Learning and AI Tools

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Front Matter

This paper is a work of art and a labor of love.

It is written in my capacity as a learner, an artist, and philosopher of learning.

How people and organizations learn in the 21st century is a topic of primary interest in my life. AI tools, not so much—impressive as they may be. But their prevalence has a bearing on the primary interest, and so this paper became important to write.

First and foremost this paper is a positive proposal about what facts we have good reasons to affirm in consideration of learning, knowing and intelligence. Everything else is gravy.

I hope this paper can be of use to people working on wicked problems of our time. It is clear to me that we need better tools for the problems which confront us as a peoples. Hopefully this paper is a contribution in service of that recognition.

This paper includes a number of easter eggs for longtime visitors of my personal website cameronsow.com. I hope to further validate your accrued interest and curiosity.

I also thought long and hard about the conditions and consequences under which, and for which, scoping of this paper would matter ...both with respect to my contemporaries, and as concerns future generations.

Of course, I can't possibly take myself too seriously; but the work is significant, even should you come to different conclusions than those here noted. And so I hope to have honored the contributions of the people from whom I draw, and to whom I letter.

- Cameron Sow, learning about learning

Acknowledgments:

This paper could not have happened without the love and support of many people, especially my family and friends. They have long known this paper is close to completion. And now here it is. Thank you.

Special Thanks:

The Art Institute of Chicago staff, especially the Ryerson & Burnham Libraries staff, and the curatorial team for Bridget Riley Drawings: From the Artist's Studio; The MCA Staff, especially K and I; H and A; N; anonymous Professor, thank you for encouraging me to write; anonymous Professor, thank you for taking the time; other Professors of note; G; P. T M, thank you... the In Bloom device in Bonanza is straight from y'all ...you rock!; Professor Pavlick, thank you for the thoughtful consideration and taking the time, especially under fairly short notice and rather uncustomary context, I hope to have honored this; B; L; D; Professor Hickman, it is in movement with history and a sensitivity to the immediate that continuity is actualized.

Dedication:

This paper is dedicated to lifelong learners; to all of us who have been and will be substantially harmed by unnecessarily reckless scaling of computational technologies (which, while not inherent to the related fields, is all too common); those working to mitigate such harms, and those working towards more responsible stewardship of new technologies towards a brighter future; every Promethean; Kitty Cat, R.I.P.; the best educator I know, without whom this paper would not have been possible.

Note:

I am not speaking on behalf of any of the organizations I represent in various capacities, but rather as an individual.

Sentence

Learning is a wonder of experience; we should not mistake narrowly operationalized terms of art or conversational designations with bona fide theories of learning, knowing or intelligence.

Paragraph

Learning is an everyday human behavior. Sensitivity, perception, and affect are characteristic of learning in humans. We have good reasons for hypothesizing that these traits are among those distinguishing knowing and intelligence. AI tools do not literally learn, know, nor demonstrate intelligence. Treating AI tools as if they do hazards mistaken inference about their use and capabilities. We have to deal with the effects of AI tools in any case. Let us do so from a sound experimentally verifiable theoretic position.

Dear reader,

This paper covers fairly complex subject-matters. I have endeavored to do so with clarity and simplicity where feasible. I have aimed as much as possible to make this paper accessible to curious learners who are not expertised in the fields under consideration while still meeting the requisite constraints to formidably address primary intended audiences.

This paper speaks in modest degree to some of the (historically) most challenging philosophic questions around. Considerations of scope were important across development of this paper. Context has not allowed that I elaborate every point of consideration. In general, the complexity of subject-matter increases as the paper progresses. Should you find yourself adrift, skip the section of challenge. I have made some unconventional stylistic choices and taken some liberties with literary devices. I anticipate that some readers may not much require extensive engagement with the footnotes. If they are a distraction, skip them.

Some readers may find it helpful to read the paper in four or five sections. The first about theory of learning (p. 7-16), the second about AI tools generally (p. 16-21), the third considering specific examples of AI tools disciplinary research (p. 21-30), the fourth noting some challenges ahead (p. 30-38) and then closing remarks (p. 38-40).

Hopefully this paper is helpful to you, even if you come to different conclusions.

- Cameron

Glossary:

- **Sensitivity** - selective discrimination of an organized environment (Dewey, 1925, esp. Ch. VII, 1934, esp. Ch 2, esp. **p. 22,** 1939, esp. Ch II; Johnson & Schulkin, 2023, esp. 3, 4)

- **Perception** - evolutionary transformation of organized behavior in anticipatory manipulation of environing conditions (Dewey, 1925, 1939; Dewey & Bentley, 1946; Chirimuuta, 2017)

- **Affect** - "the general sense of feeling that you experience throughout each day"; scientifically characterized by valence and arousal (Barrett, 2018, p. 72-77, Lisa Feldman Barrett, 2023)

- **Learning** - participatory modification of organized behavior (Dewey, 1925, esp. Ch. VII, 1939, esp. Ch II; Johnson & Schulkin, 2023, esp. Ch. 4; Barrett in HT-fakulteterna vid Lunds universitet, 2024, esp. 25:45-37:57)

- **Knowing** - signifying consequences of events as successfully employed in problem solving behavior (Dewey, 1916, esp. p. 14-16, 1925, esp. Ch. IV, VII, VIII, X, 1929, esp. Ch. VIII, 1939, esp. Ch. I; Johnson & Schulkin, 2023, esp. Ch. 1, 6)

- **Intelligence** - operationally employing foresight of the consequences of events as means of successful problem solving behavior (Dewey, 1922, 1925, esp. Ch. IV, IX, X, 1929, esp. Ch. VIII, 1939; Bohm, 1996, Ch. 3, 4)

Learning about this world is a wonder.

In our everyday experience of learning we know it be involved with our perception of the world as it, and we, are changing. Our bodies are integral to how we learn about the world. And not just our familiar senses; from our heart-rate and breathing, to hunger and thirst, environmental and bodily conditions are involved when we learn.

To illustrate an idea, I ask that you think of something you have been learning about recently.

…Next, think about something you learned a long time ago. Take a moment to imagine what learning has been like in these respective experiences. Notice what you remember, sense, and feel. Keep these experiences in mind as we consider the following…

It is in vogue to treat terms associated with organismic behaviors, terms like “learning”, “knowing”, “intelligence” as if they should be applied literally to account for capabilities of today’s *AI tools*[1]**.** This paper argues that in the case of humans[2], *sensitivity*, *perception*, and *affect*[3] **(**S,P,A**)**, are characteristic of *learning*, *knowing* and *intelligence* (L,K,I[4])(see: Glossary).

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[1] For purposes of this paper, *AI tools* designates current computational techniques commonly referred to by engineers as constituting Artificial Intelligence—primarily those covered by machine learning, deep learning and a family of technologies undergirding generative models. This seems to me close to the received and vernacular use, while being amenable to further specification in subsequent inquiry. Greater specificity for “computational” required for subsequent inquiry, but taken as adequate for present use. For those especially concerned about this point I will note that the use of “computations” in (Penrose, 2000, esp. Ch. 3) has been useful for purposes of reasoning in present consideration, but I will reserve further comment until a later time. Some limitations of the arguments in Penrose (1994, 2000) are noted below.

[2] This paper mostly limits inquiry to human traits, with some relevant exceptions. This is in part a recognition that prominent in discourse about AI tools is an express avowal to (aspirationally) match or exceed "human level intelligence”, ex. “AI systems that are generally smarter than humans”, whatever these statements may be taken to mean (Columbia Engineering, 2024, 9:04; OpenAI, 2024; see related: Chirimuuta, 2024, Ch. 9).

[3] If the reader is not familiar with the term “affect”, subsequently designated, as employed in current cognitive science and related discourse, the term “feeling" should suffice for present purposes; though this is not to suggest that they are equivalent. The term “feeling” has been avoided as a linguistic safeguard against dramatically different interpretations of that term as it has evolved in human history (Dewey, 1925 Ch. VII, 1939). While Damasio (2019) employs the terms “affect” and “feeling” (esp. p.100-101) to useful effect in *The Strange Order of Things*, it is primarily the body of work represented by Barrett (2018) and colleagues of which this paper chiefly makes use (see also: Lisa Feldman Barrett, 2023). Use of the term “feeling” in Godfrey-Smith (2023) *Whitehead Lectures* may be useful for subsequent inquiries, particularly those regarding non-human organisms.

[4] S,P,A·L,K,I is used to indicate reference respectively, collectively (see: footnote 8)

They are generic traits verifiable upon empirical[5] study. Significantly, we have early cross-disciplinary understandings about when, how, and why they are involved in L,K,I under what conditions, and to what effects.

We have better reasons for hypothesizing that sensitivity, perception, and affect are among the distinguishing characteristics of knowing, and intelligence than for supposing they are irrelevant[6]. We should keep an open mind about whether these traits are in time established to be among the distinguishing traits of K,I. And surely their study scientifically and philosophically will evolve[7]. But for now, S,P,A are taken as facts relevant to L,K,I which call for substantive account (Dewey, 1916, p. 221); we have good reasons for hypothesizing that they are necessary —even if insufficient—for a fully formulated theory of K,I in humans. We should at least be skeptical of designations of "learning", "knowing", and "intelligence"[8] that do not substantively account for the behavioral traits of S,P,A.

This paper argues that as of today when we are using such terms as "S,P,A·L,K,I" in description of AI tools they are being used for narrowly operationalized (technical) purposes or

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[5] "Empirical", as with so many terms employed in study of complex topics like learning, has a fraught history. I mean the term in the sense described in Dewey (1939)— which notes a deeper insight behind the "ambiguity" of the term in its historical context —as that context provided in inquiry by "controlled observational operations. In this sense it is opposed to the *merely* ideational or *merely* theoretical" (emphasis in original) (p. 304-305; see also: related note regarding "*theoretical",* emphasis in original, p. 305; see also: footnote regarding "operational", p. 14).

[6] Greater nuance is required for consideration of the potential role of affect in learning across the evolutionary range of organisms. This paper leaves the matter open for now. Sensitivity and perception are taken as candidate distinguishing traits of learning, S,P,A are taken as candidates for knowing, and intelligence. For relevant ideas about "gradualism" stemming from earlier (pragmatic) uses of "continuity" see (Godfrey-Smith, 2023, p. 1-3; Johnson, 2006). The role of excaptation will be important for subsequent inquiry but is simply here acknowledged as relevant to present concerns (Johnson & Schulkin, 2023).

[7] It is not here suggested that scientific study and philosophy are separate realms, rather a distinction is made between different forms of inquiry respectively suited for different requirements (Dewey, 1925, 1939). Likewise as respects scientific and common-sense inquiry, where a distinction is made between different purposes of inquiry (Dewey, 1939, Ch. IV). The distinction between science and philosophy noted at top of this footnote is nearly consistent with views expressed across Chirimuuta (2024). (See also: exposition of philosophy in Dewey, 1925, Ch. I, X) The term *inquiry* is used subsequently to cover both endeavors and more (Dewey, 1939, p.104-105). (See also: Godfrey-Smith, 2023 for terminological considerations related to how inquiry changes over time)

[8] In general, italics and quotation marks are used in their customary capacity. Terms that are italicized in quotes indicate designations directly in question.

figuratively[9]. Applying terms like "*learning*", "*knowing*", and "*intelligence*", literally to describe AI tools hazards making mistaken inferences[10] about their capabilities and use. This conclusion follows from the recognition that figurative or narrowly operationalized usages of "S,P,A·L,K,I" designate dramatically different conditions than do warranted literal applications of S,P,A·L,K,I.

It is important to ask: What is meant by "sensitivity", "perception", and "affect"? What is meant by "learning", "knowing" and "intelligence"? To answer these questions we must first consider a few preliminaries (see similar: Chirimuuta, 2024, Ch. 6). There are significant methodological challenges concerning exactly which designations we employ in consideration of S,P,A·L,K,I in humans. These methodological issues have a bearing on the subsequent claims we are warranted to make upon their study (Cartwright, 2016; Cartwright et al., 2016). Each of these terms may be important to distinguish from one another for purposes of inquiry (Dewey, 1925; Barrett, 2018; Barrett in HT-fakulteterna vid Lunds universitet [HTFLU], 2024). And yet we know that when it comes to humans, behavioral activities are profoundly intertwined. This is especially so regarding sensitivity, perception, and affect, particularly as they factor into L,K,I. Organisms like humans are complex, as are the conditions of their occurrence and consequences of their activities.

There are practical limits of studying any sufficiently complex activities where conditions may be difficult to control or notice (Dewey, 1925, Ch. VII, 1939, Ch. XXIV; Chirimuuta, 2024). There are limits to the scientific instruments and methods we use whether fMRI, subjective reports, or otherwise (Lisa Feldman Barrett, 2023, 1:27:28). There are serious concerns about the generalizability of designations employed in particular inquires (Cartwright et al., 2016; Dewey, 1939). What designations of "S,P,A" we go with matter, especially as they are used to support more general claims about L,K,I (Cartwright, 2016). For such tasks though, it is imperative that we acknowledge the limits of science and the indispensability of philosophy (Chirimuuta, 2024; Dewey, 1925). Science relies on ardent simplification, especially in face of the torrent of complexity presented by organisms and culture (Dewey, 1929). We also recognize that philosophic stances underly employments of terms like "perception" (Chirimuuta, 2017; Lagerspetz, 2008) and scientific approaches more generally (Bateson et al., 2017).

Technical specifications of terms like "S,P,A·L,K,I" are essential to scientific study (Cartwright et al., 2016; Chirimuuta, 2024; Dewey, 1929, 1939; Dewey & Bentley, 1946). But they may be of limited or even detrimental use in more general inquiries about organisms and their abilities, such general inquires as are known to philosophy (Chirimuuta, 2024; Dewey,

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[9] There are non-trivial linguistic and philosophic considerations in how this paper employs the terms "literal" and "figurative" (especially pertaining to the nature of denotation, and to distinctions between requirements of common-sense and scientific inquiry, in the context of broader logical theory and philosophy of science) that are out of present scope (Dewey, 1939, Pt. III, esp. XVIII). The respective terms have been selected with readability in mind, and in recognition that their use in engagement of the here noted issues is adequate for present purposes. (See: Chirimuuta, 2024, esp. Ch. 2 for engagement with some of the related concerns)

[10] "Inference", "reasoning", and "concepts" will have to be taken up on another occasion. For purposes of this paper it may be fine for the reader to employ their ordinary understanding of these terms.

1925, 1939). Of course, all inquiry relies to some degree on simplification. Science, however, relies on simplification of a special order under strict conditions of inquiry, while the crush of factors relevant to human affairs elude even our most sophisticated scientific regimes (Chirimuuta, 2024, esp. p. 305-307; Dewey, 1925, Ch. I, 1929). The history of inquiry is a warning against taking scientific terms wholesale in application beyond their appropriate scientific settings (Dewey, 1925, 1939; Poincaré, 1907). We may, however, judiciously use scientific specifications as a guide for further and general inquiry to the extent that they are relevant and warranted; that is, useful and borne out in theoretical consideration and wider practical application (Dewey, 1925, 1939). We should be aware of the choices we make in distinguishing subject-matters for study, the conditions of the latter's occurrence, and the purposes and consequences involved (Chirimuuta, 2024, Dewey, 1925). What we seek is a "this-world philosophy" (Johnson, 2006, Reichenbach, 1923, p. 159), that is, as Barrett describes in Center for Mind and Cognition (2024, 1:08:16), "principled", in accord with our best available methods of inquiry—scientific and technological included.

How shall we know the real McCoy[11]? As noted in Dewey (1939) and Hickman (2007), formal consistency is not enough. Nor even are merely productive results of research. We are concerned with verification across problem solving. We use our theories to guide our observational and experimental activities in the world so that we might find out if they properly attend to the solution of particular challenges. Our observations and experiments in inquiry are done in view of conditions and their consequences. Done comprehensively to the full merit of scientific productivity and rigor we rule out alternative explanations, systematically affording better reliability of our practices applied in the world through "successful predictions and interventions" (Cartwright, 2016, 2.; Dewey, 1939). But our work is never over; new horizons abound, indicating the possibility of perpetual discovery and new circumstance (Dewey, 1939; Pillsbury, 1957).

In the context of this paper, well established results from bodies of scientific work spanning a range of fields is employed in conjunction with tried and true philosophic methods to render a set of designations of S,P,A·L,K,I that can successfully guide further inquiry[12]. A note however that such designations are somewhat under, as opposed to over-specified, while still meeting criteria of requisite logical specificity, and theoretical accuracy. This strategy is a recognition of the nascency of our broader understanding of the subject-matters under consideration. It is an acknowledgment of the limitations of our tools and methods of study. It indicates a preference for humility, affirmation of fallibility, and striving for defeasibility (Cartwright & Ray, 2023; Cartwright et al., 2016; Chirimuuta, 2024)[13]. This way of inquiry is expressly meant to contrast with the tendency of some inquires into "*L,K,I*" to emphasize

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[11] I found this apt phrase in Cleland (2004).

[12] Effort has been made to rely on minimally scoped citation, with judicious attention paid to citation of work that can, upon further inquiry, be corroborated by bodies of established knowledge and that are broadly in accord with present designative construals. Some limitations of this strategy have been noted above and some are noted below.

[13] The aim is refine-able method and accuracy in lieu of available precision—except where the latter is available and prudent. Notice the use of "affect".

technically precise and mathematically stringent operationalizations as if to suggest, even implicitly, an argument in favor on their generalizability, relevance or wider acceptance (as opposed to narrow utility). In cases of exceedingly complex processes like those of organismic, especially human activities in social-cultural contexts, such efforts risk the usual perils of "'precisificaiton'"(Cartwright, 2016, 2.), and those of—bullishly stated—being "precisely wrong" (Taleb, 2010, p. 284-285); no small matter when such designations are employed to intervene in complex social domains.

We return to answer the earlier questions: "What is meant by 'S,P,A·L,K,I'?". Here offered is a tentative set of designations that accord to the extent relevant with well established inquiries, in acknowledgement of their respective limitations and need for further explication. The designations here employed are submitted as experimentally verifiable, theoretically extensive and potentially extensible (Dewey, 1939)[14]. The proposed designations are general and non-arbitrary with respect to the human case and poised to point in fruitful directions regarding organisms generally.

Sensitivity distinguishes organisms, in this case humans, as of an environment, connecting their activities to conditions therein; it is here designated as selective discrimination of an organized environment (Dewey, 1925, esp. Ch. VII, 1934, esp. Ch 2, esp. **p. 22,** 1939, esp. Ch II; Johnson & Schulkin, 2023, esp. 3, 4; see: Glossary). *Perception* occurs as behavior is transformed in anticipatory manipulation of environing conditions (Dewey, 1925, 1939; Dewey & Bentley, 1946; Chirimuuta, 2017; see: Glossary). Our behavior changes in fulfillment of organized activities and in so doing changes the world in our efforts to solve the problems of living. *Affect* is our processing of how we are doing moment to moment across time, guiding our behavior in fulfillment of allostatic imperatives and homeostatic constraints; it is characterized scientifically by valence and arousal (Barrett, 2018, p. 72-77, Lisa Feldman Barrett, 2023; see: Glossary)[15].

Everyday examples can help illustrate the practical relevance of S,P,A in L,K,I, prior to designation of the latter terms. We can then consider relevant scientific results in the context of broader philosophic inquiry.

Our first example is learning to ride a bike. Seeking to learn how to ride a bike presents a challenge. We use our sensory abilities, vestibular system, vision, among others, to help us in our

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[14] As noted earlier, these behavioral traits are interconnected across experience. They may profitably be considered as phases or aspects of broader ongoings (Dewey & Bentley, 1946). We may, for different purposes, emphasis one or more of these aspects while holding in mind their extensive interconnections concurrent with broader life activities (Dewey, 1925, 1939; compare: HTFLU, 2024, 54:37, see also: Barrett, 2018). In consideration of scientific study, it *may* be helpful to point to the relevance of complementarity as used in physics, or consideration of "*Ballung* concepts" (emphasis in original) as presented in Cartwright (2016) and Cartwright et al. (2016), though either held loosely in mind at present.

[15] Choosing to employ Barrett and co's version of affect is intentional. To watch alternative views debated see Lisa Feldman Barrett (2023). "Valence" and "arousal" are not here elaborated but are explained in Barrett (2018). (see: earlier recognition that terms will change as study evolves, related to considerations of footnote 6, 7; Godfrey Smith's (2023) consideration of terminological issues and their evolution, presented across the *Whitehead Lectures*, may also be of use in further inquiry.

sensory-motor coordination as we try to ride. We are able to perceive potential obstacles, our transit across time and space, along with the sense of getting the hang of it. As a course of action, we feel the experience of riding the bike, as we affectionally process how things are going; potentially of aid in determining whether riding a bike is an activity for continued participation.

Our next example is wondering what time it is in the context of someone curious if it is yet lunch time[16]. There is an existing problematic situation: a need to answer the question "is it time for lunch?". There is a felt doubt, as inquiry into the matter initiates (Dewey, 1939). We maybe check the position of the sun or the digits of our wristwatch. These actions require both sensory(-motor) and perceptual abilities. We see that the sun or a shadow is in the right place and that the clock counts noon. We thus come to *know* what time it is, where first it was doubtful, achieving the objective of present inquiry (Dewey, 1916, p. 14-16, 1939, Ch. I). If we act on this knowledge to ensure we are not too full for dinner, it will likely serve us well (Dewey, 1925). Affect is here noted as a context of ordinary behavior, relevant in determination of hunger (Barrett, 2018).

Regarding intelligence, Harriet Tubman made her way from the Confederate South to northward emancipation. She relied upon her faith and intelligence to assist others in doing the same, in full recognition of the consequences of failure (Ringgold, 1930; Miles, 2024). She relied upon her sense of direction, perception of changing circumstances and potential threats, and affectional experience in ongoing determination of resolve. She drew on her previous experiences in foresight of the consequences of her actions, aware of potential risks and possibilities of success. She successfully adapted to changing conditions across her journeys, which involved demanding sensory-motor activities. She acted on her foresight in collaboration with others towards favorable ends, freeing slaves from the South, pointing a way for others, famously, with aid of the North Star and a noted affinity for the natural world.

These examples do not serve as rigorous scientific accounts. They rather point in a somewhat schematic way (Hildebrand, 2024) to the firmly empirical basis of hypothesizing the relevance of S,P,A in L,K,I in humans. While in some sense artifactual, these illustrations are not arbitrary; they offer "public, observable, verifiable" samples (Dewey, 1929, p. 228-229). They emanate from human behaviors in the world and are amenable to further inquiry in the world as "test and verification" (Dewey, 1939, p. 418). In any case, the theory that S,P,A are crucially relevant to L,K,I accords at early approximation with findings in learning sciences, cognitive science, evolutionary biology, and logical theory, at least[17]. The patchwork of fields corroborating the relevance of S,P,A in L,K,I lends to the suggestion that the theory is not arbitrary[18]. As we shall see, the hypotheses therin can be successfully employed in showing the limitations of alternative accounts. Of course, there is work to be done and open questions concerning generalizability beyond the human example, but we are indeed able to start

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[16] Adapted from transit example in Dewey (1910)

[17] I suspect many educators and artists view the facts covered by the theory as commonplace, especially were "affect" to be preliminarily substituted with the term "feeling" as considered in footnote 3. (see also: footnotes 6 & 7)

[18] (see: Cartwright, 1994; 2015; 2021)

somewhere informed and potentially extensible[19]. First, let us consider S,P,A's role in *learning***,** taken here as participatory modification of organized behavior[20] (Dewey, 1925, esp.Ch. VII, 1939, esp. Ch II; Johnson & Schulkin, 2023, esp. Ch. 4; Barrett in HT-fakulteterna vid Lunds universitet, 2024, esp. 25:45-37:57; see: Glossary).

Sensitivity supplies the context of organized activities in our environment. Our sensory abilities connect our activities with conditions of a changing environment in which we subsist (Dewey, 1925, Ch. VII, 1939; Damasio, 2019). Our sensory organs are important. Senses enable us to learn what is going on in our immediate surrounds and across spatial and temporal distance. We may see the world around us, hear the sounds of the city, or smell the scent of a candle. Scientific study suggests that to significant degree sensory abilities coevolve. We also know that our ancestors' experiences are relevant to our current learnings, conditioning behavior in the broadest sense, and are amenable to scientific study as such (Eagleman, 2006). Our senses guide habits of motor activity when we are learning how to survive amidst changing conditions (Dewey, 1925 p. 280-282, 1939; Johnson & Schulkin, 2023). Senses allow us to respond *with* various changing conditions of the environment. As conditions change we can change, and sometimes we overtly perceive those changes, and may thereby be able to direct them (Dewey, 1925, 1939; Dewey & Bentley, 1946). In line with the organism/environment context of our senses, perception is recognized to be "an action-guiding interaction between perceiver and environment" (Chirimuuta, 2017, p. 7-8), suggesting its relevance in sensory-motor activities involved in learning. Perception is recognized to be "interest relative", a nod to its involvement in fundamental evolutionarily shaped activities as in "finding food, avoiding predators, etc" (Chirimuuta, 2017, 7-8; Dewey, 1925, 1939). Scientific study has suggested the important role of our senses and perception in temporal order judgments and determination of causality (Eagleman 2005, 2008). In learning the causes of activity in the world we use our senses, as when we learn that pressing a button on a toaster can help us make toast (Dewey, 1925, 1939; Johnson &

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[19] Subsequent examples from scientific and philosophic literature are not taken as established to be straightforwardly interchangeable with the designations of S,P,A·L,K,I employed in this paper. Rather they are employed as informative and suggestive in ways that are relevant and broadly in accord, whether supportive of, or consistent with present inquiry (Lisa Feldman Barrett, 2023, 1:28:19). I take seriously caution from Chirimuuta (2024) that "Philosophical views about the mind should not be read off from the science of the brain […]" (p. 3), similar caution in Dewey (1925, Ch. I, 1939), and warning in Cartwright (2016) about "inference by pun" (p. 2) noted below. All entries taken as amenable to further inquiry and requisite further configuration or engagement. Complete exposition would require volumes, new tools, better methods and updated experimental work—some of which we will have to create—here we have a start (see: earlier methodological notes). Chirimuuta's (2024) encouragement around developing new strategies towards naturalistic accounts of the subject-matters under present consideration was a partial inspiration (and warning) for this section (p. 33).

[20] Disciplinary scientists are better positioned to speak to disjunctive results and negative cases found upon experimental variation of conditions, to the effect that damage (etc.) to systems crucial to S,P,A respectively have bearing upon L,K,I, likewise as regards their prevalence or not in other organisms. (See also: previous footnotes 6 & 7 about gradualism, and related footnote 15)

Schulkin, 2023)[21]. Scientific study indicates that time perception is "'metasensory'" (Eagleman, 2009, p.2), and yet both ordinary experience and scientific study suggest the importance of time perception to learning (Eagleman, 2008). Scientific study corroborates our recognition that perception and affect underly ordinary behavior in the world, including learning (Barrett, 2017, 2018; Barrett & Bliss-Moreau, 2009; HTFLU, 2024). As organisms aiming to survive within constraints on how we go about so doing, allostasis involved in affect operates as part of broader anticipatory behaviors (Barrett, 2017). We notice, for instance, that learning on an empty stomach has its challenges. Affect suffuses and conditions our behaviors in the world while our ongoing behavior shapes our senses, perception, and affect in turn (Barrett, 2017; HTFLU, 2024; Dewey 1925, 1939).

We will next consider the importance of S,P,A in *knowing*, signifying consequences of events as successfully employed in problem solving behavior (Dewey, 1916, esp. p. 14-16, 1925 esp. Ch. IV, VII, VIII, X, 1929, esp. Ch. VIII, 1939, esp. Ch. I; Johnson & Schulkin, 2023, esp. Ch. 1, 6; see: Glossary). As noted in Erikson (1988), "all knowledge begins with sensory experience" (p. 25). Senses play an important role in filtering incoming information from the "blooming, buzzing, […]" (James, 1911, p. 50) environment, as noted by Barrett in HTFLU (2024), and Prete (2004) as cited in Chirimuuta (2017), and they do so across human development. Senses guide our selection and discrimination of what there is to know in the first place (Dewey, 1925, 1939). They help supply perception with subject-matters of our experience which come to be known in the process of inquiry (HTFLU, 2024; Dewey, 1925, Ch. VII, VIII; Johnson & Schulkin, 2023). Perception helps us process sensory experiences into knowable information, especially when we are unsure in the face of a problem (Dewey, 1925, Ch. VII & VIII). We recognize that "perceptual systems do not give a uniquely true description of the world" (Chirimuuta, 2017, p. 7-8), so to find out what is the case in situations of doubt, we employ broader sensory-motor activities to resolve uncertainty, as in coming to know if that loud sound was a shut window or a door slam (Dewey, 1905, 1916; HTFLU, 2024). When we come to know a thing in tentative verification through successful behavior upon its signification, we feel its effects in aiding our aims (Dewey, 1925, 1939). These aims are entwined with our broader life activities, especially allostatic imperatives involved in affect (Barrett & Bliss-Moreau, 2009; Dewey, 1925; Johnson & Schulkin, 2023). The earlier lunch time example, for instance. Scientific study indicates that abstract conceptual knowledge is reliant upon senses, perception and affect (Barrett, 2017; HTFLU, 2024; Johnson, 2006; Johnson & Schulkin, 2023; Vygotsky, 1962), as do naturalistic accounts from logical theory (Dewey, 1939). Affect is involved with sensitivity and perception in everyday life behavior, including knowing (Barret, 2017, 2018; Johnson & Schulkin, 2023). We recognize that the sense of a thing precedes an ability for its signification (Dewey, 1925) and that "a problem must be felt, before it can be stated" (Dewey, 1939, p. 70), important contexts of knowing. Once a problem is solved, leading to the objective of particular knowings (Dewey, 1916), this process, and its consequences will effect how the organism is doing in their environment, and condition subsequent behavior (Dewey, 1916, 1939; Barrett, 2017; HTFLU, 2024).

[21] Mostly a perfunctory nod to Cartwright (2009)

Finally, let us consider S,P,A in *intelligence*, operationally employing foresight of the consequences of events as means of successful problem solving behavior (Dewey, 1922, 1925, esp. Ch. IV, IX, X, 1929, esp. Ch. VIII, 1939; Bohm, 1996, Ch. 3, 4; see: Glossary). As illustrated in the earlier example, intelligence is about sensitive interpretation of the world (ourselves included) as a guide for successful behavior[22] (Bohm, 1996; Dewey, 1925, Ch. VII; Johnson & Schulkin, 2023, p. 120). As with learning, and knowing, sensory experience, and perceptually guided outcomes of previous activity, set the context of present behavior (Barrett, 2017; Dewey, 1925, 1939; HTFLU, 2024). Intelligence, particularly with the aide of concepts, involves survey of previous and current behavior to solve present or anticipated problems of various sorts (Barrett, 2017; HTFLU, 2024; Dewey, 1925; James, 1911). Intelligence is about using foresight of when or how, and sometimes why events occur to intervene favorably in the world (Bohm, 1996; Dewey, 1922, 1925; Cartwright & Ray, 2023). Activity in the world is incumbent for realization of intelligence (Dewey, 1925, Ch. IV, 1929, 1939), and such intelligent behaviors involve sensory-motor abilities. Sensory-motor and perceptual abilities are crucial to our intelligence, particularly as we observe and experiment in intervention of the world's ongoings, whether in a lab or trying a new hobby (Dewey, 1916, 1929, 1939; Johnson & Schulkin, 2023). Discerning sensitivity is characteristic of intelligent problem solving, needed for noting important differences in subject-matters previously considered indiscriminately (Bohm, 1996; Dewey, 1925, 1939). Perception guides our noting of changes thus discriminated such that we might use their fruits in subsequent activity (Barrett, 2017; Bohm, 1996; Dewey, 1925, 1939). Perception allows us to distinguish aspects of our knowing behaviors as to matters of preferred course of (intelligent) action (Barrett, 2017; Chirimuuta, 2017, Dewey, 1925, 1939). Sense-perception is involved in affect during intelligent activity, as suggested by the "interest relative", "action guiding"(Chirimuuta, 2017, p. 7) aspects of perception previously noted (Barrett, 2017; Dewey, 1925, 1939). Solving the problems of life requires us to move forward and backward in time, so to speak, drawing from memory and anticipating future consequences to play out sequences of events in anticipation of their possibly happening, or in determination of a previously occurring series of events (Buonomano, 2017; HTFLU, 2024; Damasio, 2019; Dewey, 1939; Erikson, 1988; James, 1911; Johnson & Schulkin, 2023). As noted earlier, scientific study suggests that time perception is important to how we deal with time across activities involved in intelligent behavior (Eagleman, 2005, 2008, 2009). Scientific study suggests that foresight (especially as concerns affect), involves "interoceptive consequences" (Barrett, 2018, p. 182, 282) of our environmentally contextualized activities (Barrett, 2017; Damasio, 2019; Dewey, 1925, 1939; Johnson, 2006; Johnson & Schulkin, 2023). Affect shapes what we sense and perceive, what we perceive and sense affects affect in turn, and each together how we reason about events (Barrett, 2017, 2018; HTFLU, 2024). Affect is thus essential to how we make inferences and trace implications of our concepts employed in the world through intelligent behavior (Barrett, 2017, 2018; HTFLU, 2024; Dewey, 1925, 1939). This is the crux of

[22] Ubiquitous across discussions of creativity and intelligence by artists and scientists from Einstein, to Rubin, and Cleese, to Riley and Gauss …and many more are various recognitions of the respective roles of sensitivity, perception, and feeling (see: Appendix).

learning general and more refined practices of intelligence—especially the tools and methods of scientific inquiry (Dewey, 1939).

We have now seen how in everyday examples, and with judicious appeal to insights and findings across various disciplinary inquiries, we have good reasons for theorizing that S,P,A are integral to L,K,I in humans. Significantly these hypothesized distinguishing characteristics are drawn from empirically accessible examples of L,K,I.[23]

What contemporary AI tools do is significantly different from organismic, especially human, learning, knowing and intelligence. AI tools work under substantially different conditions than do humans, and to different effects. AI tools are engineered in-some-sense-mimetic devices that when considered at a substantial degree of abstraction aim to approximate abilities taken to be commonly associated with L,K,I (Chirimuuta, 2024). They are advanced tools, but tools nonetheless.

AI tools are reliant at virtually every phase of development and deployment on intensive human intervention, and even then, they falter in ways consistent with theory under present consideration (Chirimuuta, 2023; Karpathy, 2023; Machine Learning Street Talk, 2024; Mitchell & Phoboo, 2024). Exactly the areas where modern AI tools are shown to be lacking are those which most notably rely upon traits of distinction exemplified in L,K,I as evidenced in humans (and other organisms)—in the *bona fide* cases; namely, S,P,A. Concerning popular discourse about AI tools, exactly where qualification, hedging or oscillation between faulty literal usage or recognized figurative language occurs is where these distinctions are most pronounced.

AI tools do not exhibit evolutionarily[24] shaped organization. AI tools are not constituted as an organized whole in which organs function in growth of an organism in an environment (Dewey, 1939). AI tools do not selectively discriminate conditions of an environment with respect to continuation of evolutionary organization in relation to changing conditions (Dewey, 1925). AI tools do not literally have sensitivity, they do not literally have senses[25]. They have

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[23] In line with recognition across this paper and footnote 20 above, further work is needed to consider other organismic examples, and other ostensibly challenging cases of concern. Further work is also needed regarding studies considering damage to, preclusion of, etc of S,P,A under variation of experimental conditions, and relevant corroboration. Such engagement has been here limited primarily in consideration of scope, sensitivity of subject-matter (i.e., damage to S,P,A systems respectively, historically contextualized psychiatric or psychological subject-matters, etc.), and in recognition of the prudential value of more seasoned expertise—not due to unavailability of substantial inquiry into such matters per se. Let us see what the relevant disciplinary research can bring to bear, and follow-up. Some of the pertinent disjunctive work is implicit in the studies cited, and bodies of work referenced, though a more thoroughgoing treatment is required for subsequent inquiry. Comparable to points made in Godfrey-Smith (2023), there is anticipation that more refined terms will be required for other organismic examples and potentially challenging cases of consideration for S,P,A·L,K,I. (see: footnote 15)

[24] Further consideration of “evolutionary”, “organization”, “environment” and “behavior” requisite for subsequent inquiry, current usage considered sufficient for present purposes. See: Wong et al. (2023) for anticipated concerns (see: footnote 28 below on “experience” and “behavior”, and “environment”).

[25] Similar contrast drawn in Chirimuuta (2023)

sense-inspired capabilities; are conceived as bio-mimetic in specifiable respects (Chirimuuta, 2024, p. 241), and are consistent with "sensory" and "perceptual" appliances in robotics and other fields of engineering. These are terms of art. They cover substantially different facts than do the terms we use in consideration of humans and other organisms. For purposes of disciplinary study such terms are somtimes assumed as interchangeable with their bona fide counterparts independent of whether or not such assumptions are verified to be valid in broader consideration. That is, their interchangeability is somtimes taken for granted, without requirement of scrupulous attention to the underlying premise (Dewey, 1939). AI tools do not literally perceive (despite the possible suggestion by acknowledged terms of art as in "grounded perceptual models"; NYU Center for Mind, Brain, and Consciousness [NYUCMBC], 2023, 24:28). Architectures of AI tools in some cases aim to model a modicum of the conditions taken to be important to perception.

Current AI tools do not posses affect, though some aspire that AI tools might be engineered to maintain something like emotions[26]; work still being required to establish proposed operationalizations, and subsequent implementations, as substantially comparable or relevant to more general accounts of emotion (LeCun, 2022; NYUCMBC, 2023)[27]. AI tools do not have allostatic imperatives, they do not have homeostatic regulation of the sorts relevant to human behaviors under consideration. AI tools do not feel moment to moment, nor do they use feeling(s) in guiding their outputs. AI tools do not demonstrate evolutionarily shaped behaviors noted previously as important to L,K,I (see also: Chirimuuta, 2024 esp. Ch. 4, Godfrey-Smith, 2023).

AI tools do not experience but by fiat[28]. AI tools do not experience or understand changing conditions of environments without devastatingly severe qualification of every one of those operative terms. AI tools do not experience change—distinguished from exhibiting processes of change—and AI tools do not experience events, computational objects labeled as such notwithstanding (Dewey, 1925, Ch. III, 1939, Ch. XVIII). AI tools do not experience problems *as such*, but rather in a sense imputed to them by their human operators (Dewey, 1929,

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[26] Emotions are not the same as affect (Barrett, 2018).

[27] Such operationalizations do not on their own warrant the relevance of comparison to human emotions. I will point out that it is significant that efforts by LeCun (2022) acknowledge, at least nominally, the importance of (at least) S,P …so did Turing, for that matter, regarding "sense organs" (Turing, 1950).

[28] Suppose we were to substitute the term "behave" for "experience" (Dewey & Bentley, 1946), in what sense might we reasonably speak of AI tools as "behaving"? Under what specifiable conditions do behaviors occur? In general, the term "experience" has been avoided throughout present inquiry for reasons similar to the terminological concerns earlier noted around "feeling". It is, however, here used to suggest a deeper point around the importance of experiment to knowing, and experience to experiment (Dewey, 1916, p. 74). For further development of this point, along with an indication of how I am using the terms "organization", "experience", "behavior" and "environment" see: Dewey (1916, Ch I, 1925, 1939) and Dewey & Bentley (1946). Is there any evidence, as of today, to suggest that the use of the term "experience" as regards contemporary AI tools is not wholly specious?

1939)[29]. That is, their "*problem solving*" is imputed; apparent under given conditions rather than actual[30]. AI tools do not have interests, and interests do not guide their mechanics, beyond those animating interests attributable to their human operators (and, in some sense, social systems of which they are apart Cristianini et al., 2021; Dewey 1925, Ch. VII)[31]. As noted across Chirimuuta (2023, 2024) regarding intelligence, we should not anticipate AI tools to demonstrate bona fide S,P,A·L,K,I behaviors, lacking as they are of the interconnected, chemical, biological, physiological or broader evolutionary conditions requisite to exemplary cases …And this is exactly what we find.[32]

Famously, AI tools do not have common sense. This fact is suggested by the latter term of the phrase, especially as employed consistent with the presently considered set of hypotheses. Without senses, without a *sense* of common culture and received conditions of social communication, there are no senses in *common* to AI tools; there is no common-sense subject-matter available to modern AI tools nor means of their processing (Dewey, 1925, 1939, Ch. IV).

AI tools struggle with generalization—very abstractedly conceived—hence the significance of efforts to spur advancements in "human-like general intelligence" like the

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[29] I noticed similar point made by Godfrey-Smith in Harvard Philosophy Department (2023, 1:53:57) near completion of present paper.

[30] This does not imply they are not powerful problem solving tools, and marvelous feats of engineering and commerce. The type of business and engineering problem solving and curiosity required for their development and deployment is substantially informative to understanding learning more generally, as is the creativity required for their experimental study. Regarding the point around imputation, see a related recognition in Roederer (2016).

[31] There is a tendency in popular and academic discourse to emphasize variously termed "functional similarity" between AI tools and humans as in Millière in Carroll (2023, 29:03, 32:23) regarding "cognitive capacities humans have like reasoning". Somtimes this is done with various degrees of qualification and acknowledgement of the limits of analogies, as in the example just cited. There is a similar risk with terms like "goal", "objective", or similar, etc., which we should not confuse for interests, purposes etc. as in, or substantially similar to, the organismic, or human case. These sorts of functional arguments tend to offer thin analogies which elide many disanalogies as expressly exposited across Chirimuuta (2024) and discussed in Godfrey-Smith (2023); more on this later. "Restricted" technical employment of such terms as "intelligence" under specifiable assumptions, granting "goal-driven intelligent behavior" as in work by (Cristianini et al., 2021) is, however, somewhat useful.

[32] Across scientific and popular discourse some arguments will caution about being too anthropocentric in our generalizations about S,P,A·L,K,I or related terms (Bubeck, 2023, p. 92). Somtimes this is done in casual appeal to arguments seen as similar to scientific discourse around life (Carroll, 2023) (see below). We should acknowledge these concerns to the extent relevant without exaggerating the latter or former. The fact of the matter is that we do have adequate theories covering bona fide cases, from which we should base our reasoning in lieu of goods delivered by alternative theoretic accounts in sufficient application, or relevant new discoveries. This is especially called for in consideration of AI tools used in social contexts. More on this below

Abstraction and Reasoning Corpus (ARC) (Chollet, 2019, p. 3, 46-58)[33]. This challenge of the AI tools craft is not a surprise in recognition of the logical significance of particular events entering into human behavior in all their varied complexity, the importance of determinate singulars, and of experimentation in logical construction of grounded generalizations (Dewey, 1939). Notably, AI tools lack abilities with logic. Some researchers have even been inspired to call for greater engagement with "logical foundations" of the fields relevant to the study of AI tools (Gurevich, 2021; see also: Gurevich & Blass 2024).

Even by standards of computer science, engineering or adjacent disciplinary studies[34] there are serious questions as to whether AI tools (particularly, autoregressive generative models of popular imagination) credibly demonstrate "reasoning", variously employed as a term of art, let alone anything approaching the type of bona fide reasoning known to humans, as suggested by LeCun in (UWECEmedia, 2024, 29:32). Such is the case even acknowledging that they are engineered, deployed, (and marketed) to give an impression as such.

These are just a few of the differences between AI tools and humans[35]. Proposals to treat AI tools as literal examples of S,P,A·L,K,I face profound obstacles and significant peril. As of today, the fact of the matter is that AI tools do not learn, AI tools do not know things and AI tools are not intelligent in the literal senses of these terms, by criteria of common sense[36], scientific analysis, and philosophic scrutiny. This is especially the case if we must draw comparisons between study of organisms, specifically humans, and research on computational capacities as tech industry discourse insists we must (Columbia Engineering, 2024; LeCun, 2022; OpenAI, 2024).

To claim seriously that modern AI tools learn in other than a figurative or narrowly operationalized sense is to hazard extending terms of art or conversational designations as if they settle questions of generalizability. It risks treating figurative device, or scientific posit, as ontological fact; significantly, following a legacy of fraught and known epistemological and metaphysical difficulties (Dewey, 1916, 1929, 1939; Balz & Dewey, 1949; Hickman, 2007; Chirimuuta, 2024). We should be profoundly skeptical of claims purportedly supported by such

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[33] This is not primarily a comment about the likelihood of such efforts lending to intelligence proper, nor even to more substantively comment on the conception of generalization underlying its development. That such efforts will continue to contribute to advancing disciplinary studies, solving specifiable engineering objectives, and inspiring learning in people seems likely. See below for further consideration of Chollet (2019).

[34] Which, as has been repeatedly noted, and will be further pointed out, we should be cautions not to overgeneralize from, and free to dispute the relevance of with respect to comparability with humans or other organisms

[35] For further and more advanced consideration of related contrasts see Chirimuuta (2024).

[36] Popular discourse has ostensibly challenged some of our common sense understandings about L,K,I. While figurative language is perhaps fine to explain complex technologies, we should at least be wary of its limits (Chirimuuta, 2024, Dewey, 1939). Plenty of engineers express such wariness as a matter of course; I have noticed anecdotally that developers using AI tools by and large recognize the limits of these tools as applied to specifiable domains, as do some who build advanced computational technologies, as indicated in Li & Etchemendy (2024).

erroneous literal treatment, especially when they are used to make cases for how AI tools should be used to intervene in human matters, especially social life, or as regards other living organisms. Because of course, figurative language and narrowly operationalized terms used for the varied purposes of limited scientific study do not settle matters concerning adequate generalizations of terms like "S,P,A·L,K,I" —they are not bona fide theories of the subject-matters under present consideration[37]. Likewise, regarding the mere positing of algorithmic, or computational accounts of "S,P,A·L,K,I" —or the brain for that matter (Chirimuuta, 2023, 2024).

Appending the term "learning" in front of the term "algorithm" beyond relevant technical employments, and treating the resultant as an adequate general account of learning is the example *par excellence* of begging the question in modern AI tools discourse. Relatedly, the claim variously proffered that "AI tools will inevitably surpass human intelligence" is merely a provocative assertion[38]. No doubt a forklift has surpassed my strength, but what we are able to infer from this mechanic capacity is limited in scope (Chirimuuta, 2023, 17:52, 2024, Ch. 9). We should heed Cartwright's insistence in Conceptual Engineering (2022) that we aim to use the "right tools for the right purposes" (10:03) in consideration of a "duty of care*"* detailed in Cartwright (2023). Unmoored claims of AI tools discourse risk promoting the use of the *wrong* tools for the wrong reasons, even if we are glad to occasionally find helpful examples of getting it "right" by organizations that build them.

The claim is that today's AI tools do not learn, do not S,P,A·L,K,I in the literal senses of these terms. Systematically acting as if they do—especially in sensitive—especially social—domains—is an extraordinarily bad idea, even if (or, especially because) AI tools appear to behave as such in a shallow sense. We should avoid using systematic nesting of figurative language to support assertions about discernible facts in the world that we have vanishingly few reasons to take as supplying credible general accounts. Understanding this recognition allows modern discourse to make a lot more sense than the alternative explanations noted above (and below) afford. It stands to account for the ubiquity of qualifying language, strong modifiers, hedging, ambiguity and vagueness in AI tools discourse. It lends to understanding of the asymmetry between the purported nigh "superintelligence" and the wrenching actual of how these tools are currently being used in practice when not in the hands of judicious developers or conscientious professionals. This recognition may help to account for the potentially waning

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[37] Available science indicates the metaphors we use matter (Thibodeau et al., 2017).

[38] Such claims may turn out to be the case, but simply asserting them is not a compelling argument that such outcomes are either likely nor inevitable. How does one get there from the subject-matter under consideration in Columbia Engineering (2024) or LeCun (2022), however impressive are the technologies there under discussion? (see also: "*preasymptotics*" (emphasis in original) in Taleb (2010, p. 345, 354-355); see below for further consideration of LeCun (2022)

LLM hype of the past few years and what that hype looks like today (Machine Learning Street Talk, 2024, 1:33; UWECEmedia, 2024, 29:32)[39].

When we describe popular AI tools using terms like “learning”, “knowledge”, “intelligence”, we are using the terms in a figurative, or term of art sense or making a metaphysical pronouncement. To use more critical language: the perceived similarities upon which literal usages hinge are apparent as opposed to actual (Dewey, 1939 p. 197; Chirimuuta, 2024). In extremis, the imputations (upon literal interpretation) are comparable to presuming bats are birds because they have wings, or that pyrite is a golden nugget on account of its appearance (Dewey, 1939). All three instances are mistakes resultant upon similar and related logical errors. The underlying issues are lineage of old philosophic conundrums, and the value of historic knowledge here is great (Dewey, 1916, 1925, 1939, Ch. XXV). As with earlier versions of the related errors it is deeply ironic that such literal accounts often rely on “purely metaphysical” notions while somtimes masquerading as if devoid therin (Dewey, 1939, p. 286, 475, 530)[40]. These claims are sometimes positioned, if even implicitly, as being inevitable conclusions of scientific facts, but the evidence adduced is not that of central claims around literally matching or equivalence to human intelligence being of much credence, but of something else (Chirimuuta, 2023, 2024). More on this in a moment, but let us first consider some instructive examples after anticipating some hazards involved therin.

When we take “S,P,A·L,K,I” terms in discourse about modern AI tools literally it can be hazardous. It can be hazardous to take these terms as if they designate bona fide examples of S,P,A·L,K,I as demonstrated by organisms, specifically humans, or as if the use of terms like “learning” etc. are based on adequately designated— verifiable— generalization… or even that “learning” is warranted by comparison in significant resemblance not reliant on imputation; the latter often assumed and merely asserted …as if terms in question covered general or particular bona fide cases of interest. Consistent with Chirimuuta’s (2024) assessment of intelligence, “L, K” in description of AI tools are more like shallow analogies upon analysis. This is not to say that AI tools, or designations used to characterize their mechanics in disciplinary study are not somtimes, as devices, important aids to human learning, knowing or intelligence; clearly they can be (Chollet, 2019; Columbia Engineering, 2024; Hasabis via MITCBMM, 2022; LeCun, 2022; QUT Centre for the Digital Economy, 2021; Merullo et al., 2023).

By hazardous is meant with respect to reasoning and hazardous in real world application. We already see this playing out and have been for some time. If one thinks a system is intelligent and it is “*intelligent*", one might mistakenly follow its silly suggestions like Michael Scott

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[39] To echo comparable points made across a number of included references, it can be simultaneously the case that souped-up generative models are technological achievements with profound economic implications and opportunities for innovative appliances, and that they are not, literally, intelligent (beyond restricted disciplinary discourse) nor on track to be as such (UWECEmedia, 2024, 29:32; Chirimuuta 2023, 2024; Machine Learning Street Talk, 2024; TensorFlow, 2024). Do we need the advanced techniques describe by LeCun in Columbia Engineering (2024) to provision for literal intelligence to accomplish many important tasks of interest?

[40] Related: “Fundamentally, it makes the personal interest which actuates a particular logician or group of logicians the criterion for logical subject-matter.” (Dewey, 1939, p. 280)

driving into a pond. While this is a fictional example, it is probably not hard for you to think of comparable real-world examples.

If we were to infer that AI tools we describe in common conversation— for practical, political, or marketing purposes— as "intelligent", for instance, feel or perceive, or understand context, or learn from experience, imagine, etc. or that they reason (in something other than an assiduously qualified way) we would be mistaken. To assume AI tools use foresight of consequences of events as means in problem solving behavior to the tune of people, or even earlier evolved organisms is to be incorrect (Chirimuuta, 2023 & 2024; Columbia Engineering, 2024, 12:52).

I want to be very clear about the implications of what is being pointed out. If one takes "S,P,A·L,K,I" terms literally in the case of contemporary AI tools one risks consistently and systematically (though not necessarily unanimously) making mistaken inferences about them; ones which can be predictable, demonstrable, and avoidable. If one takes these terms, justifiably, as figurative or narrowly operationalized devices with more or less appropriate, albeit limited applicability (depending on the context) one will be better positioned to make valid inferences about them. Choose wisely[41].

Let us now consider some examples which test the claim that there are hazards to inference involved with taking terms like "S,P,A·L,K,I" literally in the case of AI tools. One example that highlights hazards of granting literal interpretation of "*S,P,A·L,K,I*" to describe capabilities of modern **AI tools** is the *Sparks of Artificial General Intelligence: Early experiments with GPT-4* (*Sparks*) paper by Bubeck et al., (2023).

There are a few supposedly related claims upon which to focus, in order of appearance:

I. "Given the breadth and depth of GPT-4's capabilities, we believe that it could reasonably be viewed as an early (yet still incomplete) version of an artificial general intelligence (AGI) system." (Bubeck et al., 2023, p. 1)

II. "We report on evidence that a new LLM developed by OpenAI, which is an early and **non-multimodal** version of GPT-4 [Ope23], exhibits many traits of intelligence." (Bubeck et al., 2023, p. 4)

III. "The central claim of our work is that GPT-4 attains a form of *general* intelligence, indeed showing *sparks of artificial general intelligence*" (Bubeck et al., 2023, p. 92) (italics and bolding above in original)

Not one of these claims is established in this paper[42]. First, let us consider claim I. The designation of "AGI" employed in the paper is meant "to refer to systems that demonstrate broad

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[41] This is expressly a caution against granting nigh "*superintelligence*" of AI tools uncritically.

[42] Others have noted the equivocation across the Sparks paper (Xiang, 2023). Still others have noted a range of concerns with the fashioned versions of "intelligence" in the *Sparks* paper. I am choosing to take the paper seriously on its own account as it typifies a number of broader issues in the larger AI tools discourse.

capabilities of intelligence including reasoning, planning, and the ability to learn from experience and with these capabilities at or above human level" (Bubeck et al., 2023 p. 4). The capabilities "reasoning", "planning", "the ability to learn from experience", are purported to be exhibited by GPT-4. Unfortunately, what "reasoning" is taken to be is never designated in the paper[43]. As such, it is difficult to see how "*reasoning*" (emphasis added) can properly be claimed as evidenced, nor how it can "reasonably" (claim I) be asserted to factor substantively into (claim II[44]) about "intelligence", or (claim III), "a form of *general* intelligence" or "AGI" (Bubeck et al., 2023, p. 92). The most we are given towards designation of "reasoning" is the purported demonstration of a capability to "manipulate complex concepts", which is cited as "a core aspect of reasoning", or that "coding and mathematics are emblematic of the ability to reason" (Bubeck et al., 2023, p. 8). Such nods are a far cry from an adequate designation of "reasoning" that allows us to determine what exactly is being evidenced[45].

By the researchers' own concession regarding GPT-4, "arguably it is entirely missing the learning from experience" (Bubeck et al., 2023, p. 4-5). This is an accurate statement. Which, again, makes it unreasonable to factor "the ability to learn from experience" into an account of "AGI" and thus meet the marks set by the researchers chosen standards (Bubeck et al., 2023, p.4). Regarding claim II, and III in particular, it is not merely that the "capabilities of intelligence" cited are not established to be evidenced, but also that there is not adequate warrant to substantiate the relevance of these capabilities in distinguishing "intelligence", "general intelligence" or "AGI" in the culminating claims in the first place (Bubeck et al., 2023, p.4). The *Sparks* paper does not even establish that GPT-4 meets the researchers' fashioned "AGI", let alone that the traits of consideration are relevant to a more general account of intelligence applicable beyond this erroneously purported instance (Bubeck et al., 2023, p. 4).

What we are given is causes for the claims provided, as opposed to grounds (in the logical sense of the latter term) (Dewey, 1939, p. 267). The ostensible presence of the three capabilities taken to characterize "*AGI*" is the cause of the researchers' supposing the warrant of their version of that designation. And yet the authors expressly state "we do not address the

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[43] By the researchers' own concession regarding the definition into which "reasoning" is supposed to factor, "this definition does not specify how to measure or compare these abilities", and is maintained as a "starting point" (Bubeck et al., 2023, p. 92).

[44] There is a vagueness regarding "traits of intelligence", as compared (…or related?) to the designation of "artificial general intelligence" noted above. Capabilities noted after the phrase "traits of intelligence" (Bubeck et al., 2023, p.4) such as "comprehension" and "understanding of human motives and emotions", are subject to similar perils as those noted with respect to the explicit "AGI" designation. It is noted by the researchers that "in this paper we used an informal definition of intelligence by focusing on reasoning, planning, and learning from experience" (Bubeck et al., 2023, p. 92), as such it is these capabilities upon which consideration is focused.

[45] Cursory attempts are provided to substantiate claims around "mathematical understanding" including the "aspects" of "creative reasoning" and "critical reasoning", which, again, do not answer the question about what is meant by "reasoning" as a trait of consideration in the designation of "AGI" employed (Bubeck et al., 2023 p.34; note: Section D1 p. 122).

fundamental questions of why and how" (Bubeck et al., 2023, p. 94)—the reasons and logical grounds (Dewey, 1939)—of claims about "*intelligence*".

The paper is a prototypical example of circular reasoning. Even if it were not, the argument would be an example of affirming the antecedent. The logical consequences of inadequate designation, are devastating to any attempt at verifying the legitimacy of the primary claims. Even in instances where this insufficiency is not catastrophic, the account of "*intelligence*" or supposed capabilities therin, lacks anything close to a bona fide theoretic treatment (as is somewhat acknowledged on p. 92, 94). Other plausible explanations have not been sufficiently addressed and ruled out, even in consideration of acknowledged methodological limitations. Even if we thought that capabilities like "reasoning" and "the ability to learn from experience" were established as evidenced (they are not), they would not of themselves sufficiently ground a claim about exhibition of "AGI", "general intelligence", or "intelligence" (Bubeck et al., 2023, p. 4, 92). These capabilities, if evidenced, would have to be observed as results of discriminating analysis upon experimentation such that they alone (as much as is practically possible to demonstrate) sufficiently characterize the case (Dewey, 1939). The purported evidence is apparent, not actual, and even if it were not would be inadequate to substantiate the central contentions of the paper.[46] Still, the "assessment that a technological leap has been achieved" (p. 6) remains.

Let us now consider a substantive argument that allows us to better test the claim that there are perils to inference of taking "S,P,A·L,K,I" terms literally in the case of AI tools. In a recent event hosted by the NYU Center for Mind, Brian, and Consciousness, researchers and industry practitioners debated the question:

> "Do language models need sensory grounding for meaning and understanding?" (NYUCMBC, 2023)

One of the researchers arguing in negation made a few claims for consideration. In assessment of these claims we will first do so, as the researcher does, by taking terms of interest (i.e., "sensory", "grounding", "understanding", etc.) primarily as terms of art in the context of specifiable disciplinary studies[47]. Then we will consider the same claims as possibly lending to a literal interpretation. The claims are as follows:

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[46] There is a deep irony that this paper begins with a quote from Sir Arthur Eddington, "something unknown is doing we don't know what", taken from a passage about the role of generalization in science and the nature of reality (Eddington, 1948, p.145). While further comment on the irony of this quote is out of scope, I leave it to the curious reader to further consider in the context of the present indication that taking "S,P,A·L,K,I" terms literally in description of AI tools risks mistaken inference. (See also: concerns with same work of Eddington in Dewey 1929, p.129-131 …The historical parallels here are profound.)

[47] Not here specified but available for consideration upon inspection of works referenced during cited presentation. In finalization of this paper I contacted Professor Pavlick with a few clarifying questions in effort to ensure I was responding to the appropriate claims. I am grateful to Professor Pavlick for the responses and have endeavor to faithfully reflect resultant clarifications in how present consideration has been constructed.

I. “This debate will largely be settled empirically, and current empirical data points to ‘no’” (NYUCMBC, 2023, 15:56)
    I. “there is no clear benefit of grounding on measures of language understanding”
    II. “the representations of text-only LLMs are structured the ‘right’ way and can be grounded post-hoc with minimal effort”

To support these claims the researcher first points to research that: “compares the semantic representations learned via VL [vision-and-language models] vs. text-only pretraining for two recent VL models using a suite of analyses […] in a language-only setting” (Yun et al., 2021, p. 4357). The researchers find that: “multimodal models fail to significantly outperform the text-only variants” (Yun et al., 2021, p. 4357). In presentation of this work, the researcher describes testing text-only and VL models on a range of tasks including PIQA (“physical common sense reasoning task”), “various semantic probes” (“meaning in a linguistic sense”), and “adjective-noun relations” (NYUCMBC, 2023, 19:45). They go on to explain that: “across the board with the models we have, and the metrics we have, adding sensory data doesn’t help even on these kind of metrics of understanding where we really would have expected it to” (NYU…, 2023, 20:32). The research is presented as data indicating “No measurable difference when tested head to head”, supporting claim I.I. (NYUCMBC, 2023, 18:52).

The researcher then points to scientific studies presented in support of claim I.II. As noted in the debate intro, the argument is that “when we actually look at the representations that we have in the language models, that they’re actually quite similar to what we would expect [of] representations of the actual world” (NYUCMBC, 2023, 18:36). The researcher points to a pair of related studies that are taken as exploring the “structure of the representations that the models learn”, specifically, regarding RGB codes (NYUCMBC, 2023, 20:52). Of primary significance is the study that finds “the largest model can not only learn to ground the concepts that it is explicitly taught, but appears to generalise to several instances of unseen concepts as well” (Patel & Pavlick, 2022). The research demonstrations are taken as indicative that in some sense, instances of relations between RGB codes (ex. “blue to dark blue”) can, to noteworthy extent, be mapped by models across variations in experimental conditions to “unseen” instances as when the “world” of interest is rotated (“as long as we preserve the structure”, 22:22), that is, as long as “relations between colors are preserved” (p. 4)[48]. With reference to visual aids contrasting original and rotated tests for the model tasked to “label RGB codes”—ex. “RGB: (255, 0, 0);

[48] I am summarizing in brief, as does the researcher in presentation. Readers are encouraged to watch the debate section, and consult the work there referenced for a better explanation with provided visual accompaniments. This procedural note, from Patel & Pavlick (2022) about rotating the “world" of interest is a measure taken by the researchers to rule out the model transferring the RGB code relations by way of “memorization”. The researchers’ illustration of “*isomorphism”* (emphasis in original) might be helpful: “imagine a situation where you are lost in the woods. Once pointed in the direction of north, you instantly know which way is south. However, this ability is not dependent on having been correctly pointed north–if someone were to incorrectly point east and tell you this was north, you would readily infer west to be south” (Patel & Pavlick, 2022, p. 3). See also: consideration of same work in Mollo & Millière (2023, 5.3), considered below; see: footnote 53

Answer: Red")—the researcher explains "so if I tell the model that this dark blue color is blue, and this dark green color is dark blue, it should learn that getting greener is how it should realize the dark relation, and then when I tell it this light blue color is green then it should infer that this light green color is dark" (NYUCMBC, 2023, 22:10). The researcher further explains the predicted results, experimental setup and actual results.

In presentation of these findings the researcher notes some limitations of the studies and that: "it would be valid to push back on this to say 'well maybe reasoning about RGB codes isn't really the same as perceptual reasoning'[…]" (NYUCMBC, 2023, 24:02). To follow, additional scientific study is then considered. The findings of primary significance "indicate that LMs encode conceptual information structurally similar to vision-based models, even those that are solely trained on images" (Merullo et al., 2023, p. 1; NYU…,2023, 25:50). The researcher closes this section with explanation of what is meant by grounding post-hoc in view of the significant findings just noted. Taken together the research cited is presented as supporting claim I.II.[49]

First, as to claim I it is significant that the researcher affirms the importance of empirical work in adjudicating the debate question. On this point there is agreement with the position of the present paper[50]. It is however prima facie difficult to square a direct appeal to empiricism made in tandem with denial of the relevance of senses (even as term of art) in understanding[5152]. Central to experimental empirical study is the role of human experience, especially observation and experiment involving our senses and perception, even if via the aid of instruments (Dewey, 1929, 1939). Nonetheless, let us consider claims I.I and I.II as they are positioned in support of claim I in negation of the debate question.

In efforts to establish claim I.I, research is cited that suggests multi-modal models do not "outperform the text only variants" regarding "a suite of analyses […]"(Yun et al., 2021, p. 4357, 4359). The idea being that if we add sensory grounding, here taken as terms of art, to language models under experimental conditions, perhaps counter intuitively, it does not improve performance on operationalized language understanding tasks. In a term of art interpretation deployed multimodal capabilities (in this case VL) are taken in the context of specifiable disciplinary discourse as finely constituting sensory grounding.

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[49] I have endeavored to present the work faithfully and briefly without getting too much in the technical details of the research cited. I encourage the curious reader to watch the debate, and to review the research here considered, on their respective accounts.

[50] See earlier note on the ambiguity of "empiricism"; while it is true that empirical work is crucial to settling this matter, it is also true that broader logical and philosophic considerations are germane (Dewey, 1925, 1939). What facts are taken as evidence (and in what respects) in particular inquires is an issue of prevailing concern. So, "largely" (NYUCMBC, 2023, 15:56), indeed.

[51] I do not here directly take up the philosophic accounts pointed to by the researcher that are taken as possibly supporting the claim "grounding is not *a priori* obviously necessary for meaning" (emphasis in original) (16:14); again, see earlier Dewey (1939) reference regarding "empiricism". Noting a similar recognition on the empirical point made in Chirimuuta (2024, p. 41).

[52] Of course, such accounts could possibly contribute to interpretation of the significance of the main contentions…

It must be noted, as others have, some of the concerns which arise in use of the term "grounding" as a term of art across AI tools discourse, and in consideration of work cited in the NYU debate (Mollo & Millière, 2023)[53]. A related concern is especially pertinent to the works under present consideration. In one of the studies cited by the researcher "grounding" is designated as "the ability to tie a word for which they ["text-only language models (LMs)"] have learned a representation to its referent in the non-linguistic world" (Patel & Pavlick, 2022, p.1). In another, it is designated as "connecting words to their meanings in the physical world" (Yun et al., 2021, p. 4357). In granting these designations as terms of art, it remains important to point out that here we are firmly placed in the fields of philosophy and logical theory. Beyond the required research assumptions, such placement surfaces much deeper issues, germane to the research and it's interpretation, with the terms of art employed, especially "concept(s)", "meaning(s)" "representation(s)" "referent", "non-linguistic world", especially as they are taken to factor into claim I.II[54]. The deeper issues are mainly out of present scope, though suggested across the present paper. It suffices to here note that "tie" is vague even if we can muster an intuition about what might be meant[55]. Of course, "its referent in the non-linguistic world" is not immediately or necessarily given. Take, for example, a caution in Dewey (1939), that when pointing at an object, it might be unclear as to what exactly we are pointing …are we pointing at the tree, its leaves, the bird or its nest, or the molecules therin? Context matters. This is one where— technical requirements of the study notwithstanding— engagement with the philosophic questions have dramatic consequence, and crucial bearing upon the broader claims warranted and their interpretation. Of course, assuming a disciplinary stance for purposes of research makes sense and enables discovery.

"Grounding" as a term of art in the study of modern AI tools has little similarity with how we take grounding in human inquiry, as in the practice of science (or its philosophy)(Cartwright, 2015; Dewey, 1939; compare with Mollo & Millière, 2023). It is decidedly different from how we use the term in a logical context, as in establishing the *logical* grounds of inquiry (Dewey,

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[53] I am pointing to the recognition of the problem space and value of the contribution, without affirming proposed ways forward provided by Mollo & Millière (2023)—the latter of whom from which I was initially made aware about the studies cited in negation of the debate question via Carroll (2023). Professor Pavlick indeed noted Mollo & Millière (2023) in clarifying responses previously acknowledged, though my original engagement with this work for present consideration stems from initial awareness of Millière's broader work via Carroll (2023). For adequate accounts of grounding across inquiry see citations of Cartwright in References, and —with express attention to logical theory—Dewey (1939).

[54] Claim I.II is not much further taken up, and is perhaps better adjudicated within the frameworks of disciplinary studies relevant to the subject-matters considered in the NYU presentation. I do however point the curious reader to logical considerations around color in Dewey (1939), Barrett's presentation in HTLFU (2024) and Center for Mind and Cognition (2024) on Relational Realism, and the evolving work on color perception by Chirimuuta.

[55] This is not primarily a point about so called "explainability" or "interpretability" variously designated across AI tools discourse.

1939)[56]. Establishing the logical grounds of claims can be an "arduous process", as the work of our most advanced and nascent sciences attest (Dewey, 1939, p. 270, 346).

Regarding claims about "meaning and understanding", one must take the debated resolution in a restricted term of art interpretation for the research results presented to provide a compelling negation[57]. At multiple points during their spoken presentation, especially at the end, the researcher appropriately qualifies the term "understanding" (there placed in quotes) with respect to the debate question and research cited, and makes related qualifications about "measures of language understanding", "with the metrics we have", "according to our metrics", "meaning in a linguistic sense" etc. (NYUCMBC, 2023, 18:20, 20:10, 20:34, 27:47). Indeed, when claim I.I is presented as "there is no clear benefit of grounding on measures of language understanding"(NYUCMBC, 2023,18:20) it is roughly valid (with caveats about the limitations of grounding as a technical term, and acknowledged research limitations) so far as it goes in the term of art interpretation. Whether these operationalized "kinds of metrics of understanding" have relevance to a fulsome account of understanding or meaning as in the human case, or broader generality is left unaddressed. In the presented context, such concerns are out of scope. The qualifications about "metrics" and otherwise suggest that the concern is not unacknowledged (NYUCMBC, 2023, 20:32). Notice regarding the qualified "measures of language understanding", "metrics we have", that they do not alone establish the relevance of those measures to the question under debate were the latter to be taken in regard to more comprehensive account of meaning and understanding as in the case of humans, or more generally (NYUCMBC, 2023, 15:56, 20:32). Are these measures in accordance with an adequate account of "meaning", or "understanding", or both as positioned in the question under debate? The starting point assumption of a term of art interpretation, lent from requisite and specifiable disciplinary work is that, restrictedly, perhaps they do. Still, how is "meaning" related to "understanding"?

Taken in the term of art interpretation, the particular VL sensory capabilities of study do not improve performance on the cited test examples from the research setups which include operationalized measures of language understanding. And a type of grounding of disciplinary interest is seen to be achievable post hoc in a qualified way (NNYUCMBC, 2023). It is important to underline that the core claims of the researchers as stated in the research papers cited are more or less valid so far as they go within the discernible assumptions and acknowledged limitations of the respective studies and disciplinary agendas. This recognition is interesting, and important. Research like this is crucial for improving our understanding about how to make the most of AI tools, for discerning where to be wary of their limits, and for devising experimental setups. But in *interpretation* of this work we must be cautious in moving too much beyond the warranted claims of the research regime. Even following a term of art interpretation of the researcher's claims, the primary contentions against the debate question are not sufficient to roundly negate the debate question. Even assuming we take all of the terms in question as terms of art, there is still substantial risk of affirming the antecedent, alternative

[56] It is not a coincidence that this is an area engineers will point too as a challenge for the field.

[57] Perhaps this is not surprising in the context of a scholarly debate!

explanations have not been sufficiently ruled out[58]. Further, the comparison of "measures of language understanding" with "meaning and understanding" calls for elucidation not provided, yet indicated as of concern (NYUCMBC, 2023)[59] …What exactly is being evidenced? It may however be fair to argue that the work cited in negation of the debate question might profitably function as a significant caution against overly "deflationary" (Millière in Carroll, 2023, 29:03) accounts of LLMs which seek to out-of-hand dismiss claims of their demonstrating something-like-meaning (though, in a very limited sense).

In any case, so much of the presented argument is easy for us to mistake in broader consideration—as if the terms employed could or should be taken literally; as if they are interchangeable, or substantially similar to S,P,A·L,K,I[6061]. I am not speaking to the researchers intent, and expressly affirm that I understand the researcher to be proceeding along a term of art interpretation. I am rather acknowledging how work like this sometimes proceeds in public discourse, and the risk of such interpretation lent by contestable designations of complex subject-matters, even when employed with cautionary qualification.

Let us now consider a literal interpretation of the work presented. In a literal interpretation, if we are to consider the term "sensory grounding", matters are much more hazardous than a term of art interpretation. Under literal interpretation the argument would amount to an account of purportedly sensory examples that are patently not examples of bona fide sensory abilities, if by "sensory" we mean something somehow interchangeable with senses in the case of organisms, or "sensory" as construed to constitute a generalizable account which—for reasons indicated across this paper—would be unsubstantiated. Similar to Chirimuuta's (2024, p. 250-251) contrast of brains and computers, multi-modal capabilities might be taken as

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[58] As noted above, the researcher makes repeated efforts to avoid this, and is clearly aware of the risk on more than one account (18:24, 24:02). The risk, however, remains important to point out in our *interpretation* of the presentation, even while acknowledging the relevance of the limitations of the debate format, and scope of the research cited. See Dewey (1939) for consideration around thresholds of sufficiency in the continuity and progress of inquiry.

[59] Here relevant: How are these terms taken in appeal to broader disciplinary studies (some of which are noted in the research, and were further noted in clarifying response previously acknowledged), *and* how do these relate to more general accounts? It is not here suggested that the broader concern of disciplinary assumptions are primarily the responsibility of the researcher. The concern is noted as relevant to our *interpretation* of the work (this relates to concern with the *Sparks* construals noted earlier, though the work under present consideration is of a fundamentally different order).

[60] Of course, this is a debate explicitly in the context of field practitioners and researchers. But the ambiguity of the debate question remains relevant. In the course of writing this paper, in contrast to the work under present consideration, I found it to be common for profoundly interesting research to be interpreted in ways that went well beyond the warranted claims therin. I understand this to be a challenge in scientific communication and discourse generally, and even social learning more generally. I suspect that in lieu of a clear logical account of grounding, or recognition of adequate theories of S,P,A·L,K,I and the criterion by which their designations are reasonably substantiated such challenges are to be expected.

[61] It is worth noting that argumentation by later contestant Chalmers uses the qualified "quasi-sensory" which at least seems more accurate (NYUCMBC, 2023, 49:26).

like senses for specific objectives, but taking them *as* senses would be a mistake. This has a bearing on whether or not the research cited could be reasonably interpreted as evidence in negation of the debate question taken literally.

If taken literally, the presented use of sensory grounding is taken in the sense that model capabilities ground to some referent of research interest. Receiving the VL "sensory grounding" as interchangeable with either bona fide sensory abilities or grounding in its logical or scientific sense would be inaccurate. The capabilities of VL models are not literally senses. A sensory analogy is thin, reliant as it is on severe simplifications comparable to those between organismic neurons and neural nets of AI tools (Chirimuuta, 2024). The sense in which multi-modal capabilities are purported to ground would be logically insufficient without adequate theoretical and experimental treatment (Dewey, 1939)[62]. The research techniques and model capabilities explained in the research cited and debate presentation have little to do with how organism sensory abilities work nor how they function in the process of grounding claims. If such a version of "sensory" is posited—taken—as its own example to be included in the fray of what we mean generally by "senses", it is one which covers so few of the facts known to undisputed exemplifying cases, so few of the involved conditions and consequences of their occurrence, that one must wonder what might warrant a supposed resemblance at all other than the mere use of the word "sensory". Of course, we know these are simplifications employed for their practical value in legitimate scientific, engineering and economic objectives of import (Chirimuuta, 2024; Dewey, 1925, 1929).

If taken literally, the terms in question would be a corral of spherical cows; devices treated as capabilities we could *supposedly* reasonably take to be roughly equivalent with sensory abilities, grounding (in its logical distinction), or bona fide understanding and meaning[63]. Under literal interpretation we would have "*sense*" rather than sensibility[64]. As such, the claims of the research cited in presentation could not be used to establish claim (I.I, I.II, or I) in negation of the debate question taken literally.

People can and should interrogate our general understandings of learning, knowing and intelligence as well as S,P,A. We should have an open mind about the possibilities and future discoveries. Such is the way of inquiry. But we must be careful not to exaggerate the substance or relevance of these contingencies as they relate to the real and pressing matters of current AI tools in social contexts. Inquiry into general accounts of S,P,A·L,K,I their respective distinguishing traits, and constituting characters may be taken in abstract, but their application in the world is concrete. Formal (or informal) "intelligence"'s go as far as they go in particular employments as aids to scientific research or business objectives etc. They help us learn stuff and do things. Hence, they are quite important and valuable. Maybe it is fine if for conversational purposes we see some practical value in using terms like "intelligence" to describe capabilities of AI tools so long as we understand the limitations of so doing (Chirimuuta, 2024).

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[62] See "functional" comparisons concern above (footnote 31)

[63] See related notes by Chirimuuta in Brains Blog (2023)

[64] Over the course of writing this paper I discovered a course with like name by Perlmutter et al. (2017).

While the matter as to accurate theories of L,K,I in humans or other organisms is not settled, some progress has here been made. Again, we must have an open mind given how primitive are our currently available tools and methods of studying these very complex subject-matters. But that does not mean we cannot make reasonable hypotheses from relevant empirical and valid theoretical situation particularly as concerns generic traits of organisms, particularly humans, demonstrating S,P,A·L,K,I. We have good reasons for primarily drawing our understanding from the human, alternatively, organismic cases even if they may not be exhaustive. Where we must proceed on the basis of hypothesis we are wise to draw mainly from what we do know about the organismic, especially human, case unless we have good reasons for proceeding otherwise. This is especially called for when the widely expressed concerns of AI tools discourse are pegged to the human case, and when there are important consequences for humans from use of AI tools in social contexts. We should recognize a "duty of care" as noted in Cartwright & Ray (2023), informed by the best available research of our time (Johnson, 2006). The consequences of our choices here are profound for people and the planet. Despite all the hype, speculation and posturing, as regards current AI tools we do not at present have good reasons for proceeding otherwise than reasoning primarily from the human and organismic cases.

We will begin winding down by noting some of the barriers to recognition of the fact that designations of "S,P,A·L,K,I" in the context of AI tools discourse are not literal. Regular appeal is made to the fact that there are not consensus definitions of terms like "L,K,I" (Bubeck et al., 2023). This is accurate. What is often glossed over in popular discourse is the criteria by which we adjudicate theoretical disputes in inquiry; we systematically determine the productivity and rigor of our theories as borne out in application, their predictive and explanatory power, and problem solving capacity in intervention in the world, or offering of insight, while ruling out alternative explanations (Cartwright, 2015, 2016a; Dewey, 1939)[65]. My view is that the contributions of Barrett, Godfrey-Smith, Hickman, Johnson and Schulkin, and respective collaborators, at least, show just how far adequate theoretical accounts of S,P,A·L,K,I can successfully guide us[66]. The variously named "experimental theory of knowing" or "theory of inquiry" (Dewey, 1929, p. 171, 1939) across Dewey's work and the scientific and philosophic work upon which it is based, and for which it has served as inspiration has been substantially

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[65] This is not taken to be a comprehensive articulation of a philosophy of science.

[66] Back of their respective works is substantive engagement, and to varying degree, broad accord with the work of the American Pragmatists, especially that of James, and Dewey. As a considered aside, it is not a coincidence that Dewey's philosophic stance was informed by the products of advance scientific works up through the 20th century, notably those of physical theory—and to fruitful effect. Dewey was in substantial engagement with the works of Maxwell, Heisenberg, Einstein and others (Dewey, 1929, 1939; Dewey & Bentley, 1946). What these facts are significant of I will reserve for another occasion without here affiliating to particular interpretations of physical (or cosmological!) theories, nor their proponents. On any account, I do not mean to exaggerate here, though neither do I wish to understate. The respective contemporary contributors are obviously able to speak for themselves, particularly if I have erred in my assessment.

borne out by the scientific facts[67], and so done via multiple fairly independent lines of inquiry[68] (Barrett, 2017, 2024; Godfrey-Smith, 2023, Johnson, 2006; Johnson & Schulkin, 2023). In these instances it is not the designations employed by Dewey or others per se, but rather the weight, verification, and African Jacana nesting—tangle (Cartwright, 2021, 28:42-31:38)—of the theories in which they factor as applied in solving problems and providing explanation. Is there an alternative theory of L,K,I currently on offer from the AI tools discourse which comes close? We should not confuse lack of consensus about L,K,I with a lack of bona fide theory sufficient for present circumstance. And we should not confuse the pointing out of open questions with such accounts of S,P,A·L,K,I as providing serious alternatives.

Related to the "no consensus" canard that tends to obfuscate the fact that "L,K,I" are being used figuratively or as terms of art within contemporary AI tools discourse is a standard caution that we should not be too "anthropocentric" in our accounts of L,K,I (Bubeck et al., 2023, p. 92). Controversies in the study of life are sometimes pointed to as furnishing comparable arguments. There is a popular[69] claim that it is not the organismic case in general, and human case especial, from which we should base our designations of terms like "reasoning" or "L,K,I" (Carroll, 2023)[70]. These arguments stem from noted limitations of our concepts in studying complex subject matters like learning, and the idea that current examples from which they are based might be unrepresentative (Carroll, 2023; Cleland, 2012, 2019). While theoretical consideration of these concerns may indeed be warranted, the relevance and weight of such arguments as regards modern AI tools in social contexts need not be over emphasized. A full engagement of such arguments is out of scope, but I will provide a brief note on a few particularly relevant aspects to which appeal is sometimes made.

I will present a version of these arguments in brief as they would go when informed by the thoroughgoing argument. Our current examples of L,K,I might be unrepresentative, leaving our designations as empirically lacking for theorizing about their respective distinguishing traits

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[67] Primarily, regarding humans …greater nuance than is here feasible is required for consideration of this theory in respect to other organisms, especially in view of more advanced scientific results than were available in the 20th century.

[68] I disagree with suggestions that we are without adequate accounts of L,K,I. I disagree with the suggestion that terms like "intelligence" are of little use, as suggested by Valiant in Carroll (2024a, esp. 45:51, 57:55). It is true that the history of such terms is rife with peril. I also empathize with those averse to such terms in recognition of a too often foul history. But bankrupt theories abound in the course of human inquiry, and in this case it is not the particular words that are nuisance, rather it is the now long well contested premises supporting archaic epistemologies, or worse, pseudoscientific social theories, that co-opted their use, which we are wise to respectively criticize and eschew (see also: Taleb, 2019).

[69] As distinguished from the thoroughgoing arguments about inquiry into life presented across (Cleland, 2012; 2019). The anthropocentric worry regarding L,K,I is not mentioned by Cleland (2012, 2019). And it is not the thoroughgoing argument to which preset response is directed.

[70] Carroll in discussion with Millière is making appeal to considerations by Bartlett in Carroll (2020) who in turn makes appeal to Bartlett & Wong (2020). Relatedly, the latter seeks to include "learning" as part of a broader approach to a considered designation of "Lyfe." I do not see that this use of "learning" is claimed as a theory of learning, rather than as a device within the particular disciplinary inquiry. See below

—theorizing about them considered generally, especially as regards universal theories (Cleland, 2012). Such could be the case if, for instance, we discover something on or beyond Earth that challenges our understanding of L,K,I[71], or of course, if there is warranted demand to account for AI tools or other possibly challenging cases. Now, for the purposes intended by the *Life without definitions* argument—looking for life in lieu of an adequate universal theory and in recognition of the limits of definitional approaches (Cleland, 2012)—the reasoning makes a lot of sense. It is a formidable argument, one that has improved over time, and one we are wise to learn from in its emphasis on the value of searching for certain types of anomalies as spurs to discovery (Cleland, 2019).

Let us however distinguish between the purpose of looking for life on and off Earth, from that of present consideration of L,K,I while still benefiting from the soundness of reasoning where applicable. As regards the anthropocentric worry in AI tools discourse, we are expressly concerned with the human case in deployment of these tools and as regards related policy considerations. Even if our contemporary theories of L,K,I have room to grow and important limitations we need them now, and we can apply them credibly while still recognizing open theoretical questions. In short, the purposes, conditions and consequences of the *popular* anthropocentric worry consideration about life, are different from those of the learning here on planet Earth consideration even granting that serious contention with the theoretical concerns around representantiveness are requisite to comprehensive argument. Again, we should indeed recognize a "duty of care" in social domains (Cartwright & Ray, 2023). Of course, as noted in Cartwright (2015), we sometimes have to act in policy domains while waiting on more refined theoretical work. This may be fine, but we are cautioned that action should not proceed upon false pretense.

While granting that leaving open questions about L,K,I is theoretically prudent (as has been done across present consideration), it is nonetheless important to point out that where we must proceed on what available theory can offer, not any ol' theory will do. Privileging designations of L,K,I which aim to provide general accounts does demand proper theoretical and experimental bona fides to be non-arbitrary. Indeed one of the lessons from Cleland (2012, 3) is that it is not so much a definition, but explication amidst theory into which designated kinds factor, that warrants due consideration. Notice that the *Life without definitions* perspective starts *somewhere*; it is not arbitrary in its emphasis on "*tentative* (vs. defining) criteria to search for *potentially* biological *anomalies* (vs. life *per se)*" (emphasis in original)(Cleland, 2019, p.723; ICE at Dartmouth, 2020, 43:38-45:04; 2012, 3.2).

General theories of L,K,I must allow for successful inference, especially in solving particular problems in the world, bonus if they help explain the discourse surrounding problems under analysis (Dewey, 1939). They should do so systematically, rigorously and productively (Cartwright, 2015; Dewey, 1939). Better if they are multiply corroborated with resources marshaled from across disciplines, towards being "short, stocky, and tangled" (Cartwright, 2015,

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[71] The thoroughgoing argument around the study of life includes a more detailed account of the theoretical concerns of unrepresentativeness and perils of reasoning from a single example, a comparison of which to theories of L,K,I is out of present scope. Subsequent inquiries into L,K,I will require greater engagement with related concerns and more subtle analysis than is here provided.

p. 4). They must have theoretically sound, appropriately extensive reasons and experimentally established results, that stand "firmly attached to the ground". We want to be able to get the easy cases right, have carry on the historically and anticipatedly tough ones (bacteria, plants, organoids, etc.), and make as much headway as possible in ruling out alternative explanations (Cleland, 2012; Dewey, 1939). We definitely want to be able to share something insightful about learning in the human case.

Even the most formally or technically astute accounts of "L,K,I","S,P,A", or like, employed in AI tools discourse barely even approach these marks, or even really claim to in the stricter scholarly work[72]; for example, respectively: "sensory" or "perception" in LeCun (2022)[73], or "intelligence" in Chollet (2019)[74]. And—despite what casual or industry conversation may suggest—the research purposes are, in general, more explicitly tied to fairly specific engineering, disciplinary or business problem solving pursuits (Chollet, 2019; LeCun, 2022)[75].

More to the point, by any account, the human case *is* relevant and important as our presently exemplifying instance of L,K,I. The "L,K,I"s on offer from AI tools discourse do not at present put serious pressure on the presently prevailing theories of bona fide L,K,I. The same theoretical justifications for being open to non-S,P,A or "*S,P,A*" designations present obstacles to their adoption; the blade cuts both ways. If one grants that AI tools lacking in S,P,A (or having "*S,P,A*") are intelligent, one would still face the rather daunting task of establishing that this designation is grounded by adequate theoretic and experimental treatment covering and distinguishing determinate singulars of various kinds and comprehensively explaining particular

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[72] Friston et al. (2016) comes to mind as a candidate exception, though seemingly by the researchers' concession are taken as "metaphorical[…] process theory" (p. 862) for phenomena under consideration. I do not here take this work up. I appreciate the use of products from the work of Friston and collaborators in Barrett (2017) and Johnson & Schulkin (2023).

[73] A notice, however, for Section 8.2.1 "Could this Architecture be the Basis of a Model of Animal Intelligence?" (LeCun, 2022) …which I will leave for others with more esteem than I in various fields of relevance to judiciously take up, or not. I would recommend engagement with Chirimuuta (2024) in general to those pursing this type of inquiry.

[74] I do not deny that these respective accounts are both important and useful, particularly for their more narrowly fashioned objectives. Both channels of pursuit have already produced interesting results. I caution us against using fruits of these works in a way that runs too far, too fast, and too loose with the respective "foundings" (Efstathiou, 2009 as cited in Cartwright, 2016, 2.) as if they merit proper logical or scientific standing as sufficient general theories of L,K,I or S,P,A. Even—or especially—if they continue to produce results seen as desirable within disciplinary study and commercial activities (see: Chirimuuta, 2021, 2023, 2024). Significantly, both researchers do much to engage in public discourse tempering the excesses of AI hype with varying degrees of attention to the limits of available research (considered below). (See also: References; footnote 76 for comment on disclaimers and limitations in Chollet, 2019)

[75] Of course, there are avowedly speculative and aspirational aspects of these works. Notice: terms like "human-like" (Chollet, 2019), or "machines that learn more like animals and humans" (LeCun, 2022, p. 1) etc. (see: footnotes 74 & 76)

cases of interest (Dewey, 1939). Simply granting these requirements by fiat, or by proleptic presumption does not supply adequate grounds.

We have good reasons for doubting that attempted designations of "L,K,I" that preclude account of S,P,A or rely on scientifically narrow operationalizations of the latter have proper bona fides. As was shown with the *Sparks* example, traits taken as relevant to "L,K,I" in the context of AI tools, are somtimes arbitrary and vague. What "L,K,I" terms designate regarding AI tools often have to do with apparent traits rather than those verified upon sound experimental and theoretical engagement to be distinguishing (Dewey, 1925, 1939). If formally sophisticated designations from the AI tools discourse are offered as lending to bona fide theories, they risk failing to allow for rigorous and productive implicatory relations across reasoning that promote systematic inference applicable to facts of the cases we want to be able to explain, easy or hard. How are S,P,A·L,K,I involved in behavior, or not? …how do they co-operate in different contexts with one another or other behaviors, or not? To claim something is a *kind* of intelligence or perception, explanation must be available as to how requisite general designation of these terms pertain to singulars, the supposedly different generic kinds, and how said kinds are distinguished from each other (Dewey, 1939, Ch. XIV)[76].

The express clarion call of the AI tools industry is various versions of pegging to and (aspirationally) surpassing the human case whatever that might be taken to mean (Columbia Engineering, 2024; OpenAI, 2024). Public policy regarding the AI tools about which such claims are made is expressly concerned with humans and other organisms. Under these circumstances we should not over-index upon speculative, tenuous, or narrowly fashioned theories (when even offered) from nascent fields. We should instead draw from well established inquiries into L,K,I. In this context we are wise to prioritize the human and organismic examples, for the consequences on their lives are concrete, not abstract. In this context, the moral argument against uncritically using posited literal interpretations of "*L,K,I*" in description of contemporary AI tools aligns well with the best available scientific and philosophic work.

Merely assuming an AI tool is intelligent for the purpose of study does not answer the question of whether or not enforced commensuration for or beyond narrowly defined objectives

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[76] When, for instance, it is claimed by Chollet in Carroll (2024b) that LLM's have "non-zero intelligence" (48:08), it is taken to mean that according to a specifiable formalization (i.e."so intelligence according to me[…]", 49:01), such is taken to be the case. Notably, upon inspection, as respects the formalization cited, Chollet (2019) appears to disclaim purporting to a more general account, and is fairly emphatic about both its primary objectives and the limitations of modeling (Chollet, 2019, p. 27-28, p. 57). Perhaps claiming, in the context of term of art discourse, that LLMs are a kind of intelligence (whatever modifiers, or qualifications we choose where appropriate), is fine so long as we avoid leaping too far beyond the contestable premise and requisite assumptions. But such claims, if taken more generally, face similar concerns as "according to our metrics" (NYUCMBC, 2023) noted above, along with those here noted. This particular operationalization is not a *bona fide* theory of intelligence pertaining to humans that offers generalization covering the range of particular examples we want to be able to explain and, at least on paper, is not so claiming. The designation in Chollet (2019) does however maintain distinction within AI tools discourse in: indicating *specifically* what is meant by "intelligence", acknowledging important limitations of the stated formalization, benefiting from being informed by *actual* insights into human intelligence as contrasted with state of the art computational techniques.

is warranted. It does not suffice for institution of verifiable generalizations or comprehensive theory. Using a narrowly operationalized version of terms like “concept” or “perception” or “L,K,I” in AI tools research does not of its own confer a capacity to establish their respective relevancies to a more generalized set of facts or their full formulation. But we do know that using metaphors in discourse has limits and consequences, so the decision to treat such terms literally or figuratively should not be taken lightly (Thibodeau et al., 2017). Let us hear in detail how specific designations of “L,K,I” or “S,P,A” operate within broader theories concerning undisputed cases, or about their limitations therin, prior to becoming too confident about their validity beyond the restricted domains of their possibly warranted applicability.

When we hear terms like “learning algorithm” or “cognitive" in AI tools discourse proffered as pertaining to literal accounts of L,K,I it is important to understand that such employments often rely on dubious metaphysical assumptions (Chirimuuta, 2023, 2024; Dewey, 1916, 1925, 1939). The ideas that learning, literally, is algorithmic or that intelligence is necessarily computational in nature are posits[77]. Treated as literal accounts of learning or intelligence—beyond their potential value *as* posits in guiding research—they are fancy ways of begging the very questions at issue. Perhaps these posits are in time verifiably established in experimental application as part of comprehensive theories of L,K,I; but then again, maybe not[78]. The fact of the matter is that as of today the capabilities conferred to AI tools by way of so called “learning algorithms” in tandem with a range of other dramatically human intensive engineering techniques suffer from the very limitations noted across this paper and elsewhere, and are rather

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[77] There are still good questions left to be answered regarding refinement of what is meant by “algorithm”, and related prospects for future discoveries and applications (Gurevich, 2014), likewise for “computability” (Cleland, 2004; Olszewski et al., 2013). One may grant the relevance of computational aspects of L,K,I (or, say, perception), or the value of computational analogy, without requirement that computation be the whole kit and caboodle (see: Chirimuuta, 2024, esp. Ch. 4).

[78] Such metaphysical commitments are unnecessary to a naturalistic account of L,K,I, even if their *positing*—treated as such—is helpful in furthering naturalistic accounts furthered by the fruits of scientific study (Dewey, 1925, esp. Ch.V, 1939, esp. Ch. I). Such views are unnecessary to a naturalistic account of learning, at least. I will draw attention to recognition in Penrose (1994) that even if we were to sufficiently move beyond purely computational or algorithmic (he makes no distinction) accounts of “mind”, it is not thereby implied that explanations lie “beyond the powers of science and mathematics” (p. 49) (to avoid misinterpretation here I affirm that I, like others and the author, view the second half of *Shadows of the Mind: A Search for the Missing Science of Consciousness*, and related work to date of which I am aware, as precariously speculative). Chirimuuta (2024) makes a somewhat related note regarding “hypothetical machines made through synthetic biology” (p. 266). Though, both instances are primarily concerned with “consciousness”, which I am not. Moreover, I am keen to simply point to the position taken in Carroll (2021); though I do not view the motivating subject-matters, particularly as relates to consciousness, as pressingly germane to discourse about contemporary AI tools.

much more suggestive that "hey, maybe we are missing something"[79]. One can understand the use of the term "learning"' in the phrase "learning algorithm" as a term of art, in a way similar to our understanding of the former's value in common conversation about AI tools. But there is not much at present to suggest we should take the term or phrase literally, quite the opposite. Likewise, the idea that the brain is literally a computer elides many significant disanalogies, and relies on austere and relevant simplifications (Chirimuuta, 2024, esp. Ch. 4, 9). Cognitive scientists and others are wise to repeatedly caution against over-emphasis on the brain and to highlight the relevance of broader evolutionarily conditioned organismic activities, materials, and contexts (HTFLU, 2024; Chirimuuta, 2024; Damasio, 2019; Dewey, 1916, 1939, Godfrey-Smith, 2023; Johnson, 2006). Similar concerns plague rigidly physics-based accounts, as pointed out by Cartwright in Penrose et al. (2000).[80]

It is here that we must address AI hype. AI hype relies, at least, on ambiguity and vagueness. **AI hype** treats common sense or tech vernacular usage of terms like "S,P,A·L,K,I" as if they are logically grounded, or scientifically verified. Terms like "L,K,I" are treated as if they have earned the status of designations process to adequate generalized accounts amidst sufficient theoretical treatment, rather than simply being posited as such. AI hype often uses scientific-sounding language regarding terms heavily contingent upon the particular studies, or contexts, in which they are employed, be those purposes scientific, economic, or political. AI hype often uses terms like "S,P,A·L,K,I" as if to mean something generally applicable or similar across familiar engineered and organismic subject-matters, scientifically distinguished, and literally evidenced in the world a la purported demonstration by AI tools. This approach contrasts with using "S,P,A·L,K,I" as useful but limited figurative language for describing AI tools or as narrowly operationalized terms of art[81]. This can cause confusion.

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[79] I agree with views presented across Dewey (1916, 1925, 1929, 1939) and Balz & Dewey (1949) that the numerous problems generated by the underlying epistemological dilemmas germane to rigidly computational accounts (related to the Eddington concern noted above), and literal treatment of "*L,K,I*" in AI tools discourse, are as irrelevant to bona fide theories of L,K,I as they are "insoluble" and indicate that considering other ways forward is worthwhile. This recognition has been so well developed and so prevailing that I will not at present develop the point further than has here already been done through the lens of contemporary subject-matters. I agree with recognition in Von Neumann (1958) about the prospects of inquiry into subject-matters under present consideration "alter[ing] the way in which we look on mathematics and logics proper" (p. 2), but for reasons perhaps differing from those there suggested. Gurevich (2021) and Gurevich & Blass (2024) are prudent to encourage deeper engagement with logical theory in the context of computational techniques.

[80] It seems to me a fairly modest proposal to suggest the relevance of physics, and chemistry, and biology, and physiology…onward through to social-cultural conditions for account of such complex subject matters as L,K,I in humans, at least (Dewey, 1925; related: Cartwright in Penrose, 2000). It seems to me quite a leap to assert solely [arbitrary discipline here] as the s*ummum bonum* (Dewey, 1916). See also: Dewey on "mechanistic metaphysics" (Dewey, 1925, Ch. VII, 1939), on sense of reliance on math and physics (Dewey, 1929, p. 218, 1939, p. 438), on mechanism (Dewey, 1916, p. 343-344, 1929, p. 247-248; see also: Cartwright, 2009, esp. #3.)

[81] See Chirimuuta (2024) on simplification in science and role of analogy.

Often folks simply do not sufficiently explain what they mean to designate by terms like "S,P,A·L,K,I", and thereby may avoid having to substantiate claims which rely upon their employment (ex. "superintelligence") (OpenAI, 2023). This is one concern about vagueness[82]. What does "human-level" or "human-like" mean and how would we know we are there without adequate hypothetical designations of L,K,I with requisite logical standing amidst a substantive theoretic treatment? Without experimentally verified designations, and theoretical accounts which promote successful systematic inference and rule out alternative explanations, literal treatments of "*S,P,A·L,K,I*" in description of AI tools lack the logical grounds needed to be non-arbitrary (Dewey, 1939).

It is here useful to introduce a phrase that is relevant to possible interpretations of the examples explored above and **AI hype** more generally:

> '**inference by pun**': drawing inferences that follow legitimately from a claim employing the same words but which is not the claim we have established, whose meaning is fixed in part by the test procedures we have used to establish it." (Cartwright, 2016, 1.)

Arguments about "S,P,A" and "L,K,I" in the context of modern AI tools risk inferring by pun. It is exactly this pitfall this paper has studiously sought to avoid[83]. It is potentially fine and somtimes necessary to make use of terms like "S,P,A·L,K,I" especially in qualified or modified form e.g. "machine learning", "artificial intelligence" for the sake of conversation, study, or otherwise. But we benefit from awareness about the limitations of so doing (Chirimuuta, 2024). As well as I can tell, this recognition is for the most part consistent with how many leading engineers already operate (Li & Etchemendy, 2024). It is perhaps more consonant with how some veterans of the related fields operated prior to the hype era, though not entirely (Chirimuuta 2024, Ch.4, 2023; Institute for Science and Society, 2021).

This paper does not establish that *in principle* AI tools cannot one day be made to simulate or model some, and excel at many specifiable versions of the abilities of humans or other organisms. We have every reason to believe computational, engineering and scientific techniques will continue to advance, with some of the usual caveats about social and technological progress. In some circumstances it may simply be beside the point whether or not these tools learn proper; like other tools, they are still powerful and prone to misuse. But of course in many contexts the distinction *does* matter, and it matters a lot. The present argument is not even to say that S,P,A·L,K,I have to be construed from our current understandings of

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[82] There are related though deeper concerns about vagueness in logical theories germane to modern computational appliances (Bentley, 1945a&b; Dewey, 1939). More explicit contention with these concerns is out of present scope. Sensitivity by Gurevich (2021) and Gurevich & Blass (2024) to some of the logical concerns pertaining to AI tools has been noted above.

[83] See methodological concerns noted above. The resolution of such concerns as regards the present inquiry is not clinched (Dewey, 1939, p. 435-436). But, alas, we must start somewhere. How many of the limitations of the present inquiry are due to oversight, compared to those inherent or contemporary to the fields, methods, technologies, subject matters under consideration?

humans, or organisms of earth cases in ultimate rendering. Like a pragmatist before me, I do not intend to issue and edict (Dewey, 1922, p. 117) against usage of particular words; this is not an asinine point about terminology. What has been pointed out is that if one uncritically uses "S,P,A·L,K,I" terms literally in describing or studying AI tools it leaves the questions as to the matters thereby designated just where they stand: unsettled (Dewey, 1939, p. 248). Better to acknowledge this than to overlook such a critical recognition. We should avoid exacerbating risks of mistaken inference, large as they already loom in ordinary human experience.

The present paper builds upon a theory characterizing learning, knowing and intelligence from a place of verifiable, experimentally corroborated situation rather than upon unduly vague, arbitrary, or rigidly formal basis. The theory has predictive, explanatory, and problem solving formidability for the human case. With some refinements, it is well positioned for further inquiries concerning other organisms, difficult cases, and for the study of AI tools and their deployment. It also stands to account for otherwise confounding features of popular, and scientific discourse about AI tools. It has the benefit of pointing towards ascertainable criteria from which to distinguish the capabilities of contemporary AI tools from abilities of humans and other organisms, until or unless we have good reasons for supposing otherwise. Of course there is work to be done, and this is just a start. Hopefully, movement towards more suitably grounded accounts of S,P,A·L,K,I can contribute to amelioration of the confusion wrought by unfounded literal usage of "*S,P,A·L,K,I*", reliant as they are upon perplexing metaphysical stances that fail to (or disclaim responsibility to) account for bona fide human, and organismic cases.

We will have to deal with the consequences of scaled AI tools in social contexts in any case given current social-cultural conditions. We should aim for achieving the benefits of these powerful new tools without having to incur too severe costs. The least would could do is be careful with language (in a full sense of that term) (Barry, 1983). Better language and understanding within the broader communities of which we are a part will help us in our reasoning, the obverse is also true. The most likely outcome of employing confused "*S,P,A·L,K,I*" designations is the hampering of both scientific study and responsible societal use of AI tools. This recognition is relevant to disciplinary studies, business strategy, and public policy. When we hear terms like "superintelligence", we are wise to ask for clarification about what is meant, and what might be left out (OpenAI, 2023; Chirimuuta, 2024). What assumptions underly such pontifications? Are they well founded? It is important that we better understand what purposes particular designations of terms like "S,P,A·L,K,I" are meant to meet, and their capacity (or not) to so do (Dewey, 1925). Recognizing the conditions and consequences, the origins and applications, the limits of different technical or trendy employments of such terms will better enable us to solve the types of problems in which we are interested, while helping us to avoid some of the hazards of AI tools' misapplication in social settings (Dewey, 1925, Ch. VIII, 1929). It will help us to better claim the economic benefits, make more strategic investments, and better mitigate intolerable risks. Let us unburden ourselves from the daunting and contorting challenge of setting for ourselves unrealistic expectations sure to cause disappointment and exacerbate technological misuse. We are wise to strive for honesty and humility, to strive for accuracy and precision where required and potentially achievable, and to learn from history where plausible (Cartwright & Ray, 2023; Chirimuuta, 2024; Tufekci, 2024; Winchester, 2018).

As such, we should do more to invest in the liberal arts especially art, philosophy, and logical theory, especially in rigorous commerce with our technical fields of prominence[84]. Spaces of such collaboration can provide venues whereby better tools can be produced to help us solve social, technical, policy, and product challenges. They may also serve as sites of economic opportunity and social import. We should prioritize interdisciplinary expertise especially from artists, educators, and philosophers of learning, when considering questions about human S,P,A·L,K,I. We should make wiser investments in helping people learn, perhaps as a multiple of investments in trying to make machines "*learn*". Should the gulf between the two become too large we may risk jeopardizing the conditions under which both objectives are possible (Orr, 1996).

We should do more to ensure informed consent in the implementation of AI tools, and offer abilities to opt-out of unwanted automation as a default practice. Such practices are particularly called for where opacity is intractable; especially where underlying algorithms are those described by O'Neil as important, secret, and potentially destructive (Frick, 2016). We should do more to visiblize, explain, and help people learn about the development, operations, deployment, and use of AI tools. Likewise regarding their true costs where plausible, and we should be as clear as possible when it is not. We should do more to cultivate reliable and trustworthy institutions surrounding the development and scientific study of AI tools (Bristol Humanities, 2020; TED Conferences, 2013). We should place human judgment and shared responsibilities at the fore and not pretend as if anything like judgment is what AI tools are doing. We should recognize and work to ameliorate the systemic limitations placed upon good judgment within the social processes and cultural institutions surrounding the development and deployment of AI tools (see: Cartwright & Ray, 2023 p. 13-16).

Systematically discounting and externalizing the costs of AI tools, while eliding their disanalogies with human behavior is an avoidable peril of our current approach (Chirimuuta, 2024). Would AI tools seem as promising were we to pay closer attention to their actual (as opposed to unfounded specter) harmful effects? Harmful runaway computational effects, so often at the expense of human understanding, good judgment and insight, limit our ability to be successful in meeting global challenges and those of everyday living. It does not seem to be a coincidence that just as the world is so rapidly changing we are most seduced by lore of an ultra count-on-able "*reasoning*" machine. Sometimes fear of the unknown prompts flee to imagined sanctuaries, or retreat to juvenile habits of bygone ages. The more rapidly conditions change, the more we are able to see that the past is not unanimously like the future. The more substantially future conditions differ from those of the past, the less helpful will be rigidly automated procedures. Pretending as if this is not the case places in jeopardy our already existing and most powerful forms of creative intelligence: intercultural teams and ecosystems that learn and cooperate well to solve shared problems. And yet we still seek to benefit from the legitimate and major potential of AI tools in business, healthcare, accessibility, learning about the natural world and as tools for creative peoples.

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[84] In this encouragement I have in mind a body of work from Nussbaum, discussed in brief in (RSA, 2010).

In a recent talk, Professor (Admiral) McRaven emphasized the importance of learning as a national security imperative (McRaven in TheLBJLibrary, 2023, 32:15). I agree. With the stakes so high, and such profound social implications, it is all the more important to avoid confusing learning with "*learning*". But of course, national security is not the primary reason learning is important. Learning is how we survive and experience life's wonders in society and nature. Ultimately, cultivation of conditions that better allow people across cultures to learn and cooperate well in address of shared challenges is our most intelligent choice. The heart of this insight has long been recognized by educators the world over throughout history.

I would like to close by noticing that while Jefferson wrote that "honesty is the 1st chapter in the book of wisdom" (Jefferson, 1819), it is Von Neumann's *Collected Works* which begin with remarks concerning the nature of logic (Von Neumann, 1961). I encourage engineers who are serious about learning about learning to start there. 🖖🏽

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