

Emergent Constructivism: Theoretical and Methodological Considerations

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Abstract

Nativist and empiricist approaches require foundationalism because they cannot account for the emergence of representation. Foundationalism is the assumption of an innate representational base. In turn, foundationalism places limits on the nature of learning as a constructivist process. In contrast, action-based approaches can account for the emergence of representation through (inter)action. In so doing, action-based approaches can pursue an *emergent constructivism* for learning and development. Despite the theoretical symmetry between nativism and empiricism with respect to foundationalism, there is an asymmetry in nativist and empiricist research programs. Nativism generally ignores constructivist complexity that non-nativist approaches assume needs to be investigated empirically. In practice, this means that the plethora of nativist looking-time studies do not provide adequate control conditions for the rich interpretations drawn from such research. Instead, it is the a priori assumptions of nativism doing the justification. Without such assumptions, the meaning of the data is unclear at best. Importantly, the problem of a priori assumptions driving rich interpretations is not specific to nativism or looking methodologies.

Mindreading as a research program also engages in rich interpretations for studies that concern social-cognition from infancy through preschool. Similarly, these studies do not include the types of control conditions motivated by more constructivist thinking. To the extent that empiricist research programs incorporate constructivist thinking into research, they converge with action-based approaches. This creates a sort of methodological bridge between lean-empiricist research programs and action-based approaches. However, this bridge has limitations that we illustrate through an example concerning maternal mental-state discourse and theory of mind development. The ultimate conclusions are threefold: (a) Action-based approaches are the best theoretical framework for understanding learning and development; (b) constructivist methodology is multiply motivated; (c) there are varying degrees of methodological commensurability between empiricism and action-based approaches.

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Today, developmental researchers all seem to advocate for some form of constructivism. For nativists, this may take the form of rational constructivism. For empiricists, constructivism is usually of a statistical or associationist

sort (e.g., Bayesian, connectionist, conditioning, etc.). In contrast, for researchers who tend to ground development in (inter)action, constructivism is something closer to the Piagetian view. Along such lines, we argue for an action-based *emergent* constructivism that can be contrasted with the nativist and empiricist varieties of constructivism. The emphasis on emergence is in contrast to the foundationalism common to all nativist and empiricist approaches. Foundationalism is the assumption that a base-set of innate representations is needed to get the construction processes of learning started. Within the context of foundationalism, nativist and empiricist differences are a matter of degree. Nativist approaches argue for a rich foundation, often at the level of concepts, while empiricist approaches argue for a lean foundation, often at the level of perception. In contrast to both, action-based approaches offer a third way meant to transcend foundationalism altogether. This third way models the emergence of mental phenomena, like representation, through (inter)action. From the current perspective, interaction is construed broadly to encompass any sort of modulated influence between processes. This includes not only agents interacting with objects or agents but also the newborn infant interacting with its own proprioceptive-kinesthetic body during the development of primary circular reactions.

For action-based approaches, qualitative changes in representing continue throughout development in terms of the emergent constructivist processes that obviated the need for foundationalism in the first place (Allen & Bickhard, 2011). In contrast, the foundationalism of nativist and empiricist approaches restricts any constructivist processes (throughout development) to combinations amongst the primitives in the innate foundation. In other words, relative to action-based approaches, foundationalist approaches to constructivism have a shared limitation – no representational emergence. This means that there is a theoretical symmetry between nativist and empiricist explanations for the origins and development of representational phenomena. However, such theoretical symmetry does not necessarily hold for methodology and empirical programs of research. That is, while showing symmetry at the level of theoretical approach (i.e., foundationalism), there is an important asymmetry in the practice of developmental science at the level of methodology and empirical research. Accordingly, the empirical practices of empiricist research programs allow for a *practical* bridge with action-based approaches.

The lean-foundationalism of empiricist research programs means that they tend to assume constructivist complexity for development in general as well as for the particular phenomena being studied. This results in both more factual/descriptive research on what young children can do at different ages, as well as experimental designs that include control conditions that test for “lean” interpretations. In contrast, the rich foundationalism of nativist research programs means that they tend to disregard developmental complexity in general and design experiments that *require* “rich” interpretations – in that they ignore the sort of control conditions that are motivated by more constructivist thinking. Accordingly, the constructivist thinking from empiricist researchers has motivated studies with relevant control conditions that have undermined nativist conclusions across different domains of development.

Examples of such studies will be presented in the domains of object and number reasoning for methodologies that are focused on looking paradigms. However, the lack of relevant control conditions, through the exclusion of constructivist thinking, is not specific to looking paradigms or even to nativism. Mental-state-attribution as a research program for the study of social-cognition shares the rich interpretive methodology of nativism, and the subsequent lack of constructivist control conditions can also be found. These studies often utilize more active behavioral measures than the looking paradigms that were used for the object and number domains, but that does not resolve the methodological problems concerning relevant control conditions. In the area of social-cognition, examples will be provided that range from looking, to imitation, to helping paradigms. The current article will end with an example of how the more powerful constructivism of an action-based approach can be used to extend constructivist thinking from existing empiricist methodology in the area of maternal discourse and theory of mind development.

The main conclusions to be drawn from the current article will be that: (a) action-based approaches are the best theoretical framework for explaining development and thinking about constructivism; (b) constructivist methodology is multiply motivated; and (c) despite the theoretical incommensurability between empiricism and action-based approaches, there are varying degrees of methodological commensurability such that action-based approaches can make use of and extend empiricist methods and data.

Constructivism as an Umbrella Term: Theoretical Considerations

Our theoretical discussion begins with considerations of constructivism. In a broad sense, constructivism refers to the creation of something new through learning. There are many varieties of what might be called constructivist models of learning and development, some so minimal as to almost collapse the meaning of the term, some more complex, and some involving important metaphysical phenomena, such as emergence. In this section, we provide an integrated space of possibilities for what constructivism *could* be and situate existing positions within that space when they are available.

At the minimal level, we have models of the generation – “construction” – of singular elements of “cognition.” One example would be the generation of single independent associations. Not many models today – since the “cognitive revolution” – rely (solely) on associations, because associations, whatever they are or are taken to be, do not account for representation. A more cognitive example might be a species that is postulated to generate singular representations, but then cannot do anything further with those representations to generate further representations. There does not appear to be any model of this sort in the current literature, so it remains a conceptual possibility only.

A close-to-minimal kind of constructivism postulates some foundation of basic – “atomic” – representations with which some constructive process can construct more complex representations, such as the construction of concepts or propositions (whatever those are or are taken to be) out of some (foundational) set of innate representations. This kind of model is quite common in contemporary developmental literature (e.g., Baillargeon, 2008; Baillargeon et al., 2009; Carey, 2009; Gelman & Kalish, 2006; Mandler, 2004; Spelke & Kinzler, 2007).

Fodor (1975) pointed out some time ago that such a model cannot, in principle, account for its own foundational atoms and so strongly motivates an innatism, in which evolution somehow does what learning and development supposedly cannot do – create a set of innate atomic foundational representations. Since the impossibility is an in-principle impossibility – namely, if representations can only be constructed out of already available representations, then the foundational representations cannot be accounted for, because there is by assumption no even more foundational base for them to be constructed out of – then these kinds of

models suffer from a fundamental internal inconsistency.

In-principle foundationalisms are inconsistent: they presuppose a foundation but argue that foundations must be *already* available and, thus, are impossible. In-principle foundations cannot come into existence, but they must somehow come into existence if foundationalism were correct. They presuppose themselves. In-principle foundationalisms are incoherent.

There must be some way in which new representations or new representing can be constructed within and upon a framework that is not itself necessarily representational. Representing must be *emergent*, and any model that cannot account for such emergence is thereby refuted.

We will return to issues of emergence in a moment but first would like to address two important forms of further complexity in the dynamics of construction per se. The first form of complexity concerns the resources available for construction. “Construction” of singular associations, for a *negative* example, do *not* make use of previously constructed associations. Construction of atomic strings of some sort (perhaps of “symbols”) – in contrast – could be postulated to make use of *previously* constructed strings (or “structures” of some kind) in the construction of *new* representations. That is, the constructive process could be *recursive* in the sense of new constructions making use of the products of previous constructions as units in those new constructions. This sort of recursive constructivism is presupposed in most models today, though rarely are the dynamics of how this does or could occur addressed.

Another form of complexity addresses the constructive process itself. Recursive constructivism per se could involve an *unchanging* process of construction that nevertheless made use of prior constructions. It is also possible, however, that the processes of construction themselves undergo development, perhaps also constructive development. This would constitute a central form of learning to learn, and it seems clear that humans (and some other species) are capable of such *meta-recursive-ness*. There are, however, very few models that attempt to address meta-recursive-ness. It should be noted that Piaget’s postulated process of *equilibration* is strongly recursive but is not meta-recursive.

Extant constructivist models based on an assumption of foundational atoms generally presuppose some sort of recursive-ness, though the dynamics and details of how that could occur are not addressed. It is also conceptually possible that such an “atom”-based constructivism could be meta-recursive, though there seems to be no example

in the literature.¹ However, neither recursiveness nor meta-recursiveness can resolve the basic incoherence that is intrinsic to any form of necessary innatist foundationalism.

There is, however, an alternative to atomistic foundationalism, and one central example has already been mentioned. Piaget's model is *not* foundationalist. In general, pragmatist or action-based models are not, and cannot be, foundationalist: if the world is assumed to somehow impress itself into mind that is otherwise passive, such as in a classical empiricism (or signet rings pressing into wax), then a constructivism is not necessary, though a constructivism can be postulated as an addition to such a passive mind model. Note that the representational capacities of any such sensory inputs, whether purely perceptual or also including conceptual representing, have no natural account and thus must be innately foundational. But if cognition and representation are modeled within an action framework, there is no temptation to postulate that an action system can be impressed into a passive mind.

Action-based, or pragmatist-based, models are intrinsically models of active minds. This action and interaction framework necessarily includes processes of learning and development: interaction systems cannot be impressed into the mind, but must be actively constructed. Furthermore, those constructions cannot be guaranteed to be correct (barring magical foresight), so error must be modeled as much as possible and corrected as much as possible. Errorful constructions must be able to be selected out. An action base, thus, forces variation and selection constructivism, an evolutionary epistemology (Campbell, 1974).²

Again, an atomistic foundationalist model could postulate some sort of variation and selection process on its strings or structures of "atoms," but (a) this would be an addition – it is not a forced part of the model; (b) few, if any, models even speculate what the dynamics could possibly be; and (c) none of such elaborations address the fundamental incoherence of "necessarily innate" foundationalism.

¹ Heyes (2012) proposes kinds of learning to learn at a sociocultural level of dynamics that may constitute meta-recursivity at that level.

² An additional point illuminated by an action-based model is that the recursive variation and selection constructivist processes can not only make use of previous constructions as units of further construction, but can also induce variations internal to such previous constructions – make use of them as domains of variation. This internal variation possibility could also be added to an atomistic recursive construction model, but it would be, in a by now familiar way, ad hoc, and there seems to be no example of such a model in the literature.

Action-based models transcend this realm of issues because representing is modeled as *emergent* in action systems. Action systems are not themselves necessarily representational, but representing emerges in certain kinds or organizations of (inter)action systems. Thus, no already representational foundation is necessary.

Postulating action-based emergent representation does not fix a specific model of representation. The shift from "atom"-based models to action-based models is of fundamental importance, but there are many possible models of action-based emergent representation – and not all can be correct. Piaget's model is action-based but, so we argue, is not fully correct (Campbell & Bickhard, 1986, 1989).

An interaction-based model that we do advocate has as a central notion the function of an organism being able to anticipate what sorts of interactions are available to the organism in the current environment. Some means of accomplishing this anticipatory or indicative function is necessary for any agent, and, crucially, such anticipations can be in error – they can be false (or true). Anticipations can model the emergence of truth value and, thus, of the crucial property of representing. Note that this is *not* a correspondence model (Bickhard, 2009).

Anticipation constitutes a core intuition of the emergence of representational truth value. The specifics of a dynamic model of how this can or could occur are addressed elsewhere (e.g., Bickhard, 2009) – here we point out two further metaphysical issues that must be addressed in order for such a model to be well grounded.

The first is the metaphysics of emergence per se. Emergence has been frequently argued to be impossible. We contend that those arguments are, in general, unsound – they involve false premises (Bickhard, 2009). These premises involve presuppositions of an underlying substance, structure, and particle metaphysics – which make emergence impossible (e.g., there cannot be an emergent fifth substance out of Empedoclean earth, air, fire, and water). The alternative is a process metaphysics, which, arguably, *can* make sense of metaphysical emergence (Bickhard, 2009).

A related problem is that representational emergence is not only emergence per se but is *normative* emergence: truth value is a form of normativity. The emergence of anything, such as, for a "classic" example, chemical valence, is blocked by substance and particle models, but any kind of normative emergence encounters an additional apparent barrier: Hume's argument that an "ought" cannot be derived from an "is" – no norms from facts. We argue that Hume's point (he does not really give an argu-

ment) is, on a plausible reconstruction, valid but unsound (Bickhard, 2009).

We provide explications of these positions and arguments elsewhere. The central point here is that any constructivist model must address four interrelated points: (a) the incoherence of necessary foundationalism must be avoided – this requires some model of emergence, (b) recursiveness and meta-recursiveness must be addressed – this requires appropriate process models of construction, (c) the metaphysics of emergence must be accounted for – this is addressed by a process metaphysics, and (d) the apparent barriers to *normative* emergence must be overcome – this is addressed elsewhere in a model of the emergence of normative function, in particular, the function of indicating potential interactions (Bickhard, 2009). That is, any constructivist model of learning and development must account for normative emergence (the emergence of truth value), and this desideratum, in turn, requires some fundamental shifts in underlying metaphysics.

What about Empirical Research Programs?

Empirical research in the psychological sciences does not generally start from explicit commitments to well-defined theoretical frameworks. Accordingly, the empirical programs of research do not necessarily (and entirely) collapse under the weight of fatal theoretical problems (e.g., foundationalism, passive epistemology, etc.). However, the particular brand of foundationalism present in the nativist research program does seem to render the empirical results from this program as largely meaningless without the theoretical framework. This is similar to the sense in which early empirical studies on language learning lost much of their meaning after Chomsky's (1959) in-principle critique of the behaviorist framework. In the current case, the problem with the nativist brand of foundationalism for its empirical research program is that it generally begs the question for non-nativist researchers. Experimental results are only as good as the sorts of alternative interpretations that they rule out. Nativist foundationalism precludes the sorts of constructivist control conditions motivated by non-nativist perspectives and, in so doing, leaves unclear what has been established with the large corpus of experimental studies over the past four decades. Accordingly, Paulus (2022) has recently argued that the type of looking paradigms originating in nativist studies should be relegated to history. To be clear, the conclusion is not that looking time measures

per se should be shelved, but rather that it is the collection of assumptions related to violation-of-expectation uses of looking measures that are the problem.

While in agreement with this conclusion, Allen and Bickhard (2013a) have argued that the lack of relevant control conditions for nativist research programs is a consequence of the underlying foundationalism. Foundationalism is the assumption that new knowledge is constructed out of some already existing base of knowledge (e.g., a base set of innate representations). Empiricism shares with nativism in its general commitment to foundationalism but differs with respect to the size and richness of the foundational base. In fact, nativist positions do not reject empiricism so much as argue for the need to supplement what can be learned through experience with innate content. This can be seen in the general structure of the poverty of the stimulus argument, in which experience is argued to be *insufficient* to learn the phenomenon of interest. For example, Chomsky (1959) famously argued that children's experience with language was not *enough* to explain how grammar was acquired. Chomsky did not argue that experience was not needed entirely. Similarly, as Fodor (1998) puts it, "...that there is usually more in the content of a concept than there is in the experiences that prompt us to form it is the burden of the traditional rationalist critique of empiricism" (p. 150).

Logic of Nativist Research Methodology

Competence-Performance

Nativist uses of looking paradigms in the developmental sciences import a whole collection of interpretive constraints and background assumptions that make any results especially laden with theory. Without the background assumptions, the results seem to contribute little to our understanding of infant development. The theoretical starting point for nativist uses of looking measures was Chomsky's (1965) competence-performance distinction. When discussed, the distinction is motivated by the methodological point that empirical studies typically control for variables that are not of interest for *that study* (Wynn, 1997). For example, syntax and executive functioning may be considered extraneous control variables for a study on the effect maternal mental-state talk for theory of mind development. However, this methodological situation would not mean that syntax and executive functioning are theoretically extraneous for theory of mind development. Instead, what relation these variables have to each other depends on the theoretical construal from different approaches (Miller, 2016; Moses & Tahiroglu, 2010). For nativist looking-time studies aimed to

undermine Piagetian theory (Baillargeon et al., 1985), action was presumed to be an extraneous performance factor relative to object-representational competence. This presumption is consistent with the underlying information-processing/computational framework of these researchers, but it simply ignores Piaget's constructivist framework – in which action is the ground for the emergence of representation.

At its core, the info-processing/computational framework for cognition assumes that sensory input and motor output are theoretically extraneous relative to the cognitive computations. Empiricist positions assume this framework as much as nativist positions; however, nativist positions are also inherently nondevelopmental in their commitment to the competence-performance distinction. The “modus operandi” for using the competence-performance distinction in nativist research was provided by Rochel Gelman (1969). As Thelen and Smith (1994) explain it, nativist researchers should: “define the *essence* of some knowledge structure, do a thorough task analysis, strip away the supporting process and performance variables that could limit successful use of the essential knowledge structure, and see if children possess the “essential” knowledge” (p. 26). Accordingly, if the essence of phenomena X is innate, then it does not itself undergo development; instead, development is a matter of increasing access to that innate phenomena/competence (Keil, 1981). In contrast, empiricist positions are more developmental because their innate foundations are more impoverished (i.e., there is more for learning and development to accomplish). Further, empiricist positions do not generally accept that competencies can be captured by an essential knowledge structure. As a consequence, empiricist positions are more open to partial forms. Partial forms are *complete* in the sense that they allow for certain capabilities but are *partial* in that they are still limited by some of the capabilities thought to constitute the adult form. Methodologically, this means that empiricist positions take the limitations of infants at different ages as in need of explanation (rather than treating such limitations as due to extraneous performance factors to be ignored a priori).

For a methodological example that illustrates the contrast between nativist and empiricist positions on this issue of partial forms, consider object concept development. The nativist position on object concept “development” was to provide evidence that 3.5-month-olds show some sort of sensitivity to the permanence of physical objects and consider such a finding as sufficient to ignore subsequent limitations (e.g., limitations in search diffi-

culties for hidden objects until around 8 months and the A-not-B task until starting around 10 months). For an empiricist perspective that assumes the development of partial forms, there was a need to *empirically test* whether the stipulated performance factors were responsible for the limitations at 8–10 months (e.g., means-ends coordination, working memory). After establishing that extraneous performance factors were not responsible for the search failures at these later ages, these empiricist-oriented researchers proposed a more developmental and more constructivist explanation called the Adaptive Process Account (APA; Munakata et al., 1997). From the APA perspective of partial forms (i.e., a constructivist perspective), the dissociations in performances for object related-tasks from 3.5 to 10 months could not be ignored a priori. Although the APA explanation may itself have theoretical problems due to its commitment to info-processing/connectionism/empiricism (Allen & Bickhard, 2013a), it presupposes a more developmental/constructivist approach and a rejection of the competence-performance distinction as used by nativists. In turn, the experiments motivated by this position included more developmental/constructivist control conditions, which demonstrated that the stipulation by nativists was not well founded.

Foundationalism

As discussed above, foundationalism is the assumption that a representational base is a necessary starting point for development. Bickhard (Bickhard & Terveen, 1995) has articulated that standard notions of representation (encodings) require foundationalism because their own emergence cannot be accounted for. However, this requirement is a logical issue (Bickhard, 1991; Fodor, 1975), and so it applies to evolution as much as to development. Accordingly, the fatal problem for any foundationalism is emergence. Central to the natural sciences is the assumption that all (cognitive) phenomena are emergent within other sorts of processes. Piaget offered a non-foundationalist explanation for the emergence of cognition through (inter)action. Similarly, we have outlined an action-based emergent constructivism above.

If an infant looking at an object entails that they are representing it as an object,³ then perhaps perceptual-level complexities can be ignored. However, this is an a priori assumption that is not shared by non-nativist/developmental researchers. For example, it is typical for em-

³ After all, the fact of looking at an object entails that the crucial causal or nomological or informational etc. relationship exists that is supposed to constitute a representation of the object.

piricist positions to assume that infants construct object representations out of feature representations (Fields, 2013). This is why developmental empiricist positions can be characterized by “feature foundationalism” (Mandler, 2000; Quinn & Eimas, 2000). In turn, features are considered perceptual and so developmental empiricists tend to design and interpret infant studies at the level of perceptual-level processes. In contrast, developmental nativism is characterized by conceptual-level foundationalism, and studies are designed and interpreted on that basis. For the above example, this means ignoring possible constructivist complexity (i.e., perceptual-level processes) at the level of object representation itself.

Aspects of these issues have often played out in terms of “rich” versus “lean” interpretations of infant looking data. The richness of an interpretation is usually characterized in terms of how much cognitive sophistication is attributed to a given set of results. By design, rich interpretations are potentially consistent with the results of a study, but, typically, so are other leaner interpretations (i.e., those that attribute less cognitive sophistication to the organism). For an example that illustrates the point, consider a classic “number calculation” experiment by Wynn (1992). In this study, infants observed two identical objects being placed, one at a time, behind an occluder. When the occluder folded down, the results indicated that infants looked longer when there was one versus two objects. The original rich interpretation was that infants were surprised by a violation of numerical addition (i.e., $1 + 1 = 2$, not 1). A less rich interpretation is that infants were surprised by a violation of object individuation and permanence (i.e., an object followed by another object means two objects are present, not one). Both interpretations can be considered rich because they are at the conceptual level (i.e., number concept or object concept). A lean interpretation, at the perceptual level, was that infants were quantifying amounts through variables like contour length and area. Subsequent research with adequate control conditions suggests that the rich numeric interpretation was not well founded (Clearfield & Mix, 2001; Feigenson et al., 2002).

In the context of object and number research then, rich versus lean can be seen as mapping onto the conceptual versus perceptual contrast relevant to nativist versus empiricist brands of foundationalism. For infant research, the issue of rich/conceptual versus lean/perceptual interpretation has played out methodologically in terms of two inter-related aspects. The first is more general and concerns features of the looking process itself (i.e., habituation-dishabituation dynamics). The second is more spe-

cific and concerns what type of variables should be controlled for in infant-looking studies. The general answers for the latter are variables that capture perceptual features of the situation. For example, the quantification of number by perceptual-level variables like *area*, *contour-length*, *volume*, and *density*, and, if the stimuli are auditory, features such as *rhythm*, *rate*, and *duration*. In the area of object research, variables like *amount-of-motion* have been used as the basis for control conditions, but most of the critical responses to rich interpretations for object-related research have focused on the habituation-dishabituation process itself.

Habituation is a form of learning that is characterized by a decreased responding to repeated stimulation, and dishabituation is characterized by an increase in that responding to sufficiently new stimulation. These processes form the basis of what researchers refer to as a novelty preference. That is, after enough repeated exposure to some stimulation, organisms “prefer” new stimulation. The habituation-dishabituation process was originally used by researchers in the 1960s to study the development of infant perception (Fantz, 1964). After habituation to some perceptual feature, a new feature was presented, and if infants dishabituate, then they must be *sensitive* to the difference between the two features. Similarly, nativists sought to habituate infants to more complex displays and then introduced a new situation that violated some (conceptual) dimension of that display (e.g., violating the persistence and/or solidity of objects, violating the number of objects, etc.). This move assumed (a) that conceptual habituation was possible, (b) that it operated according to the same principles as perceptual habituation, and (c) that perceptual processes would not influence the conceptual processes in ways that matter. Only the third of these assumptions was partially taken into account by nativists in their methodology.

Because nativist looking-time displays were complex, many perceptual features also differed between the habituation display during familiarization and the new conceptually novel/impossible display at test. Accordingly, nativist studies sought to control for such changes by having a second test condition that was conceptually familiar/possible but perceptually novel. Thus, this design pitted perceptual novelty against conceptual familiarity, and, perceptual familiarity against conceptual novelty. Therefore, if infant were responding on the basis of perceptual processes, then they would dishabituate more to the perceptually novel (conceptually familiar/possible) display. A classic example of this methodology was the “draw-bridge” study by Baillargeon et al. (1985).

The habituation phase involved a rectangular plank that moved in a 180-degree arc on the surface of a table. Infants sat on their mother's lap and viewed it head on such that it could look like a drawbridge that opened and closed. At the test, a yellow box with clown faces and stripes was placed in the path of the drawbridge, and sound cues and a particular inter-trial interval were used. All of this took place in a broader context of the infant sitting on their mother's lap in a stage-like enclosure. For the "impossible" test condition, the drawbridge again moved all 180° (perceptually more familiar relative to the habituation phase) by crushing the yellow box (a conceptually impossible/novel violation of physics). In the "possible" test condition, the drawbridge stopped after 112 degrees of rotation (perceptually more novel relative to the habituation phases in which the drawbridge moved all 180°), as its further movement was prevented by making contact with the yellow box (conceptually possible/consistent with how the world of objects function). Results from the study generally indicated that infants dis-habituated more (looked longer) to the perceptually familiar/conceptually impossible display than to the perceptual-novel/conceptually possible display. However, there is a robust order effect for this paradigm (Baillargeon, 1987). Specifically, infants' preference for the possible or impossible test display depends on which one is shown first. Regardless, the findings from the original study as well as other early studies suggested, to nativists, that infant preferences were not driven by perceptual processes.

Despite this effort to control for one aspect of habituation as a perceptual-level process (perceptual novelty), infant looking paradigms largely ignored the complexity of habituation and therefore ignored the need to control for perceptual-level processes. Schöner and Thelen (2006) provide a dynamic field model of habituation as a perceptual-level process with all of its known complexities. Their model accounts for 10 different features of visual habituation in the "drawbridge study" that include the unexplained order effects as well as a number of variables that effect whether their model shows a perceptual novelty or familiarity preference at test. This is important because nativists assumed that, if the habituation process had any relevant complexity to control, it was only for a perceptual novelty preference. The problem is that infants in these studies may have in fact had a perceptual familiarity preference (remember, this is paired with conceptual novelty/impossibility). Schöner and Thelen (2006) model suggests several features of nativist looking methodology which would explain infant looking to the

"conceptually impossible" display in terms of a perceptual familiarity preference. While this was a computational model, research with infants has demonstrated the same conclusion empirically (i.e., due to their assumptions about habituation, looking paradigms in nativist studies are based on confounds with perceptual-level processes).

One well-known feature of habituation as a perceptual-level process is the familiarity to novelty shift. With few habituation trials, infants will show a perceptual familiarity preference on the test; whereas with more habituation trials, they will show a perceptual novelty preference. Accordingly, Schilling (2000) manipulated the amount of habituation infants received and concluded that their looking in the drawbridge study was a consequence of the amount of habituation rather than the conceptual (im)possibility of the test display. Relatedly, Cashon and Cohen (2000) ensured that infants were fully habituated (i.e., they ensured that the perceptual novelty preference assumed by nativists had in fact been induced) and found that infants showed the opposite pattern of results from Baillargeon's original study. That is, they preferred the perceptually novel/conceptually possible test display. Further, those infants who could not be habituated, even after 20 trials, showed the opposite pattern (i.e., a replication of Baillargeon's findings). Finally, Bogartz et al. (2000) made no assumptions about whether any of the displays at familiarization or test were understood by infants conceptually or perceptually and tested evidence for both hypotheses. Their results provided no evidence that infants were responding on the basis of possibility/impossibility but rather on the basis of the number of habituation trials, changes in screen rotation, and presence or absence of the box (i.e., perceptual-level variables). Individually and collectively, these results suggest that findings from the draw-bridge paradigm involve a perceptual-familiarity preference. This is contrary to the assumptions of the paradigm and would explain infants looking longer at the conceptually impossible test display in terms of perceptual-level processes.⁴

Representational Complexity

The above studies make clear that habituation involves relevant complexity for infant looking as a perceptual-

⁴ See section 2 of Allen and Bickhard (2013a) for a full review of a variety of empirical critiques that have controlled for perceptual confounds in nativist paradigms related to both object and number domains.

level process.⁵ Further, the failure to consider such complexity with adequate control conditions led to rich interpretations of infant looking time studies. Lean interpretations do not deny that infants are sensitive to the change from the familiarization/habituation phase to the test phase but rather claim that such sensitivity is perceptual. That said, there is also a “rich” and “lean” sense for what it means for the sensitivity to be perceptual. The rich sense captures the empiricist brand of foundationalism in terms of the assumption that infants represent perceptual features. In contrast, the lean sense captures an action-based emergent constructivism in terms of the argument that representation emerges through the activity of the infant. Perception may be an aspect of this activity, but there is relevant constructivist complexity for the infant involved in all representation (whether of perceptual features or conceptual objects). For an illustration of the methodological implications for how an action-based approach contrasts with an empiricist approach to infant development, see Müller and Overton (1998).

Rich interpretations overlook constructivist complexity “below” the level of the interpretation, whether that level is perceptual or conceptual. In turn, there is no need to control for alternative interpretations for constructivist complexities at those levels. For infant research, the theoretical commitments of nativism rendered perceptual-level complexity as irrelevant for studying conceptual development. These commitments included (a) conceptual-level foundationalism, (b) the competence-performance distinction, and (c) habituation as a conceptual-level process.⁶ It is in terms of the contrast with these commitments that empiricist positions were able to provide relevant control conditions. That is, perceptual-level foundationalism (a) requires more from learning; therefore, researchers must confront relevant sorts of constructivist complexity. This will be the case in terms of both partial forms (b), and habituation as a perceptual-level process (c). Witherington (2015) has correctly noted that there is a relative asymmetry in criticisms of nativist

versus empiricist research programs such that most of the focus is on the former. Part of the reason for that asymmetry may be due to the differences in the above commitments. This means that, although empiricism is equally committed to foundationalism, there is a methodological asymmetry between nativism and empiricism due to the type of foundationalism involved. Our own analysis of methodological problems with empiricism for infant research suggests that the theoretical commitment of most relevance is a problematic notion of representation that conflates detection with representation (see section 3.3, Allen & Bickhard, 2013a).

Social-Cognition Research Also Involves Rich Interpretations

A developmental approach assumes constructivist complexity throughout the lifespan. What sorts of complexities are relevant at different ages is partially an empirical question. Further, what makes an interpretation “rich” or “lean” is relative to the domain and the developmental level of the sample. In general, rich interpretations ignore the sorts of complexity that lean interpretations suggest are relevant. Historically, rich interpretations exclude the sorts of control conditions that would be motivated by (lean) constructivist accounts of such complexity. Accordingly, the issues concerning rich interpretations are not specific to nativism or to looking methodologies.

Social-cognition research has made extensive use of looking paradigms, but more (inter)active measures have also been used. These more (inter)active measures are often thought to avoid the problems surrounding looking paradigms; however, the current argument is that this is not the case (Allen, 2015). Methodologies are tools. As tools, they have more and less applicable uses as well as different benefits and limitations; however, it is the background assumptions that create the problems. That these assumptions get taken for granted in the design and interpretive logic of certain paradigms may be why it can seem like the problems are methodological. However, it is the exclusion of the types of control conditions that are motivated by alternative perspectives that is the problem. Such exclusion has also played out in the social-cognition literature in terms of rich versus lean interpretations. Rich interpretations construe social-cognition in terms of mental-state attributions (theory of mind/mindreading) that abstracts away from the complexity of concrete social situations. Lean interpretations tend to construe social-

⁵ Oftentimes researchers using looking paradigms talk about a familiarization phase as different from habituation. In practice, this generally means using 1–4 habituation trials (Aslin & Fiser, 2005). However, as discussed above this just means that infants are unlikely to be fully habituated which is likely to have made the confound for a perceptual familiarity preference worse. For an illustration of how “eliminating” habituation does not solve the issue, see Cohen and Marks’ (2002) criticism of Wynn’s (1992) number calculation procedure and follow up by Clearfield and Westfahl (2006).

⁶ There is actually a fourth commitment to a problematic notion of representation (i.e., encodingism, Bickhard, 2009) but this is a commitment that is shared with empiricism. Accordingly, there are no examples of how empiricist methodology provided relevant control conditions with respect to this commitment.

cognition in terms of behavioral tendencies that are more directly grounded in the social situations themselves. While not typically discussed in the context of foundationalism, this does in fact map onto two brands of foundationalism: a foundationalism of mental-state representations and a foundationalism of behavior representations. In contrast to infant object and number domains, many research programs on the rich side of social-cognition research are also empiricist. As different from “rich-nativists,” for these “rich-empiricists,” development is still protracted and efforts are made to account for the emergence of the representations about mental-states (rather than being innate). Ultimately though, such accounts must fail to the extent that they fail to instantiate an action-based emergent constructivism (i.e., no nativist or empiricist theory has an adequate account for the emergence of new knowledge, including knowledge about other’s minds).

Mentalism as a Research Program

Mentalistic approaches to social-cognition tend to ignore constructivist complexity in the social situation itself. These approaches assume that the social meaning of the situation is constituted by knowing about the mental states of other agents. The behavior of these agents must still provide the basis for an inference about which mental-states are involved; however, the behavioral complexities (and, especially their relation to the broader social situation) are not generally incorporated into the design or interpretation of studies. This way of construing things presupposes a divide between the socially meaningful deep structure of other agents’ minds and the perceptually available surface structure of their behavior (Allen & Bickhard, 2013b; Carpendale et al., 2013a; Froese & Leavens, 2014). Mentalistic research paradigms typically demonstrate that infants/toddlers’ performance on a task goes beyond mere associations in the surface structure and, therefore, warrant the conclusion that the participant represents the mentalistic deep structure. In contrast, lean-alternative interpretations tend to extend along a continuum of leanness. At the leanest end are often comparative researchers who include control conditions that show association is in fact enough (i.e., the stimulus is not as impoverished as assumed; e.g., Heyes, 2014; Povinelli & Vonk, 2003). Further along the continuum are more developmental researchers who include control conditions that go beyond mere association but do not assume mindreading to explain success on the tasks (i.e., the child’s cognition involves structure but not mindreading per se; e.g., Csibra & Gergely, 1998; Perner &

Roessler, 2010). This opens the door to constructivist thinking about ways in which social-cognition may originate in something other than mental-state attributions. Methodologically, the failure of rich interpretations to consider behavioral/situational complexity manifests through minimal consideration that participants could be responding on the basis of object/agent affordances that may change in accordance with expectations within the broader type of social situation.

More Active Behavioral Measures

For an example of a rich-empiricist design and interpretation, consider the classic study by Meltzoff (1995). This study sought to use infants’ tendency to imitate other people as a methodology for exploring their mindreading capabilities. After an adult model failed to demonstrate some “intended”⁷ actions (e.g., failed to place a ring on a peg or insert a block into a hole), infants were given a turn with the materials. Results indicated that at 18 months, infants copied the “intended” object manipulations rather than the “literal behavior.” This was interpreted as an indication that infants could mindread the intention of the adult model and imitate on the basis of that intention. However, a developmental perspective would suggest relevant complexity at this age for both imitation activity and object representation activity.

Dynamic Object Affordances

For an example of a lean-empiricist alternative interpretation of Meltzoff’s study, consider the studies by Huang et al. (Huang & Charman, 2005; Huang et al., 2002). These researchers sought to test whether the object affordances involved in the unfolding event could be responsible for infants’ performance. Results from across two studies supported the idea that the changing salience of the object affordances (e.g., when brought into proximity of each other, rings afford being placed on pegs, blocks afford being placed in holes) was driving infant behavior at test rather than the model’s mental intention. Further evidence that mindreading was not involved for the 18-month-old group was that subsequent research with 3.5-year-olds showed the opposite performance from the 18-month-olds. That is, preschoolers copied the “literal” behavior rather than the “failed/intended” object transformations (Huang et al., 2006). Presumably these older children understood the actual intention of the adult model to fail at achieving the salient object affordances.

⁷ Of course, the real intention of the experimenter was to fail.

Does this mean these older children were mindreading? Perhaps, but not necessarily. For children or adults to understand the intentional action of another already requires prior knowledge about what is supposed to happen in the situation. In some cases, this may be based “only” on the affordances of the objects, but in other cases, it requires knowing more about the broader social reality. For example, in some games with a basketball, you should sink the ball through the hoop (affordant); while for others, you should hit the rim (nonaffordant). In the absence of knowing about such games, the object affordances will not suffice in the latter case to understand the intention of the adult. The point is that no mindreading needs to be involved in any of this; that is, object affordances and/or “situation reading” are sufficient.⁸ They are also necessary – no mindreading can take place without knowing about the object affordances unfolding within a broader social reality. This underlies the challenge for mindreading studies to be diagnostically adequate (Allen, 2015). That is, how does attributing the child participant with mindreading capabilities enable performance above and beyond what they could accomplish through situation reading (Perner, 2010). It is clear that much of social life does not necessarily *require* mindreading (Andrews, 2013; Ratcliffe, 2007). Expectations based on the function of artifacts, the social role of agents, and/or norms for interaction are sufficient in many cases. For examples, I expect the person with a hammer to hit nails, the firefighter to rescue the cat, and the driver to stay on the right side of the road. As adults we have the option of thinking about the mental-states of the agents in these situations (usually when something goes wrong), but for the developing child, such an assumption should not be taken for granted.

Equifinality

That features of the situation are sufficient to understand social meaning was the basis for Gergely and Csibra’s (2003) account of how infants understand goal-directedness without mindreading the mental goal of the agent. The authors recognized that they were only ever

manipulating features of the situation and so stopped attributing to infants the superfluous mental content representations corresponding to those features. For example, they only ever manipulated the outcome of a situation and so stopped attributing infants with representing the mental goal of an agent. They only ever manipulated the actions of an agent and so stopped attributing infants with reading the mental intentions of those actions.⁹ Instead, it was demonstrated that two perceptual features of the situation were sufficient for infants to treat agents (or objects) as goal-directed (Csibra & Gergely, 1998). The first was to have a salient outcome and the second was for the agent/object to display multiple methods to achieve that outcome (i.e., equifinality). Equifinality then served as a means by which infants could “see” goal-directness without attributing a mental goal. Other theoretical possibilities for how to perceive goal-directedness without mental-state attribution have also been offered (Byrne, 1999; Carpendale & Lewis, 2015; Dimitrova & Moro, 2013; Fenici & Zawidzki, 2016; Gallagher & Povinelli, 2012; Marken, 2002; Raczaszek-Leonardi et al., 2013).

The third point of recognition for Gergely and Csibra (2003) was that they were not actually manipulating the infants’ representation of the agent’s beliefs but rather the situational constraints. Accordingly, they sought to demonstrate how the constraints of the situation affected the infants’ understanding of the agent’s actions (Gergely et al., 2002). This insight was further generalized to how a particular *type* of social situation could influence what infants understand about a demonstration. That is, “natural pedagogy” provides a general framework for thinking about how infants learn differently in pedagogical versus nonpedagogical situations (Csibra & Gergely, 2009). In the former, infants are prepared to expect something culturally relevant and new to learn from an adult demonstration. While not every social situation is pedagogical, this research illustrates clearly that the social situation is relevant for how participants interpret the meaning of other agent’s actions. However, the design and interpretation of studies in mental-state vocabulary abstracts away from the situation and so mentalistic social-cognition paradigms typically take the broader social situation for granted.

An example of a mindreading study that illustrates the point comes from Buttelmann et al. (2009). This study sought to end controversy about how to interpret infant looking times studies with an (inter)active helping measure. Similar to Meltzoff (1995), this study sought to exploit a tendency of infants and toddlers, not to imitate, but to help. Analogously, it assumed that helping at these

⁸ In reality, the contrast between object affordances and situation may not reflect the actual developmental origins of infants’ understanding of intentional action. From the start, infant interactions with objects include a socio-cultural partner that collectively constitutes the social situation. As infants increasingly master the convention uses of objects within these triadic interactions, the possibility of a common ground emerges. This common ground is what then enables the “reading” of intentions through the situation (Dimitrova & Moro, 2013; Dimitrova et al., 2015).

⁹ This illustrates the sense in which the evidence for mental-state attribution in infants may only ever be in the minds of scientists.

ages does not involve relevant complexity.¹⁰ Further, this study included a confound about the type of social situation. Specifically, in the false-belief condition,¹¹ the child and first experimenter (E1) played a trick on the second experimenter (E2). When E2 left the room, the child and E1 hid the toy by moving it from one box to another, and in the true-belief condition, they did not play a trick (i.e., they moved the toy in full view of E2). At test, 18- and 42-month-olds helped the adult find their toy in the false-belief condition but not the true-belief condition. This was taken as evidence of early false-belief understanding. However, this helping paradigm has been conceptually and methodologically critiqued from an action-based approach (Allen, 2015).¹² The results of this critique strongly suggest that successful helping (i.e., retrieving the toy) was due to children's prior expectation that E2 would search for their toy. A likely candidate for this expectation was the explicit invocation to play a trick prior to the test phase. As noted by Allen, results from the original study by Buttelmann et al. (2009) also support this conclusion of an expectation about searching for the toy due to the trick confound. That is, a majority of the older children in the original study tried to help E2 as soon as E2 returned to the room. This meant that children already had an expectation that E2 would search for the toy upon return. This is important because at this point in the procedure children were not supposed to have made the false-belief inference that was supposed to have then enabled them to help by retrieving the toy.

The primary relevance of this study for current purposes is to again illustrate how mentalistic paradigms take for granted the types of complexity that non-mentalistic perspectives would suggest need controlling (e.g., complexity related to the type of social situation). To be clear, our claim is not to suggest that constructivist complexity

can never be taken for granted when studying development, but rather, that what gets taken for granted should be based on explicit theoretical claims and open to empirical test rather than taken for granted in the design and interpretive logic of various paradigms. The helping paradigm by Buttelmann et al. (2009) was intended to overcome the limitations of looking paradigms; however, the problems with looking paradigms are not simply methodological. Instead, we have argued that the problems with looking paradigms are the package of theoretical commitments typical of nativist research programs. Similarly, the problems with mentalism as a research program are the background assumptions and commitments. These include (a) the presumed split between physical surface behavior and deep social meaning and (b) that going beyond surface behavior requires mindreading. The modus operandi for mentalistic research programs is one in which tasks are defined in terms of mental states that already abstract away from any situational complexity. Then, if children are successful on a task, it is evidence for mindreading, and failure is not-evidence of mindreading.¹³ However, non-mindreading alternative approaches to social-cognition are ubiquitous and so experimental studies should consider how children might succeed on tasks with something other than mindreading capabilities. In terms of methodology, such consideration would generally result in social-cognitive tasks/designs/interpretations that more adequately consider object/agent affordances and how they relate to the broader social situation. Without such consideration, mentalistic studies cannot generally differentiate between mindreading and non-mindreading interpretations. While mentalistic studies often include some type of control conditions (e.g., controlling for mere association), they are not the type that is motivated by the more robust constructivist perspectives present in the literature.

While both lean-empiricist and action-based constructivist approaches consider situations and affordances in methodology, only the latter approach argues against the first assumption: the presumed split between physical surface behavior and deep social meaning.¹⁴ From an information-processing perspective, meaning must be added to all perceptual inputs, but this is especially salient in the case of unobservable mental-states. Accordingly, lean-empiricist approaches of all stripes generally hold onto the assumption of a presumed split. Instead, they differ from rich-empiricists (and nativists) about the second assumption: that going beyond surface behavior requires mindreading. As seen with examples from dynamic object affordances, equifinality, teleology, and natural

¹⁰ For some of the developmental complexity involved in helping around these ages, see Hammond (2014) and Paulus (2014).

¹¹ Similar to the point made by Gergely and Csibra (2003), the labeling of conditions takes a mentalistic perspective for granted in the sense that what was manipulated was the presence or absence of the adult experimenter.

¹² For an alternative critique from a teleological perspective, see Priewasser et al. (2018).

¹³ The study by Buttelmann et al. actually went a step further in that there was only mentalistic interpretations possible regardless of the results from the experiments. That is, the study was designed to allow for interpretations about which mental state attributions children might possess at different ages (i.e., false-belief and true-belief or only true-belief) but not whether they were making mental-state attributions in the first place.

¹⁴ While an action-based constructivist perspective is one theoretical loci for rejecting this presumed split, phenomenology is an alternative perspective that shares many similar conceptual and methodological criticisms of the mindreading perspective (Gallagher, 2008; Froese & Leavens, 2014; Ratcliffe, 2007).

pedagogy/situation reading, there are different ways of going beyond what is given in the perception of behavior.

For action-based emergent constructivists (and for phenomenologists), it is not so much that mindreading is unnecessary to go beyond what is given in behavior, as that the perception of “behavior” is already meaningful. The meaning of your actions is constituted by a shared history of interactions together. Over time, many of these interactions become shared practices (Racine & Carpendale, 2007a; Racine & Carpendale, 2007b) that may be characterized by adults as types of social situations (e.g., peek-a-boo, feeding time, diaper changing time, gesture-imitation, object-imitation, pedagogy, helping, hide-and-seek, etc.). From an action-based perspective, the social-cognitive processes for young children do not concern representations about other’s mental-states; instead, they concern anticipations about interactive potentiality (Carpendale et al., 2013b). Young children have an interactive knowledge of the world. Knowing others means knowing how to coordinate interactions with them (Bickhard, 2008). For this perspective, social-cognitive development is a matter of learning to differentiation types of situations that involve different sorts of interactive potentiality. In short, this is a social ontology of interactive social situations rather than a social ontology of mindreading (Mirski & Bickhard, 2021).

Going beyond the Constructivist Methodology of Empiricism

In the final section, we aim to demonstrate an area where the inherent inadequacies of empiricism, as a theoretical framework, limit subsequent methodology. This area is social experience, and, by extension, language and culture. An action-based emergent constructivist framework is generally better able to incorporate sociality (including language) and culture into development relative to any foundationalist framework (Carpendale & Lewis, 2006; Mirski & Bickhard, 2021; Mirski & Gut, 2018). Because empiricist research programs are generally open to forms of constructivist complexity and assume genuine developmental emergence,¹⁵ they can seem methodologically similar to the constructivism of action-based approaches. However, the two approaches are more clearly different with respect to discussion about the nature of *what* is being constructed (e.g., the nature of representa-

tion). We indicated earlier that a problematic notion of representation is the theoretical loci for limitations with empiricist infant methodology (see section 3.3 of Allen & Bickhard, 2013a but also Müller & Overton, 1998) and suggest the same for our current discussion. Further, with a focus on what is being constructed, more clear differences in the constructive processes themselves also become evident.

Our discussion will focus on an area of research that has been pioneered by an empiricist perspective with constructivist intuitions and developmental aspirations. This area investigates the influence of maternal mental-state talk for children’s developing ability to reason about others mental perspective (i.e., their mindreading abilities also known as Theory of Mind – ToM). This area of research concerns older children (preschoolers) and is less experimental and less theory-laden than our previous discussions (i.e., coding maternal language use and looking for factual relations with children’s performance on different sorts of tasks). Less theory-laden means that many of the findings are still meaningful for an action-based emergent constructivist approach. However, less theory-laden does not mean theory-neutral and we aim to show how a sociocultural version of an action-based emergent constructivist approach provides better guidance to methodology in this area (Ilgaz & Allen, 2020).

Theory Theory versus Sociocultural Approaches

Theory Theory (TT) is an empiricist perspective focused on the development of children’s ToM abilities. The particular brand of TT that has been developed most fully with regard to research on maternal discourse is by Wellman and his colleagues (Gopnik, 1996; Gopnik & Wellman, 1992; Wellman, 1990, 2014). For TT, the child is construed as a “little scientist” and learning is a process of generating hypotheses about the environment that are either confirmed or disconfirmed. In order to get the process of hypothesis-testing started, children require an innate starting state – that is, foundationalism (Gopnik, 2003). Different from nativism, later development is supposed to involve qualitative conceptual change that is characterized as a theory-revision process. From the TT perspective, social experience and culture have no *constitutive* role to play in the constructive process of the child or in the outcome of what gets constructed. Cultures may differ in terms of the particular pattern of socially experienced confirmation/disconfirmation but the hypotheses themselves are not socioculturally constituted. Accordingly, social experience is not different in kind from non-

¹⁵ To be clear, they assume it but have no way to account for it.

social experience. All experience just provides data for deciding between hypotheses.

For action-based approaches, all representation is a relationship of the organism to its environment (e.g., an interactive potential depends on both the environment and the organism). In the case of the social environment, representation is doubly relational in that social ontology is understood in terms of social realities (Bickhard, 2008). Social realities are mutually held interactive characterizations of the situation. Without the mutuality, the reality does not exist. This means that other people co-constitute social ontology in a *constitutive* sense and, therefore, social experience takes on a central role. One immediate consequence of the social interactive origins of sociality is to make second-person engagement ontologically and developmentally primary. In contrast, TT assumes the primacy of a third-person perspective that is at theoretical remove from the “rough ground” of second-person interaction (Gallagher, 2008; Reddy, 2007). The mentalistic abstraction away from the rough ground of the social situation does happen, but as a developmental outcome, not a starting point. One of the relevant influences of language interactants in using mental-state discourse (i.e., folk-psychologies) with children is to co-constitute the construction of such a third-person perspective taking (Bruner, 1990; Carpendale & Lewis, 2006, 2015; Nelson, 1996, 2005, 2009). This is what it means for children to enter into a “community of minds.”

Maternal (Mental-State) Discourse Interactions

Ilgaz and Allen (2020) have identified five areas where empiricist methodology, regarding the effect of maternal mental-state talk for children’s ToM development, could be extended and developed. First, (a) the second-person interaction between child and mother while engaged in third-person discourse should not be taken for granted. Accordingly, the different sources of variability related to such second-person interactions involve complexity that should be systematically investigated. These include variability regarding (b) interaction context, (c) type of mental-state discourse, (d) scaffolding *relationship* between mother and child, and (e) conversation partner.

Variability of Referent

Mental-state talk often functions to highlight the perspective of third persons. For example, if we are telling a story in which we say that, “The frog was hiding because he thought there was a wolf,” we are highlighting the subjectivity of the frog’s perspective that this was in fact the case. However, storytelling is itself a social reality and

mental-state talk is also used within the second-person interaction in which the third-person story is being told. For example, as part of the storytelling interaction we may ask the child “I wonder where the frog is hiding?” or “where do you think the frog is hiding?” However, research programs using a storytelling context have tended to focus on third-person references to the story characters (e.g., Slaughter et al., 2007). While there are exceptions (Adrián et al., 2007; Taumoepeau & Ruffman, 2006, 2008), coding for second person mental-state reference is more strongly motivated from a sociocultural perspective. TT emphasizes taking perspective as a third-person activity that makes the second-person social interaction a performance issue relative to the ToM competence. From this perspective, it should make little more than a motivational difference if the child were listening to an audio book or engaged in storytelling with an adult partner. In contrast, for a sociocultural approach the storytelling context itself is important for two reasons. First, such language should directly impact the child’s understanding of perspective through its use in second-person experience. Second, establishing the storytelling context as a social reality provides the ground from which a third-person understanding can emerge developmentally.

Variability of Context

Research on the effects of mental-state discourse for children’s development always takes place in some type of social situations. These include various sorts of storytelling (e.g., wordless, commercial with text, a few pictures), play (problem centered, sociodramatic), reminiscing, and sometimes self-report concerning everyday situations. Are these contexts an instrumental means of eliciting speech or a constitutive origin for further developing social ontology? TT seems committed to the former and sociocultural theory the latter. Evidence suggests that a plurality of contexts is relevant for investigating the relation between mental-state talk and ToM development cross-sectionally and longitudinally; however, the extant literature relies on meta-analyses for comparing the contexts themselves (Devine & Hughes, 2018; Tompkins et al., 2018). Accordingly, direct manipulation of contexts for different age groups would seem to be an important avenue to explore for this literature. For example, telling a story from a picture book is likely to be more relevant for mental-state discourse related to perception than a situation involving reminiscing. In contrast, cognitive words like remember and forget may be more relevant for reminiscing. This means that differ-

ent mental-state word subcategories may have differential relevance depending on the situation and age of the child.

Variability of Coding and Analyses

The scope of mental-state words being coded and analyzed across studies is quite variable (see Ilgaz & Allen, 2020, section 4). Cognitive words in general, and “think” and “know” in particular, are most common along with the consistent exclusion of perception words. If the essence of the theory for a ToM are beliefs and desires, and, if mental-state words transmit relevant data for the child’s ToM hypotheses, then perhaps belief and desire words should be most meaningful. Further, if the ToM tasks being used with children are focused on false-belief understanding, then, again, perhaps cognitive terms are more relevant. However, sociocultural approaches generally consider language in more functional terms such that the words are not important so much as the function that is being served by those words. In the case of mental-state language, the function is often to highlight, reflect on, and/or coordinate perspectives. This means that non-mental-state words may serve the same perspectival function. Further, taking more of a functional approach to language facilitates thinking about issues of coding and analysis in other cultures. English is a highly lexicalized language. In contrast, Turkish is an agglutinative language that involves much greater use of morpho-syntactic units (e.g., suffixes). For example, Turkish speakers can use suffixes with verbs that differentiate the modality for volitional wishes to express desires (i.e., -e, -a) versus to express intention (i.e., -se, -sa). Also, modal adverbials “ben-ce/sen-ce” (according to me/you) are frequently used with young children in everyday discourse to express perspectival content. “The utterance “Bence kaybolduk” (rough translation: according to me, we are lost), would express a belief without resorting to the use of proper mental state words” (Ilgaz & Allen, 2020, p. 12). Accordingly, a comprehensive coding for different sorts of perspectival content would be important to better understand the co-constitutive role of maternal speech for the totality of children’s folk-psychological understanding of others. It would also facilitate exploring the possibility that cultural differences constitute substantive conceptual differences in the folk-psychological constructs themselves (Lillard, 1998).

Variability of Conversation Partner and Variability in the Scaffolding Relationship

The final two areas of methodology discussed by Ilgaz and Allen (2020) are closely related. Taking into account variability introduced by different conversation partners is *just* another way of considering the nature of the scaffolding relationship. For any encodingist epistemology, including TT, scaffolding is going to involve a more knowledgeable adult or peer who can transfer their knowledge through some sort of internalization process (Mirski & Bickhard, 2021). In contrast, for an action-based emergent constructivism, learning is a variation and selection process and scaffolding is the *blocking of selection pressures* (Bickhard, 1992, 2005). The variations being constructed are for interactive potentialities (not conceptual hypotheses) and whether those potentials succeed once engaged, involves selection by the (social) environment. Accordingly, adults, peers, or even the child themselves can block selection pressures that would otherwise result in an unsuccessful interaction. For an example of “self-scaffolding” the child may learn to use their parent’s emotional reaction in a novel situation to guide approach or withdrawal (i.e., social referencing). Alternatively, the scaffolding can also be done by an adult who lacks the “relevant knowledge” (Mirski & Bickhard, 2021); for example, a US-based children’s literacy program called Reading Corps provides trainings for parents who are sometimes themselves illiterate (how to hold a book, turn pages, identify letters, etc., AmeriCorps, 2022).

This notion of functional scaffolding fits with any sociocultural approach that construes scaffolding as a *dynamic relationship* between the child and scaffold. One such approach is the mind-mindedness literature (Meins & Fernyhough, 1999; Meins et al., 2003). Mind-mindedness captures the ways in which mothers interact with their infants as mental agents. Attuned interactions (e.g., comments consistent with the infants’ actual mental states, successful meaning making from incomprehensible vocalizations, etc.) relate to later theory of mind developments. However, the approach has not been effectively applied with older children in the context of storytelling/picture book discourse. Accordingly, Ilgaz and Allen (2020) suggest three avenues for research that are largely unexplored in the literature.

The first concerns longitudinal studies on possible changes in the proportions of mental-state subcategories (e.g., perception, desire, emotion, belief, etc.). One exception to the lack of studies comes from Taumoepeau and Ruffman (2006, 2008). Of particular interest was a negative correlation between parental desire talk and child

emotion understanding that was preceded by a positive correlation at an earlier time point. From the perspective of dynamic scaffolding, this pattern would result from parents implicitly knowing that their children were struggling and, therefore, maintaining greater amounts of talk to compensate. The second avenue concerns studies that collect language data in different contexts (e.g., storytelling and play). Parents who are more sensitive to the particulars of context are likely to adapt their language accordingly. If correct, this would suggest greater context specificity in the constructive origins of a folk-psychological understanding of others than is assumed by a TT approach. The third avenue relates to the child's knowledge in the scaffolding relationship. That is, dynamic scaffolding should adjust according to the knowledge of the child. The first avenue above addresses this point for developmental time but some contexts make this particularly relevant on shorter timescales. For example, the same books are read repeatedly with children. If children's understanding of the meaning of such a book changes with repetition, then so too might the mental-state talk of the parents. Whether such changes occur and whether they have a relevant effect is open to investigation. Finally, variability of the conversation partner is the flipside of focusing on changes in what the child knows. Mothers and fathers may have different interaction styles based on issues related to gender or else they may differ in terms of their roles as primary and nonprimary caregivers. In general, primary caregivers should be more attuned to their children whether that is the father or mother. Accordingly, just as with context, mothers and fathers may provide unique scaffolding that is important for some constructive trajectories over others.

Conclusion

A starting point for our analysis was that a comprehensive empirical science of the developing mind requires an emergent constructivist framework. Foundationalist approaches preclude emergent constructivism in general and therefore cannot be adequate candidates in either their nativist or empiricist versions. Action-based approaches account for emergence and the interactivist model accounts for normative emergence. Such starting points open the door to the possibility of an emergent constructivism and therefore provide an adequate framework to study the richness of development. We further argued that despite the theoretical symmetry between nativism and empiricism in terms of foundationalism, there

is an important asymmetry with respect to methodology. It has generally been empiricist research programs that have uncovered the confounds in nativist research for object and number domains. The reason for this had to do with what sorts of constructivist and developmental complexity the different research programs did, or did not, take for granted. Empiricist methodology tended to consider perceptual-level complexity relevant in ways that were ignored by nativist methodology.

In the literature, this contrast played out largely in terms of rich versus lean interpretations. This framing helped make sense of the fact that for social-cognition research, empiricists were themselves divided. On the rich-empiricist side were those who shared with nativists the assumption that knowing others means reading their minds, while on the lean side were those who sought to demonstrate that reading behavior was enough. In assuming that knowing others means mindreading, rich-empiricists tended to abstract away from the complexities of the concrete social situation in research design and interpretation. In contrast, by assuming that knowing others means behavior reading, researchers tended to include variables related to concrete aspects of the social situation.

For some areas of research, paradigms are less theory-laden and implicit constraints on methodology are more flexible relative to background frameworks. This seems to be the case for research on maternal speech and children's ToM development. Much of the empirical results are factual relations that hold or do not hold. Decisions about comprehensive coding or conversation partner can be motivated by constructivist intuitions or a general value for thoroughness rather than theoretical assumptions; however, general trends in the literature make the influence of empiricist theory clear. More importantly, an action-based emergent constructivist approach provides a more coherent and principled guidance to methodological decisions about sources of variability. Lastly, for the explanatory side of this research, an action-based approach has multiple advantages over even the most constructivists of empiricist explanations (Mirski & Bickhard, 2021). One benefit of this overall situation is that action-based approaches can build on and extend existing research programs for this area in a way that is not possible for nativist looking time studies.

The main conclusions of the current analysis are that (a) action-based emergent constructivist approaches are the best theoretical framework to model constructivism and development; (b) constructivist methodologies have multiple conceptual sources; and (c) accordingly, although there is theoretical incommensurability between

empiricism and action-based approaches, there are varying degrees of methodological commensurability. This enables action-based approaches to have the potential to make use of and extend empiricist programs of research.

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Statement of Ethics

No ethical approval was required for the preparation of this manuscript, as no human or animal subjects were used.

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Conflict of Interest Statement

The authors declare that there is no conflict of interest.

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