating scientific concepts*.
[52] Cf., e.g., J. LAVE, *Cognition in practice: Mind, mathematics, and culture in everyday life*; E. HUTCHINS, *Cognition in the wild*; N.J. NERSESSIAN, *Interpreting scientific and engineering practices: Integrating the cognitive, social, and cultural dimensions*; N.J. NERSESSIAN, *Interdisciplinarity in the making: Models and methods in frontier science*.
[53] J.G. GREENO, *On claims that answer the wrong questions*, p. 6.
[54] Note that a similar conclusion is reached by Allen, though his focus is the problem of narrow conceptions of cognition, and whether a focus on defining cognition is even a worthy project (cf. C. ALLEN, *On (not) defining cognition*).
[55] A more systematic account of pluralism is to be found in S.F. ARAUJO, L.M. OSBECK, *Ever not quite. Pluralism in William James and contemporary psychology*.
[56] Cf., e.g., G.S. KIRK, J.E. RAVEN, M. SCHOFIELD (eds.), *The presocratic philosophers: A critical history with a selection of texts*.
[57] Cf. W. KERBER, *Pluralismus*.
[58] C. WOLFF, *Vernünfftige Gedanken von Gott, der Welt, und der Seele des Menschen*, pp. 19-20 – translation from German by S.A.
[59] I. KANT, *Anthropology from a pragmatic point of view*, p. 241-242.
[60] T.W. KRUG, *Allgemeines Handwörterbuch der philosophischen Wissenschaften*, p. 278.
[61] J. WAHL, *The pluralist philosophies from England and America*, p. 1. It should be noted that Hegel and Hegelianism played a central role in this context, as many of the pluralists' opposers were Hegelians (cf. also W.J. MANDER, *British Idealism: A history*).
[62] Cf., e.g., M. BEVIR (ed.), *Modern pluralism*; C. LABORDE, *Pluralist thought and the State in Britain and France, 1900-1925*; J. WAHL, *The pluralist philosophies from England and America*.
[63] Cf. J.-H. BOEX-BOREL, *Le pluralisme. Essai sur la discontinuité et l'hétérogénéité phénomènes*; W. JAMES, *A pluralistic universe*; P. LANER, *Pluralismus oder Monismus*; J. WARD, *The realm of ends or pluralism and theism*.
[64] For more focused discussion on pluralism's contemporary contexts of use and associated meanings, cf. S.F. ARAUJO, L.M. OSBECK, *Ever not quite. Pluralism in William James and contemporary psychology* (forthcoming).
[65] W. JAMES, *A pluralistic universe*, p. 20. James is perhaps the best-known pluralist in the American tradition. Besides offering a series of lectures on pluralism, he discussed its meanings and implications throughout his work. For a detailed account on James's pluralism, cf. S.F. ARAUJO, L.M. OSBECK, *Ever not quite. Pluralism in William James and contemporary psychology*.
[66] *Ibid.*, p. 145.
[67] It is also possible to develop pluralism as an ontological alternative to dualism and physicalism, as Ludwig claims (cf. D. LUDWIG, *New wave pluralism*).
[68] Cf., e.g., A. JANSSEN, C. KLEIN, M. SLORS, *What is a cognitive ontology, anyway?*; R. PAIN, *Phenomenology and cognitive neuroscience*; C.J. PRICE, K.J. FRISTON, *Functional ontologies for cognition*.
[69] Cf. S.D. MITCHELL, *Unsimple truths*.
[70] *Ibid.*, p. 20.
[71] *Ibid.*, p. 71.
[72] *Ibid.*, p. 122.
[73] *Ibid.*, p. 21.
[74] Cf. F. ADAMS, K. AIZAWA, *The bounds of cognition*.
[75] T. VAN GELDER, R.F. PORT, *Mind as motion*, p. 2.
[76] W. JAMES, *Brute and human intellect*, p. 12.
[77] For different developments of epistemic pluralism and its particularities, cf. A. COLIVA, N.J. LEE, N. PEDERSEN (eds.), *Epistemic pluralism*; S. RUPHY, *Scientific pluralism reconsidered*; N. ZANGWILL, *The missing link and the ambitions of epistemology*.
[78] S.D. MITCHELL, *Unsimple truths*, p. 14.
[79] The issue of the potential incommensurability between epistemic models, as raised by Kuhn and others, is of utmost importance for the establishment of epistemological pluralism in cognitive science (cf., e.g., T. KUHN, *The structure of scientific revolutions*). However, it is beyond our scope in the present paper.
[80] R. DALE, E. DIETRICH, A. CHEMERO, *Explanatory pluralism in cognitive science*, p. 739.
[81] H.L. DE JONG, *Introduction: A symposium on explanatory pluralism*, p. 731.
[82] *Ibidem*.
[83] R.N. MCCAULEY, W. BECHTEL, *Explanatory pluralism and heuristic identity theory*, p. 736.
[84] Cf. F. ADAMS, K. AIZAWA, *The bounds of cognition*.
[85] Cf., e.g., T. VAN GELDER, R.F. PORT, *Mind as motion*.
[86] Cf. E. HUTCHINS, *Cognition in the wild*.
[87] R.E. FABRY, *Transcending the evidentiary boundary*, p. 392.
[88] *Ibid.*, p. 404.
[89] R.N. MCCAULEY, *Time is of the essence*, pp. 613-614.
[90] Cf., e.g., W. JAMES, *A pluralistic universe*.
[91] For an excellent recent discussion of the concept of progress in psychological science, cf. U. FEEST, *Progress in psychology*.
[92] I. BERLIN, *The crooked timber of humanity*, pp. 79-80. Ethical pluralism, however, can develop in different directions with several particularities within each approach (cf., e.g., I. LIU, *Ethical pluralism and the appeal to human nature*; R. MADSEN, T. STRONG (eds.), *The many and the one*; B.C. POSTOW, *Toward honest ethical pluralism*).
[93] S.D. MITCHELL, *Unsimple truths*, p. 85.
[94] *Ibidem*.
[95] *Ibid.*, p. 87.
[96] Cf. H.E. DOUGLAS, *Science, policy, and the value-free*

ideal; H.E. DOUGLAS, *Values in science*.
[97] Cf., e.g., A. ABRAHAMSEN, W. BECHTEL, *History and core themes*; H. GARDNER, *The mind's new science*.
[98] Cf. H. GARDNER, *The mind's new science*, p. 37.
[99] Cf. S.F. ARAUJO, L.M. OSBECK, *Ever not quite. Pluralism in William James and contemporary psychology*; J.R. GOERTZEN, *Dialectical pluralism*.
[100] Cf., e.g., R. FRODEMAN, *Sustainable knowledge*; R. FRODEMAN, *The future of interdisciplinarity*; J.T. KLEIN, *Interdisciplinarity: History, theory, and practice*; J.T. KLEIN, *Typologies of interdisciplinarity*; N.J. NERSESSIAN, *Interdisciplinarity in the making: Models and methods in frontier science*.
[101] Cf. S.D. MITCHELL, *Biological complexity and integrative pluralism*.
[102] Cf. S. HALES (ed.), *A companion to relativism*; R. HARRÉ, M. KRAUSZ, *Varieties of relativism*; M. KUSCH, *Relativism in the philosophy of science*.
[103] For a recent attempt, cf. S.J. VEIGL, *Notes on a complicated relationship*.
[104] Cf. H. CHANG, *Is water H2O? Evidence, realism and pluralism*; S. KELLERT, H. LONGINO, C.K. WATERS, *The pluralist stance*; S.D. MITCHELL, *Biological complexity and integrative pluralism*.
[105] Cf. S.D. MITCHELL, *Biological complexity and integrative pluralism*.
[106] C. ALLEN, *On (not) defining cognition*, p. 4241.
[107] Cf. K. MUENZINGER, *Introduction*.
[108] F. HEIDER, *Trends in cognitive theory*, p. 201.
[109] *Ibid*., p. 209.

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