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Beyond the mirror: an action-based model of knowing through reflection

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Epistemic reflection involves the creation of qualitatively new knowledge. Different models have been proposed to account for new knowing through reflection that have typically been grounded in an information-processing framework. However, there are in-principle arguments that information-processing approaches preclude the emergence of new representation altogether. Accordingly, any information-processing account of knowing through reflection is plagued by emergence issues. After discussing some of these emergence issues for four prominent models in the cognitive science literature, an alternative action-based model of representation and reflection is presented called interactivism. Interactivism's model of representation, as grounded in action anticipations, serves as the foundational emergence needed to account for subsequent knowing through reflection. After introducing the interactivist models of representation and reflection through knowing levels, some of the implications for consciousness, enculturation, language, and developmental methodology are discussed.

KEYWORDS

epistemic reflection, action-based approach, interactivism, emergent representation, interactive knowing, enculturation, language as interaction

1 Introduction

Reflection is often characterized as serving one of two functions: the creation of qualitatively new knowledge, or qualitatively new capabilities involving self-/emotion-regulation through some sort of distancing process. While most researchers incorporate some role for language in the reflection process, a basic division can also be drawn between approaches that emphasize the developmental origins of reflection as a cognitive activity vs. those who argue that language is the original locus through which reflection takes place. In the current paper, we will explore efforts to explain the development of reflection as a cognitive activity for emergent knowing, but we will also indicate the subsequent role that language plays in this process. The paper will proceed by briefly discussing several different models that are all united in trying to explain how reflection enables the creation of qualitatively new knowing: these include Mandler's (2004) perceptual analysis, Karmiloff-Smith's (1992) representational redescription, Perner's (1991) meta-representation, and finally, Zelazo's (2004) levels of consciousness model. This discussion will ultimately reject the adequacy of these models due to their information-processing assumptions and inability to account for representational emergence. The alternative interactivist model is an action-based framework that contrasts with an information-processing

ontology (Bickhard and Terveen, 1995; Bickhard, 2024)[1]. This model will be introduced and discussed in the context of interactive vs. reflective knowing, primary consciousness vs. reflective consciousness, and internalization vs. enculturation as the process of socialization. Finally, the role of language for reflection will be addressed in terms of its differential relevance for both pre-reflective and reflective development with some implications for developmental methodology.

2 Qualitatively new knowing: existing models (Mandler, Karmiloff-Smith, Perner, and Zelazo)

At the core of the developmental sciences are issues of origins in general and the issue of representational/knowing origins in particular. Nativist positions generally side-step the issue of origins by assuming that essential knowledge structures are provided to the species through some unspecified evolutionary process. The theoretical motivation for nativism comes from learnability arguments that innateness is *necessary* for learning to get started (Chomsky, 1959; Fodor, 1975). Contemporary empiricist positions actually agree with the need for some innateness but disagree about the amount and type (e.g., feature representations or full concepts, a few concepts or many concepts, for a full discussion see Allen and Bickhard, 2013). However, empiricist positions are more developmental and pursue more powerful possibilities for learning such that they assume that qualitatively new representations/knowing are produced during ontogeny. That said, both nativist and empiricist positions tend to assume a background information-processing framework with implications for the nature of representation that make qualitatively new representations (i.e., emergence) impossible. For information-processing approaches, the nature of representation is in terms of some sort of encoding relationship with the world (Bickhard and Terveen, 1995; Bickhard, 2009a).

Encodingism is the assumption that foundational representations are encodings. Encodings are constituted by a correspondence relationship with what they represent, and these correspondences are often assumed to be causal, nomological, or informational. Regardless of the specific nature of the relationship, encodings are representational stand-ins such that they must derive their content from some other source of representation. For example, the rings in a tree encode its age in years. This is a factual/informational[2] relationship that is only representational if there is an epistemic agent who already knows about rings in trees, annual growth, and the relationship between the two. Without an interpreting agent, there is no content for the encoding and its relationship to what it represents. Thus, as an account of foundational representations, encoding approaches are incoherent. What's needed is an account of emergent representation in which representation is emergent within a foundation that is not already representational and only action-based approaches have offered to provide such account (Allen and Bickhard, 2013). While Piaget is the best known action-based approach, it is the interactivist model that will be presented in Section 2. Before that discussion, we present four empiricist models that all assume that learning and development involve qualitative changes in the nature of the representations that can be constructed through reflection; however, all four models are also committed to an information-processing framework that precludes the possibility of emergent representation.

2.1 Perceptual analysis (Mandler)

Jean Mandler's model has the laudable goal of trying to account for the foundations of meaning itself (Mandler, 2000, 2004). We refer to this issue as the *foundational emergence* problem. One avenue for resolving this issue is to take a nativist stance (i.e., foundational meanings/representations are innate). However, such an approach does not solve the issue so much as it ignores it. This leaves empiricism as the alternative—and in the current state of the field, some form of information-processing empiricism. While modern empiricist approaches to development also start with some amount of innate conceptual/representational base (Gopnik, 2003), Mandler's model attempts to address the developmental emergence of such a base. This model commits to a sharp distinction between perception and (meaningful) conception, in which the latter is supposed to derive from the former through an abstraction process—*perceptual analysis*. Perceptual analysis is a volitional process involving attention to certain aspects of the perceptual data stream in order to abstract a simplified rendering of the input. This process also involves "recoding" the format of the abstracted content into "explicit" form which enables "…one to describe, recall, or think about something new, not just recognize it" (Mandler, 2004, p. 18). Mandler grounds much of her theorizing in a set of empirical findings in which very young infants seem to have abstract (i.e., conceptual) categorization abilities that include the functions of objects (in addition to their perceptual features).

While these empirical findings should be a constraint on any adequate theory of foundational meaning, Mandler's account has a number of theoretical problems that appear to be unsolvable (see Müller and Overton, 1998 for a full treatment of the model and its limitations). Two of the most relevant of these problems concern the abstraction process. Abstraction is supposed to produce meaningful/conceptual categories. But how can the correct features be abstracted without already knowing what the

1 Tomasello (2024) has recently proposed an agency-based model of reflection that is also more pragmatically oriented in its background assumptions. Interestingly, it also shares the basic distinction between what we call interactive vs. reflective knowing in terms of executive vs. metacognitive regulation.

2 We contrast the meaning of "information" in information theory with the semantic meaning of it—as mental representation with truth value, intentionality, and content. Informational relationships in the former sense are integrated into the interactivist model in terms of epistemic contact (i.e., differentiation/detection) not epistemic content (i.e., representation, Bickhard, 2009a). Detected correlations need to be accompanied by anticipations, otherwise they mean nothing to the organism. In this paper, when we refer to "information," it is in the information theoretic sense, unless stated otherwise.

category is supposed to be? Mandler's empirical works suggests that perceptual features like object salience or similarity are not sufficient—correct abstraction requires already knowing which features should be abstracted. For the second issue, abstracting relevant features means taking a subset of the perceptual data, but a subset of the input stream does not give new data. A subset may give new access to volitional processes, but there is no new data *per se*. Further, both problems assume that feature representations are available as distinct "pieces" of an overall representation (i.e., a feature nativism). However, perceptual analysis was presented as an alternative that could avoid the pitfalls of nativism. This means that in addition to the problems with abstraction as an account of new content, the need for a feature innateness/foundationalism means that such a model is open to the same emergence limitation as standard nativist accounts—that representations *must* already be assumed in order to explain the origins of new representations, whether in development or in evolution (Allen and Bickhard, 2013). Lastly, a third issue is that changing formats does not change the content of the data, nor does it make the data more/less explicit (more on this in the discussion of Karmiloff-Smith). The interactivist account of representation in the current perspective will provide a model for foundational emergence that does not have the above problems.

2.2 Representational redescription (Karmiloff-Smith)

Karmiloff-Smith's model builds on the work by Mandler in terms of foundational meanings to explain a process for the subsequent development of new representations (Karmiloff-Smith, 1992). Karmiloff-Smith accepted much of the cutting-edge empirical conclusions coming out of the nativist research program in the 80 and 90's while also trying to transcend the contrast between domain-*specific* and domain-*general* learning processes (Karmiloff-Smith, 2018). Her domain-*relevant* approach attempted to explain how innate biases could result in a cascade of emergent developmental outcomes. Accordingly, Karmiloff-Smith provides an account for the emergence of new forms of representation that go beyond the foundational emergence of conceptual from perceptual. We refer to this issue as the *subsequent emergence* problem. Similar to Mandler, Karmiloff-Smith also appeals to changes in format to account for new content. Different from Mandler, Karmiloff-Smith adopts a more robust constructivism in that there are *internal sources* of change such that cognitive processes derive new content from the overall organization of old content (e.g., information embedded in problem-solving procedures). This is a process of *Representational Redescription* (RR) in which the implicit content of prior knowing is made explicit and constitutes new representational content.

The main function of RR is to facilitate flexibility, and thus, control of behavior relative to new purposes. This is a consequence of the increased operations that can *access* the more explicit representations that eventuate in conscious access, linguistic access, and theory construction processes (cross-domain integration). The RR process suggests four types of representations: one implicit (I) and three explicit (E1—unconscious, E2—conscious access, and E3—conscious and linguistic access). Implicit representations are procedures (or sensorimotor encodings) that have a sequential organization that is encapsulated and inflexible. These representations are used in response to external stimuli (i.e., they are not internally driven). The RR process involves *reformatting* the sensorimotor encodings through abstraction so that more operations can access their contents. It is an abstraction in the sense of extracting the sensorimotor information while losing the perceptual details. Once the newly formed E1 representations are available, they can be used in more flexible ways (e.g., understanding the analogy between a Zebra and a crosswalk sign). This means that the creation of E1 representations precedes any sort of reflection about potential relations embedded in the sensorimotor procedures. At E2, representations are in a format accessible to consciousness but not verbal report. Finally, E3 representations are needed to use language because they involve a "cross-system code." This makes language a tool that can be used after two or three iterations of the RR process have abstracted them into the correct format.

Karmiloff-Smith's theorizing involves developmental elaboration beyond the model of foundational meaning provided by Mandler's account. This elaboration is both at the broader level of development and at the specific level of RR. Similar to the perceptual analysis account, the issues for abstraction as a source of new content apply here as well. However, the focus of RR is on how changes in format affect explicitness, which enables new forms of knowing. There are two issues here: (1) does format affect the explicitness of the representational content? (2) does format enable new forms of knowing? For (1), as Fodor (1998) indicated, all encodings are explicit about something and so the idea of implicit representation cannot be with respect to the content of the representation itself. For example, changing the format of the letter "S" to "…" does not alter the explicitness of either representation[3]. What changes from "S" to "…" are the sorts of things one can do with the new encoding (Bickhard and Terveen, 1995). The dots can be sent over telegraph lines while the letter cannot. Accordingly, for the RR model, the implicitness is in terms of how the overall systems can (or cannot) make use of the (explicit) content of the "implicit" representations. This means that the changes in format from sensorimotor encodings to E1 do not involve new content for the E1 representation (or E1 to E2 or E3). However, if the changes in format through the RR process do not involve the emergence of new content, then the increasing access does not involve new forms of knowing. That is, issue (2) is also answered in the negative.

At the broader level of development, Karmiloff-Smith has captured several important features. Her theorizing suggests that the internal dynamics of cognition are a source for change with recurrent phases of development that oscillate between behavioral mastery and cognitive reorganization. This makes it important to consider how the same behavioral performance at two different ages may in fact be a consequence of different cognitive processes. This means that *U*-shaped development is not noise to be averaged away but an important constraint on developmental

3 Encoding content is borrowed from or defined in terms of other already available content—e.g., "…" from "S." It cannot create new content. That is the central problem with "information" processing models.

explanations (see also Gershkoff-Stowe and Thelen, 2004). The theory also makes multiple distinctions about different forms of knowing. Representational multiplicity is important because there is a strong tendency in development psychology to ignore the possibility that children at different ages have qualitatively different ways of knowing (adultocentricism) and to thus not control for such possibilities in "empirical" research (Allen and Bickhard, 2013). Finally, Karmiloff-Smith's theory attempts to reconcile the emergent constructivism of Piaget's theory with the representational innateness of nativist research programs. In this respect, it shares an overall goal and structure with Carey's (2009) more recent model of how to reconcile innateness with qualitative development. However, in both cases, the requirement of an innate representational foundation for learning and development involves a notion of representation that precludes the possibility of genuinely new representational content (i.e., encodingism). Further, an adequate account of new content through learning obviates the necessity for an innate foundation. Thus, either qualitative emergence in development is impossible, or, there is no necessity for (homuncular) innateness (Allen and Bickhard, 2011).

2.3 Meta-representation (Perner)

Perner (1991) has developed a model of meta-representational development to account for changes in false-belief understanding and a number of other qualitative changes around age 4. This model suggests that meta-representational development involves new knowledge in that children become able to represent representational relationships, and this has cascading developmental consequences. In particular, children with meta-representational abilities are able to understand misrepresentation (of people with false-beliefs or objects like signs and photographs), the representational nature of language (i.e., that words are not properties of what they represent), and the distinction between sense and reference as manifest in understanding that Clark Kent and Superman are the same person (Perner et al., 2002; Iao et al., 2011). Although this model has some basic convergence with the interactivist model to be presented below, it has been discussed in detail from the interactivist perspective previously (Bickhard, 1992). The most relevant conclusions from that discussion are that no account of foundational emergence will be possible given the (encoding) assumptions about representation and that reflection seems to already be needed for even the basic representations of infants (not just the meta-representing of preschoolers).

2.4 Levels of consciousness (Zelazo)

A more recent model for how the development of reflection enables new forms of knowing, representing, and acting comes from Zelazo (1999, 2004, 2015). This model is similar to Karmiloff-Smith's in that it is: focused on levels of subsequent emergence, developmentally rich, conceptually coherent, and grounded in both behavioral and neural data. It is also unique in terms of the focus on consciousness as being relevant for modeling changes in knowing. Nonetheless, as with Mandler, Karmiloff-Smith, and Perner, the underlying information-processing empiricism creates limitations for how well the model can account for epistemic reflection (i.e., the emergence of new knowing through reflection).

Much of the recent empirical motivation for the "emergence" process in this model comes from brain studies in which there seems to be "iterative reprocessing" of information within and between areas of the brain (Zelazo, 2015). However, if the technical sense of information relevant for brain studies cannot account for the semantic sense of information relevant for cognition, then the implications of these data are unclear. Further, the myriad reciprocal projections of the brain can also be characterized as supporting oscillatory processes, rather than semantic "re-entrant" processes, and oscillatory processes have been argued as a neural foundation for the anticipatory processes that constitute the core of an action-based "semantics" (Bickhard, 2015, 2024).

Regardless of the status of re-entrant processing, the original reflection model is mostly explicated in terms of theoretical considerations, and that will be the focus of our analysis. The Levels of Consciousness (LoC) model is an account of changes in the reflective capabilities of children (Zelazo, 1999, 2004). New reflective capabilities enable more complex representing through the creation of new representations (i.e., of relations between lower-level representations and of hierarchical control structures). Zelazo highlights intentionality as the key feature of any form of consciousness. This is intentionality in Brentano's sense of being *about* something and for motivating action [1973 as cited by Zelazo (2004)], but there is no account of the emergence of intentionality itself. Instead, intentional representations/descriptions of objects in semantic Long-Term Memory (LTM) are triggered by actual objects from the environment. These representations then trigger the most salient action pattern that has been learned through association (e.g., a rattle might trigger the action pattern of sucking at one age and shaking at another). This form of representing is supposed to constitute basic consciousness (i.e., minimal Consciousness or minC).

Although the mechanism for ascent in the LoC model is the same (i.e., recursion), the most qualitative change in representing takes place in the transition from level 1 to level 2 at the end of the 1st year of development. This change involves a constitutive role for language in terms of labeling. Labels are supposed to provide an enduring trace to segments of the perceptual input stream that constitutes basic conscious experience (i.e., minC). These traces are representations proper in that they can be "decoupled" from the ephemeral flow of experience and manipulated in working memory as part of top-down control (e.g., representation of an occluded object that can serve as a goal). However, for labeling to serve this decoupling function requires level 2 consciousness to create identity relations between two moments in the input stream from first-level consciousness. Thus, the construction of these identity relations require reflection through *recursion*. Recursion is understood in the sense of a computer program that calls on itself as a parameter [e.g., Factorial (n) = n * Factorial (n-1)]. More recent discussion about reflection is in terms of *iterative reprocessing* where information output is fed back into the system to be combined and integrated with existing representations to create a new interpretation of the situation (Zelazo, 2015).

Our concern with this model can be divided into two issues: (1) how do semantic representations/descriptions work such that labels liberate the infant from the flow of first-level consciousness? (2) how does recursion enable new levels of consciousness? We suggest that the answers given by the model presuppose a rich innate representational base as well as the reflection capability that was meant to be explained. First, labels (from semantic LTM) are supposed to be attached to identity relations that connect the contents (also from semantic LTM) from two moments in the input stream. However, this process seems to be creating a linguistic encoding of the content of the identity relation with the label—instead of "…" there is "dog" whose content is dog, and the content of dog came from semantic LTM. This means that all of the content for the encoding relationship is coming from semantic LTM with no account of its origins or how the semantic descriptions are being interpreted in the first place. Further, if reflection is needed to make the new linguistic encodings (in addition to it being needed to create the identity relations and perhaps for interpreting the descriptions in the first place), then this leaves recursion to account for all of the functionality of reflection[4].

Second, if reflection is required to both interpret semantic descriptions and attach them to labels (recC) or to objects (minC), then reflection is present from the very beginning, and this would make it homuncular (Bickhard and Terveen, 1995). If reflection were already present, then perhaps recursive/re-entrant processing could construct something "new." That is, if semantic information contents are re-entered into a consciousness that is already reflective, then a homunculus can survey all those contents (with all of the consequences at each level that the model posits). However, this would not create new content, instead, different levels of detail are being selected with different levels of reflection. This makes the development of "new" representation a matter of *selection* amongst existing content rather than the *emergence* of new content[5]. If our analysis is correct, the LoC model is not able to fulfill its epistemic function. This is because recursion does not yield a higher level of consciousness *per se*, but yields a hierarchy of levels of "content" within reflection. This may be the best option available within an information-processing framework but that is not the only alternative for modeling development.

As an account of emergent forms of knowing through reflection, the LoC model appears problematic; however, the descriptions, properties, and functions attributed to the different levels of consciousness may still capture something important about development. That is, the LoC model may be adequate for certain aspects of the developmental changes in consciousness even if it is not adequate as a model of epistemic reflection. Further, a core feature of all of the models reviewed above is the idea that lower-level representations serve as the foundation for new representations at higher levels through reflection. The current interactivist model of reflection shares this basic idea but the crucial difference concerns its action-based foundation (Allen and Bickhard, 2013). In contrast, all of the above models are developed within an information-processing empiricist framework. This framework is incapable of accounting for emergent representation and precludes the possibility of an emergent constructivism (Bickhard and Terveen, 1995; Allen and Bickhard, 2022). Without an emergent constructivism, learning and development cannot result in new knowing, and any model of reflection will ultimately fail as an explanation for such an outcome.

3 Interactive knowing and reflection

Interactivism is an action-based model of cognition and persons in which knowing is doing, and competent knowing means successful interaction (Bickhard, 2009b, 2024). Perhaps the best known action-based approach in developmental psychology was Piaget's sensorimotor theory (Piaget, 1954). However, misinterpretations and misguided methodology side-lined Piagetian theory in general and its action-orientation along with it (Smith, 1993; Allen and Bickhard, 2013). Rejections of computationalism for some strands of cognitive science have seen a move toward embodiment and most recently an explicitly pragmatist turn (Engel et al., 2016). However, interactivism differs from these embodied/pragmatist approaches, including Piaget's, in terms of the underlying models of representation (i.e., interactive knowing) and reflection (Bickhard, 1978; Campbell and Bickhard, 1986; Bickhard and Terveen, 1995).

For interactivism, representation is constituted in terms of anticipating potential interactions with the world. The anticipations are discovered to be true or false once enacted (i.e., they have *truth-value*) and they involve presupposition that the world will cooperate (i.e., they are *about* the world). For example, to anticipate that a coffee cup can be picked up presupposes that the cup is not broken. Being unbroken is usually presupposed by our interactions with cups, but it is not indicated within the anticipation and therefore it is not represented explicitly. However, if that presupposition is relevant (i.e., the cup is in fact broken), then the interaction will fail (or at least break down) and thus, presuppositions can be functionally important for the interaction without being explicitly represented. In this model, presupposition provides the implicit content that is about the world (note that presupposition is an aboutness that is not homuncular) while the explicit content is constituted in the internal anticipations or indications of potential interactions *per se* [e.g., a "pointer" indication of a subsystem that could engage in the anticipated-as-possible interaction(s)][6].

Let us stress the point that interactivist mental content is constituted by what is *implicitly presupposed* by the anticipatory dynamics, which contrasts with the criticized model of

4 There are also potential empirical reasons for caution about the role of labeling in this model as it is not clear that infants use labels to succeed on tasks like A-not-B at the end of the 1st year, or what kind of labels those would be Müller and Kerns (2015); also, non-human animals seem to have rather sophisticated forms of top-down control although they do not use language (Penn et al., 2008).

5 Further, how could reflection explain the origins for how we represent non-observables like mental-states. No amount of reprocessing at any level of resolution is going to enable the extraction of something that is not already present in the input stream of conscious experience.

6 The possibility of pointers show that indications pose no particular problem, although that is not how the CNS actually does it. See Bickhard (2015, 2024) for how the indicating/anticipation function is served in the CNS.

encodingism. As we have discussed earlier, encodingism views mental content as constituted by information in information theoretic sense, i.e., by correlation between the agent's internal states and some feature of the world (see text footnote 2). In the interactivist critique of encodingism, the issue is not whether or not information plays a role in cognition. Information understood as correlation is a property of the world and it naturally matters to agents. Rather, the problem is the ontological assumption that information *constitutes mental content*. One of the critical points we made earlier is especially relevant here—correlation needs to be known in order to be representationally utilized by the agent and so it cannot be what constitutes that knowledge itself. In contrast, content as implicit presupposition makes no such problematic assumption; as a natural consequence of learning to effectively interact with the world, the organism's anticipatory knowledge comes to "agree" with how the world is, to implicitly presuppose how it is.

For a developmental example, consider object representation. Object representation for the 2-year-old is constituted in the web of anticipated possibilities for interaction remaining constant with respect to other sorts of changes (e.g., occlusion or displacement). While the basic properties of representing are present in the anticipations (i.e., truth-value and aboutness), the permanence is a property of the overall organization of the web of anticipated possibilities. Such permanence is functional for the 2-year-old in that they can act in accordance with the presupposition that the object has a continued existence, but the permanence *per se*, the presupposition, is not itself represented by the toddler. This is because the toddler cannot directly interact with the permanence of the object and therefore cannot have anticipations directly about it. Instead, reflection will be the process that enables the implicit content/presupposition to become explicit (i.e., reflection is required to know about permanence *per se*).

Interactive knowing is constituted in the organism/system interacting with the environment (i.e., first level knowing). Reflection requires a second interactive system that can interact with the first system/organism (i.e., second level knowing). In humans, this means that the development of reflection involves an architectural change to the CNS—maturational development of the brain—to enable interaction between regions (i.e., second level knowing) in a fashion similar to how the CNS of the toddler interacts with the world (first level knowing, Bickhard, 2015, 2024)[7]. With reflection comes the possibility of knowing about the system (its internal functional organization) that interactively knows the world. That is, the properties and relations implicit in first level knowing (i.e., the presuppositions of interactive knowing) become knowable through reflection (i.e., second level knowing). While there are no a priori constraints on the age of development for reflection, there are ample empirical reasons to think that it is around age 3.5–4 (Allen and Bickhard, 2018). This is the age at which there seems to be developmental transitions in abilities within and across domains. There is also evidence that uniquely supports the interactivist model of reflection over other domain-general explanations for such changes at this age (see discussion of Allen et al., 2021 below).

To further illustrate the contrast between interactive and reflective knowing, let us consider the development of an empirical test specific to the interactivist model of reflection. Any such test is difficult for three general reasons: first, given that any task can, in principle, be interactively learned through non-reflective knowing, it is important that the task have sufficient novelty. Second, if all the different interactions of a toddler[8] are already consistent with the implicitly presupposed properties like permanence, then what difference does it make to have explicit knowledge of those presupposed properties? Third, as adults, our reflectively conscious experience of objects can always be explicit, and so it can seem as if infant interactions that are consistent with our explicit representations are also explicit for the infant (i.e., adultocentrism).

To address these issues, a test of reflection was developed that turned on being able to explicitly represent the relationship between two objects—a mutual support relationship (Allen and Bickhard, 2018). Similar to the permanence of objects, relations amongst objects cannot be directly interacted with and therefore cannot be explicitly represented by toddlers. Without representing relations *per se*, children should not be able to anticipate their consequences in a sufficiently novel situation. Accordingly, the Leaning Blocks (LB) task involves asking children what will happen to a block being held at a 45° angle when released (i.e., "fall" or "stay up"). After asking the same question for a second block, the test question involves holding the two blocks such that they are *leaning* against each other. Children are again asked what will happen upon release. Three-year-old's fail the question while 4- and 5-year-olds are basically at ceiling. These findings suggest that the older children can explicitly represent the mutual support relationship between the two blocks, and in so doing, correctly determine the consequence given the relative novelty of the situation. A follow-up study, that included a second reflection task (i.e., Candy Monster, CM) and three EF measures, suggests that the results from LB are not due to changes in executive functions. Specifically, inhibition, working memory, and cognitive flexibility interpretations were tested against the reflection interpretation and the results favored the later (Allen et al., 2021). Importantly though, reflection is an enabling constraint which means that learning relevant to any specific task must still take place before the "reflective ability" can be measured. The design intention of the LB and CM tasks are as relatively "pure" measures of reflection because they do not seem to involve many additional abilities beyond explicit representing *per se*.

7 For example, a maturation of a neural loop from pre-frontal to basal ganglia to thalamus and back to cortex (Bickhard, 2015, 2024), thus enabling interaction with other regions of the CNS.

8 It is not until toddlerhood that children show a coherent set of interactions consistent with the permanence of object. At earlier ages, infants show only a limited set of interactions consistent with permanence (Baillargeon, 2008). For example, small changes in whether a looking measure involves occluding an object vs. covering it, and later, containing it, affects performance such that the same aged infants fail one version while passing the other(s).

3.1 Consciousness and reflection

"Consciousness" is often used in a crucially equivocal manner: (1) as an "awareness" of the potentialities that constitute the world, and (2) as a kind of reflection on those first level processes and organizations. Failing to distinguish these yields aporetic problems in understanding consciousness (Bickhard, 2005). For example, as Dewey pointed out about Russell's "sense data" (Dewey, 1915, 1941; Tiles, 1990), sense data (today's descendent is "qualia") are supposed to *constitute* "consciousness" of the world, but in fact sense data (qualia) are products of *analysis* of (reflection on) primary awareness—they are generated in analysis, not constitutive of what is being analyzed,

In the interactivist model, there is a clear distinction between first level interactions with the environment and anticipations of possible such interactions, and second level interactive reflections on those first level processes and properties (and relations). The model of primary awareness has already been outlined: anticipations of (organizations of) possible interactions and their intrinsically related presuppositions. The model of reflection is that of a second level of such interactive "knowing" that interacts with the first level. The first iteration of such reflection is not possible in all species—it requires the macro-evolution of a special functional organization in the brain, and a developmental maturation of that functional organization in the individual. Further levels can be constructed in a strictly functional manner through language and culture (Bickhard, 2024), which will be discussed briefly in what follows.

4 Internalization vs. enculturation

While psychology today generally accepts that human minds are largely shaped by culture, the actual models of how that happens remain problematic (Turner, 1994, 2018; Christopher and Bickhard, 2007). Culture tends to be framed in terms of a set of beliefs and practices that the child "internalizes" as she undergoes the process of enculturation. The concept of internalization can be traced back to both Piaget (1952), Piaget and Inhelder (2000), and Vygotsky (1978), but its current uses usually draw on the latter. Vygotsky was especially interested in internalization of culture. His idea was that culture is dialectically externalized and internalized by any individual interacting socially. Children, being newcomers to social reality, were said to internalize into their minds the ways of thinking instantiated in social interactions, which made for the central mechanism of enculturation in his theory.

The details of the presumed internalization process remain vague; most fundamentally, the question arises as to what it actually means—how something that is out there in the world can get into the child's mind? And once it gets there, what kind of phenomenon is it? Potential answers to these questions depend on one's wider ontology of the mind. In encodingist models, which still dominate the field, the internalization process has been argued to be a conceptually incoherent proposal (Christopher and Bickhard, 2007). This incoherence is a consequence of the wider problems with encodingism discussed earlier: In order to internalize anything that is outside of the agent—such as a norm or custom—an encodingist agent would have to already know the thing in order to be able to internalize it, which means that internalization cannot be the basic mechanism for how cultural knowledge is formed (cf. the similar critique by Piaget, 1971). The interactivist model of enculturation, in contrast, follows naturally from the principles on which the interactivist ontology is based, and has no need for the concept of internalization.

Enculturation in interactivism follows the same basic principles as development of interactive knowledge of the physical reality—what differs is the object of interaction and resulting anticipatory organization: While knowledge of the physical world is constructed by engaging with and learning, for instance, the interactive stabilities of physical objects, cultural knowledge originates in the child's interaction with cultural or conventional objects of social ontology, such as norms governing dinner or nighttime routines (for the interactivist model of social ontology as convention see Bickhard, 1980; Mirski and Bickhard, 2021). Consequently, the pre-reflective knowledge of a child developing within a culture involves implicit presuppositions about cultural phenomena—it is organized in a way that "honors" cultural phenomena such as values or customs, but the child does not represent them explicitly as such; culture is implicit within the child's anticipatory organization, it is part of how the person views the world and interacts with it. Rather than internalization, the process is that of construction constrained and guided by the socio-cultural milieu.

Implicit presuppositions concerning the socio-cultural world, similarly to those concerning physical reality, can be represented explicitly once reflection is available to the child. For example, at knowing level 1, the child can interactively differentiate him or herself from other agents and the rest of the world, but she will not be able to represent that differentiation explicitly. In other words, the child will have a self, but will not know it. This implicit self will be greatly constrained and guided by culture as it will involve all types of presuppositions about the social world and its norms, such as, for instance, a preference to play with toy cars rather than dolls. Reflection, or level-2 knowing, allows the child to examine the self-embodied in level-1 organization and develop, for instance, meta-strategies for navigating the social world, such as heuristics for successfully creating play situations with toy cars rather than dolls. These reflective representations and strategies will constitute the child's self-representation, or its *identity*—a set of ways of being in the world. However, this self-representation will not be known explicitly, the child will not be able to represent the way it represents him or herself—for that, a third level reflection is needed. The self-representation will have their own set of implicit presuppositions, which again can be only explicitly known by a higher level of knowing; once that is available, the child will be able to, for instance, compare her own identity with alternatives or examine it in terms of values and perhaps reconstruct it to agree with them (Campbell and Bickhard, 1986, p. 118–127). The epistemic climb up the knowing levels need not stop at level 3—every epistemic level involves its own implicit presuppositions, which can be potentially known by a level higher than that. A level 4 examination of one's identity may involve a discovery that one has a tendency to frequently switch between identities, which can then be duly addressed by the agent. Importantly, even though every level leads to the emergence of qualitatively new knowledge, it too involves implicit presuppositions that remain unknown before a higher-level reflection makes them explicitly. While there is not

an in-principle limit to how high in the reflective levels the agent can climb, there naturally are various factors that influence the process[9]. Among them, language seems to be a major one, to which we turn below.

5 Does language serve a reflective function?

Interactivism models language as a system for interacting with social situations, or situation conventions, which constitute social reality (Bickhard, 1980). The basic idea is that language is a meta-convention—a convention for interacting with conventions—that allows the agent to coordinate action with its conspecifics. For instance, consider the child's early developing use of the utterance "no!" and how he or she uses it to negotiate or modify social situations—even though at first the child uses it simply to protest the current situation, it is understood by both the child and the caregiver in a similar way and thus succeeds in communicating the desired change to the situation (i.e., that it should stop or change). Importantly, such early uses of language are fully implicit and do not amount to a symbolic understanding of utterances—they are part of knowing level 1[10].

However, pre-reflective mastery of language is limited: language is not in this early form understood symbolically, i.e., as representing some part or aspect of reality, but only as yet another way of interacting with the world. As such, it does have presuppositions about it, and—just like any other knowing in interactivism—those presuppositions are not explicitly represented. Once reflection is available, it becomes possible for the child to start constructing explicit representations of what utterances actually mean and how they fit into the social world—i.e., what the presuppositions are of and how they modify situation conventions. This process takes time and effort, but by age 4, when reflection seems to emerge, the child has already constructed considerable knowledge of the linguistic realm of interaction, whose implicit presuppositions can be examined and represented. That is, content is there, but it is not as-of-yet represented explicitly.

More mature linguistic interaction, such as having a conversation about things that are not there, requires its participants to exercise reflection and to understand the meaning of utterances symbolically. That is, a toddler can have a conversation of that kind—e.g., about clouds and pets—but will be incapable of representing and considering in the conversation the abstract properties of those objects, such as the "hidden" causes of their behavior. In other words, language (i.e., situation conventions involving linguistic interaction) constitutes a realm of interaction that can be fully successfully navigated only with proper reflective understanding. As such, it imposes a selective pressure on the child's budding reflection—language-based interaction tests out the child's attempted constructions of reflective understanding and selects only those that afford successful anticipation of the interactive flow. Naturally, the child is aided in this developmental task by caregivers who engage in all kinds of functional scaffolding to lower the selective pressures inherent in language (Bickhard, 1992): Repeating things, narrating while demonstrating and so on. Language, then, is a realm of interaction that serves both as a motivator for reflective construction and as a testing ground for it. Without an opportunity to interact linguistically, reflective understanding is critically impaired, as the tragic cases of language deprived children attest (Fromkin et al., 1974).

Further, as success in linguistic interaction drives the child's reflective construction (once enabled by CNS developments), by the same token it imparts some organization onto the child's resulting reflective knowledge. Not only due to its formal properties such as syntax or morphology, but also in terms of associations, symbolic tropes, or generally speaking—ways of thinking—that abide in a given language or culture more broadly. Indeed, it is hard to imagine how an organism would show culturally-constituted reflection without a language scaffolding the process, and thus it can be difficult to disentangle properties of our reflective thinking that stem from its linguistic formatting and those that characterize reflection as such. Perhaps due to this entanglement, many scholars in history have declared thought to have a language-like structure (e.g., Fodor, 1975), which from the interactivist perspective amounts to misattributing properties of language to the nature of reflective thought as such.

It needs to be stressed that cultures and languages differ, and that they do so to some extent in terms of what kind of reflective abstraction is needed to enter them; this can be both in terms of types of content—like mental state concepts vs. behavioral concepts—or ways of thinking about some content—like theory vs. narrative. These differences in interactive realms likely lead to children from those cultures to exercise their reflection in accordance with them and thus do better on tests that presuppose competence in those terms. For instance, the explicit change of location False Belief Task (FBT) is passed at different ages depending on culture—in the West it is around age 4, but in Japan at 6+ (Naito, 2014). Whereas, multiple factors can be evoked to explain this difference, the specificity of the folk conceptualizations about the social world that dominates in the two cultures might be a significant one. As Naito argues, rather than a theory of mind, Japanese folk theory is that of relations between people. To be sure, both of these conceptualizations are true in the sense that they abstract real aspects of the social world—individuality and epistemic separateness in the former case, and the interconnectedness in the latter—but the difference in emphasis seems to lead to differing developmental trajectories in what is reflectively represented, which seems to be reflected in children's performance on socio-cognitive tests. The FBT arguably requires the child to have a clear reflective understanding of how perceptual contact of an individual mind relates to their knowledge of the world—the kind of reflective understanding that American children steeped in Western folk psychology would develop early and Japanese children would find rather foreign. However, things are different with other socio-cognitive tests, such as ones that involve aspects more aligned with the Japanese theory of relations. For instance, in one such task the object about which the protagonist of the FBT forms a false belief is changed from a

9 Empirically speaking, there does not seem to be evidence for development beyond level 4. However, the issue has not been directly investigated.

10 The term "symbolic" is usually understood in an encodingist way; here, instead, we mean it in the interactivist sense, as explicit representation of implicit presuppositions about what words refer to.

physical object (e.g., a toy) to a person who has promised to stay in one place rather than the other, but moves unbeknownst to the protagonist (Symons et al., 1997; Naito, 2014, p. 390). Japanese children seem to do better than their Western counterparts on that test, and when they are asked to motivate their answers, they tend to cite social obligations such as "he promised he'd be there" rather than individual epistemic states of the protagonist such as their mistaken belief.

Finally, once understood symbolically, language greatly facilitates reflective abstraction; that is, symbolic and systematic language provides a format that externalizes thought, which facilitates the climb up the knowing levels. The fundamental principle of interactivist knowledge formation is that only that which can be interacted with can be represented. For levels 1 and 2, the epistemic access is direct—level 1 interacts with the structure of reality, both physical and social, via the senses; and level 2 interacts with the organization of level 1 knowledge, via the physiological links in the CNS. This leaves the question of how reflection can climb beyond these two levels of representing—how to represent the implicit presuppositions of level 2 knowledge and higher?

Action involving level 2 reflection will leave a mark on the organization of level 1, both indirectly by influencing how the agent acts in the world and directly via internal thought. Consequently, the reorganized level 1 knowledge will come to involve some of the presuppositions of the reflective processes, which will make it possible for those presuppositions to be represented, leading to the emergence of level 3 knowledge—an explicit characterization of level 2 presuppositions.

While in principle, this loop of externalization and reflective abstraction could proceed indefinitely, having a symbolic system that provides an external systematic format for mental content greatly aids the process. Knowing processes that are put in language can be examined in terms of their presuppositions regardless of the level of reflection. As discussed by Campbell and Bickhard (1986), Aristotle's development of syllogistic logic forms an illustrative example here: He started to use abbreviations for names in syllogistic sentences, which later became variables in the general form—reflective abstraction of the logical properties of level 2 reasoning into an explicit representation of those properties. Once that happened, it became possible to examine the presuppositions of that abstracted framework and construct a representation of them as Aristotle's syllogistic calculus—level 4.

5.1 Language and developmental methodology

Thinking about how language operates for pre-reflective thought has implications for methodological design and interpretation of empirical results. In general, language does not operate for 3-year-olds as it does for 4- and 5-year-olds. This means that the same instructions or manipulations have different consequences for the two groups. For example, consider social learning research focused on testimony (Harris et al., 2012). The canonical version of the *trust* paradigm involves someone (mis)labeling familiar objects to induce (un)reliability in one of two informants. From the interactivist perspective, the nature of this manipulation is different for pre-reflective 3-year-olds than it is for 4- and 5-year-olds. For 3-year-olds, the mislabeling cannot be a *reliability* manipulation *per se*. Reliability is a reflective attribute that can only potentially be represented by around age 4. The manipulation clearly has consequences for 3-year-olds in terms of their informant preferences, but we would suggest that the proper interpretation of those preferences is in terms of 3-year-olds avoiding the "unreliable" informant rather than selecting the "reliable" informant. This would mean that trust research is more appropriately characterized as being about "mistrust" for children under age four. Further, a scientific explanation of the reasons for their (mis)trust can be modeled in ways that go beyond dispositional explanations about credulity and skepticism.

For example, consider testimony paradigms with a single informant who makes a claim that differs from the child's own experience (Ma and Ganea, 2010). In this situation, an object is placed in an occluded location. An informant then claims it is actually at a second location. Three-year-olds, but not older children, chose to rely on the informant's information over their own experience. The explanation for this is that 3-year-olds are overly credulous. However, other evidence suggests that 3-year-olds are overly skeptical (Woolley and Ghossainy, 2013). This raises two issues: (1) which characterization is accurate; (2) being credulous or skeptical does not explain behavior so much as it describes a tendency to behave a certain way. From the interactivist perspective, 3-year-olds "credulity/skepticism" are both a consequence of language as transforming social realities. In the case of credulity, the informant's claim transforms the 3-year-olds interactive characterization into one in which the object is indeed at the second location. This happens because they cannot yet evaluate the utterance separate from its transformative consequences. In the case of skepticism, the testimony applies for claims about contents for which the child does not have interactive experience (e.g., fantastical/historical characters). Accordingly, the utterance in such situations has too little interactive characterization to transform. This is like trying to manipulate physical objects that do not exist. Accordingly, reflection will be required to represent fantastical objects in the first place such that an utterance can then serve its transformative function.

6 Conclusion

The current proposal sought to critically evaluate extant models of the emergence of representation during development (both for *foundational* emergence as well as for *subsequent* emergence). It was concluded that the limitations of these models ultimately derive from their own development within an information-processing framework. Interactivism was introduced as an action-based alternative to information-processing and its specific models of representation (foundational emergence) and reflection (subsequent emergence) were presented. Implications for the model of reflection were discussed in terms of some empirics, thinking about consciousness, enculturation as a construction process on the part of the child, and the role of language in that process with some examples involving the sociality of theory of mind. A final discussion opened the door to considerations about how language may affect developmental

methodology and interpretation for preschooler with reflective vs. pre-reflective capabilities.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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