

Emergence

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Abstract

Contemporary dynamic theories of cognition and functional theories of linguistics fall into two general camps: “traditional” and “emergent” approaches. Building on work of the linguist Paul Hopper, I identify four characteristics of emergent phenomena: feedback properties; sociohistorical embeddedness; language and language-like “structures”; and what I call “recursivity,” the feedback-based presence of system-analytic elements within the cognitive systems they seem to explain. This latter feature, especially, raises questions about whether “emergence” is a phenomenon, a theory, an approach, etc. I suggest that emergence offers at least a refreshingly ordinary framework for theories of empirical cognition, which nevertheless flow to the “deep” levels claimed by rule-based cognitive explanations.

Emergence

In recent years, psychologists and linguists have developed dynamic and interactive theories about a wide range of mental activities, from thinking, calculating, knowing and understanding, to speaking and writing.¹ These approaches have developed in large part as positive alternatives to any number of what might be generically called “objectivist” views, the most extreme of which include some versions of Fodorian Realism and Chomskyan Rationalism.² But the qualities shared by dynamic approaches belie deeper divisions. Chief among them is a distinction we can draw between what might be called “traditional” and “emergent” views of cognition. Traditional-dynamic and objectivist views have received relatively thorough expositions in the literature. Emergent perspectives, which I attempt to outline here, have received less rigorous press, in no small part because they raise deep questions about some guiding assumptions of both the objectivist and even traditional-dynamic theories.

¹ In much of this essay I use the term “cognition” to refer to the whole gamut of mental capacities; when necessary I distinguish among them.

² For compelling defenses and explications of Fodor’s realism — which may not be the same thing as Fodorian realism — see Fodor (1981; 1987; 1990). For general explications of some of Chomsky’s views see Chomsky (1986); a more technical and recent explication is available in Chomsky (1995), especially its final chapter. Lakoff (1987) offers an elaborate characterization (and one of the most thorough contemporary critiques) of the objectivist position.

Dynamic Approaches in General

Dynamic theories — including approaches like connectionism, dynamic systems theory, self-regulating and self-organizing systems theories, some brands of functional cognitive theories, and many brands of cognitive and functional linguistics — share a sense that no static or highly formalizable set of rules can be used to characterize human cognitive or linguistic competence. They differ, in part, with respect to whether or not they take the notion of competence itself to be very useful or revealing. Traditional dynamic approaches display some faith in the sense that a set of rule-like principles in dynamic systems can serve similar functions to the ones served by static rules in objectivist approaches.³ What I will call emergent approaches doubt that competence makes much sense, and therefore believe that cognitive phenomena fail to obey very formalizable rules or regularities, regardless of whether these rules are construed objectively or traditional-dynamically.

Emergent Approaches. It is no surprise, then, that the tenor of emergent approaches is more often available in statements of purpose than in fully rigorous statements of principle. For example, near the end of *Beyond Modularity*, Annette Karmiloff-Smith writes that “consciousness for me [is] not a “box” or a sensible operator; it [is] an emergent property of the reiterated process of representational re-description. It is my view that the types of construct that arise within dynamical systems theory, and its implementation in connectionist models of development, may turn out to be at the right level for more precise future explorations of the RR model” (1992, p. 190). In Andy Clark’s words,

³ Rather than a hard and fast division, I really mean to suggest here that there is a continuum of more-or-less traditional dynamic theories. Theorists at the most traditional end of the continuum include Stich in his most recent incarnation (1996); Dennett (1991); and perhaps Horgan and Tienson (1996). Also, but from the reverse angle, see some of the more doubting passages in Fodor (1994; 1995). Paul Churchland (1989; 1998), Putnam (1988) and an earlier of Stich’s incarnations (1990) seem to me plausibly attempting to occupy a middle ground. Among philosophers of cognitive science, Clark (1993; 1996), Karmiloff-Smith (1992); Leyton (1992); van Gelder (1995), the works in Port and van Gelder (1995), and, arguably, Cummins (1995) push hardest toward a properly emergent perspective, as I discuss below; see further on as well for a discussion of a similar continuum in contemporary linguistics.

“connectionism reconfigures content in dynamic ways which can often outstrip our attempts to capture it in a piece of static, text-like code” (1993, p. 67).

According to this perspective, traditional approaches rest on implausible and arguably ideological grounding assumptions about human cognitive activities. Emergent theories are obviously composed in large part of critical examinations of the principles put forth by objectivist and traditional-dynamic theories; this should not cause us to lose sight of the constructive aspects of emergent views. In the remainder of this paper I briefly develop four characteristics of emergent theories: a feedback or reciprocal nature; embeddedness in social and historical phenomena; language and language-like “structure”; and, building on these three, a recursive character that constrains our attempts to offer systematic explanations of emergent phenomena, and raises substantial questions about whether emergence should best be viewed as a theory, as a set of properties, as an empirical phenomenon, or none of these.

Feedback

By far the most familiar of the characteristics of an emergent approach to cognition is feedback in the most basic sense. Connectionist systems rely fundamentally on feedback and feedback loops. Interactions between a connectionist network and a set of objects in the real world are never one-to-one; it is never the case that a connectionist system sees a pattern it associates with a rock and draws upon its lexicon to produce the word “rock” (or, more typically, the signal “true”).⁴ Rather, the system addresses the probability it ascribes to the signal being true, and it simultaneously adjusts the weighting in the network of “judgments” it has used to judge the signal itself. It thus builds an ever-more-finely-tuned system, one that never arrives at hard-and-fast and simply binary weightings.

There is at least intuitive appeal to the “feel” of feedback systems as opposed to objectivist ones; for in facts we ourselves perceive about our experiences, it is rarely the case that circumstances clearly present themselves as “true” or “false,” or that meanings present themselves as anything but “relatively true” or “relatively false.” Though it is not my focus here, this raw appeal of feedback as a principle in cognition seems to me to gain most from empirical examination.

Generality of Feedback

What is of some interest to me in this context, however, is the ubiquity of the feedback model. On reflection, it seems clear that most of the activities in our everyday lives in which we most rely on our cognitive abilities, themselves rely heavily on feedback. For example, social relationships from the most intimate to the most distant rest on feedback loops: it is very rare that we could characterize those relationships without an element of interactive change. That is certainly true of our personal and general competence at the

various mundane tasks we engage in each day, no less than of our professional expertise, and of other forms of competence as well. It is really not accurate to say that one learns to drive a car; it is more accurate to say that, once one gains a certain level of mastery over a relatively small set of skills, one feel competent to engage in an ongoing interaction with the environments and skill requirements of driving, and that one is constantly adjusting, even in minor ways, one’s competence as novel situations present themselves. And it seems hard to find any social or experiential aspects of human life that do not require such analyses: change, not stasis, is a hallmark of experience.

Resistance to Systematicity. The emphasis on change, however, does not exhaust the appeal of feedback learning to dynamic theories. Just as important, and perhaps more important to us in the long run from an emergent perspective, is the resistance to systematicity that feedback is taken by emergent theorists to imply. As I shall discuss further on, this general anti-systematicity raises what are ultimately profound questions about the status of emergence as a theory or property.

The Social

Earlier the issue of feedback pointed us to the question of the social. It is not simple coincidence that so many of the phenomena that have obvious feedback characteristics are themselves social; rather, at least some dynamic theorists have come to understand that social phenomena are inextricably part of most of the activities to which we give the name “cognition.”⁵ In its most pointed form, this view states that the kind of phenomena we call cognition, while seemingly easily abstractable from the social matrices in which they are embedded, turn out to become highly distorted by analytic abstraction. Feedback connects cognition to the social matrix, in that the social matrix is at least some part — although we might be tempted to argue that it is a very large part, and includes some of those features we characteristically consider “individual” — of that with which cognition enters into feedback loops.

The impact of the social on cognition as such has been expressed most recently along a number of axes: these include studies of the ways in which communication and cognition are realized in the body; studies in linguistics that focus on body-based phenomena (including phonology and gesture); and the classic recent line of argument in philosophy of mind around the social basis of meaning. All of these treatments are tremendously important for emergence as I am discussing it here. But the approaches I am most especially interested in here are historical (and, more generally, social) approaches, which have received much more detailed explication in the linguistic literature than in cognitive science proper.

⁴ For a more detailed account of feedback in connectionist systems, see, e. g., Churchland (1989); Clark (1993); Karmiloff-Smith (1992).

⁵ Most notably, Clark (1993; 1996) and, to a lesser extent, Stich (1996).

Emergence and History

Traditional theories of cognition assume that it is possible, and even desirable, to construct a largely “objective” picture of something that we can approximately call “human cognitive potential” (or practice). It seems to me entirely arguable whether there is such a thing, *contra* a wide range of speculation I lack the space to deal with here.

What we can say with some certainty is that there is a history of all the acts of cognition that human beings have engaged in. But what would complete knowledge of this entire, particular history look like? I mean to place this question for us, in our world — a world where the question literally has no answer. The best answer we might give would be something on the order of, well, if you had a library full of film of every event in human history, that might constitute a kind of complete history of human beings and their cognitive activity. But every time we try to use or to watch these films, we create another human event, which by definition has to be filmed, and then watched by the investigator, whose watching must be filmed, etc. That is, and not only in this fashion, we fall into a kind of infinite regress that seems more appropriate to certain kinds of metaphysical speculation than to the objective study of history.⁶

Emergence and Social Embeddedness

This illustration helps us see some of the ways in which emergent phenomena like cognition are embedded in and interactive with, and in a sense not “metaphysically” separable from, the contexts and interactive phenomena out of which they emerge. Emergent phenomena have real histories that are too granular to be explained in complete detail (but which we feel compelled to try to explain), that are impressively massive, that display all kinds of “internal” and “external” structural principles. But these structures ultimately call themselves into question — much as most recent theories of cognition and mind have, in succession, openly called themselves into question.⁷

Many if not most of the everyday social and historical forms of cognition with which we are intimately familiar are very much emergent — that is they emerge from the historical matrix. Looking at the development of any thematic material in culture it is easy enough to see what this means. The development of artistic styles, vernaculars, pidgins and creoles, institutional capabilities, professional skill sets, patterns of social interaction, groups and institutions themselves, all of these share emergent “structures” — structural features that grow, and grow on examination, and in which

⁶ Oddly, this sort of formula does occur fairly often in standard analytic treatments of cognition; David Lewis (1970) writes that “What then, are things? Of course I want to say, once and for all: everything is a thing. But I must not say that. Not all sets of things can be things; else the set of things would be larger than itself” (p. 196).

⁷ On the historical embeddedness of conceptualization, see Golumbia (In Press; Under Review) and Margolis (1995). Specifically on the historical nature of language see Golumbia (In Preparation).

the search for formally ordering rules is both extremely seductive and, ultimately, beyond the abilities of our (current?) structural apparatus.

Language

This description sounds much like the current state of investigation into language, and indeed there are no more clearly emergent phenomena than those we together call language. But that is perhaps not the most significant reason that the study of language is critical to the study of emergence, for much about our own particular languages as historically emergent entities in turn structures our ability to understand just what the subject of our discourses is.

Indeed, the source for the term “emergence” is Paul Hopper’s (1987; 1988) essays of the late 1980s on Emergent Grammar. In the first of those essays Hopper writes that “‘Grammar’ is an infuriatingly elusive notion ... it is very easy to have a clear idea about what ‘grammar’ is in the sense of being able to give an abstract definition of it, but quite another to apply that definition consistently in practice. This asymmetry suggests that the notion of grammar is intrinsically unstable and indeterminate, relative to the observer, to those involved in the speech situation, and to the particular set of phenomena being focused upon” (pp. 154-155). Earlier in the same essay Hopper writes that “the linguistic system is now not to be seen as something complete and homogeneous, in which ‘exceptional’ phenomena must be set aside as inconvenient irregularities, but as a growing together of disparate forms. Similarities spread outwards from individual formulas, in ways that are motivated by a variety of factors ... They do not, however, merge into the kind of uniform grammar which would lead one to posit a uniform mental representation to subtend them” (p. 147).

Hopper arrives at his understanding about the syntactic “system” from his own and other recent linguists’ work on grammaticalization.⁸ In opposition to the great part of theoretical linguistics that takes languages as static (synchronic) objects, grammaticalization theory looks at linguistic phenomena as diachronic processes, collections of parts that don’t readily coalesce into identifiable wholes. Grammaticalization theory addresses certain fundamental processes of language change — for example, the processes by which strings of words arranged according to syntactic “rules” change over time into more and more transparent forms. Another way of putting the observation is to note that it is very common for words that have clear lexical meanings to change over time into words that serve purely syntactic functions.

Anaphorization and Cliticization. One of the most fertile lines of study in synchronic linguistics has been that of anaphora — the “absence” of morphological forms in grammatical structures where grammatical meaning never-

⁸ For other of Hopper’s writings see (1989; 1990). Hopper and Traugott (1993) is the best overview of grammaticalization; also see Heine (1992; 1995; 1997), Traugott & Heine (1991), and Heine, Claudi, & Hünnemeyer (1991).

theless persists.⁹ Grammaticalization suggests that anaphora constitute marks not of the formal rules underlying language, but of the historical sediment traceable everywhere in emergent phenomena. Hopper (1990) writes that “the study of language change ... tells us that the normal course of events is governed by attrition. While this course can be slowed or even arrested internally by analogical extension and externally by borrowing and adaptation, left to its own devices the controlling drift of change is loss. ... It seems clear that one possible outcome of attrition is zero, the actual disappearance of a word, as a result of cliticization, affixation, and eventual absorption into a stem” (pp. 151-152).

Grammaticalization also raises questions about the notion of “word” itself — questions that have also been raised by close students of words themselves — for example, Bauer (1983), who writes that “syntactic and morphological productivity seem to have more in common than they have to distinguish them. In fact, if one accepts the conclusion that the difference between the productivity of sentence formation and word-formation is a quantitative but not a qualitative one, then the two are so similar that it becomes virtually obligatory for the analyst to attempt to deal with sentence formation and word-formation in the same component of the grammar” (p. 74).¹⁰ Through cliticization, by which grammatical particles become affixes, and through history, words are always already becoming rules and rules are always becoming words.

Conclusion. Taken together, these and other approaches suggest that language exhibits a great variety of underlying structures, and that these structures emerge from the phenomena themselves and from the “social” and “cultural” and “individual” matrices in which they are embedded.

Recursion

I will use the term “recursion” in the remainder of this paper, for lack of any better term in the literature, to indicate structures that build on those I outlined earlier when talking about feedback. Because feedback “systems” resist traditional functional or syntactic analysis, they instance a phenomenon that is both remarkably commonplace and yet generally overlooked.

To understand this phenomenon we need only reflect on the fact that traditional philosophical and cognitive inquiry

⁹ For an especially relevant discussion of anaphora see Fox (1987); also see Labov (1995).

¹⁰ Of course, the syntax/semantics division and the exact nature of the lexicon with regard to that division have long been objects of debate in linguistics and cognitive science, and I consciously take some inspiration not only from the works of some linguists after they “stopped” being “generative semanticists” (see especially McCawley 1973; 1979; 1981; 1982) and from some of Ray Jackendoff’s recent (1997) work that very calmly calls into question major aspects of the supposedly modular “language organ.” For an excellent summary of some of the issues raised by these debates see J. D. Fodor (1977); a more pointed summary of the controversy from a cultural perspective is Harris (1993). For more technical discussions of the status of words see Snow (1988), Hopper (1990), and Di Sciullo & Williams (1987).

takes it as analytically reasonable to separate into various registers or rhetorics the whole range of cognitive abilities: thinking, knowing, remembering, and so on. In emergent phenomena, all the members of this cognitive suite are generally engaged together. You can’t “use” language without understanding it, or knowing about it, or using it, or referring to it, and so on.

In fact, even the attempt to understand, to analyze, to explicate this “meta-feedback” phenomenon requires the rest of the members of the “suite.”

Which leads me to attempt to make a statement, but I am not altogether sure I have the language to express it, for it is by definition the expression of concepts that lack the structure our apparent conception of language demands.¹¹

Emergence and Cognition

Emergence is a key concept (or property, or term, or result, or procedure) in all those activities to which we refer by terms associated with mental, cognitive, and linguistic phenomena. That is not to say that it explains those phenomena, but the presence of emergent structures frustrates certain kinds of what we might call “static” (or what Hopper calls, somewhat generically, *a priori*) explanations. Much of language is characterized by emergence, as is much of thinking, understanding, even perceiving.

Too many of the categorizations of experience that have served Western society so well have begun to show more plainly than ever the holes in the fabric out of which they are made. We can now clearly see that the plainest divisions — between nature and culture, self and other, inside and outside — conceal as much as they explain. To my mind, much of the character of contemporary cognitive science theorizing (by which I mostly mean here the development of “orthodox” views in philosophy of mind) can be seen as a kind of desperate response to the great pressure under which these divisions have come.

But that pressure exists because our concepts fail to capture adequately the full texture of experience, and thus tempt us toward the construction of abstracted systems that seem to account for much more than they do.¹² Among other things, much of the syntax of our much of our handed-down conceptual apparatus consists of accretions of rule-like structures that, on examination, cannot exactly provide the formalizations they promise. This is by no means to suggest that they *cannot* model experience, or bring us understanding, or provide insight: to the contrary, that is just what they do — only not the way the word “rule” suggests that they do. Our concepts and our cognitive practices are infinitely

¹¹ It is this clear empirical paradox of conceptual systematization on which deconstruction rests. See below.

¹² It is at this point precisely that the strongest homology exists between what I am here calling “emergent approaches” to cognition and deconstruction in general. I lack the space here to explicate in great detail these connections; for a gesture in this direction (though not exactly the one I would endorse) see Globus (1995). For relevant readings in deconstruction (although their relevance itself is an issue deserving explication), see Bennington (1994), Critchley (1992); Derrida (1967; 1971; 1980; 1982; 1989; 1992; 1993; 1994), and Spivak (1980).

more flexible than rule-bound systems imply. The fact that they often display seemingly rule-bound characteristics should be analyzed in terms of propensities for regularity — emergent propensities — as well as propensities for disorder and disjunction. Both propensities exist, and the fact that our conceptual “systems,” such as they are, appear vulnerable to broadly systematizing endeavors should tell us much about the fabric in which the systems are knit, about its, we might say, its conceptual *viscosity*. But this tells us too little about the various inter-animating mechanisms that produce phenomena we label “syntax,” “semantics,” “morphology,” no less than “thinking,” “wondering,” “calculating.” And it tells us too little about the specific histories and cultural-psychological “structures” that are encoded in the viscosity itself.

The Future of Cognitive Theory

From an emergent framework, we can make a prediction about the future direction of cognitive development: a prediction more accurate, more substantive, and much more common-sensical than any predictions possible within a classical framework: that the cognitive practices of the future, and even the languages in which they at times receive expression, will build on systematizations, disjunctions, potentials, consequences, and unconscious extensions of the phenomena in place today; and furthermore that those phenomena at which we gesture by terms like “consciousness,” “rationality,” “social hope,” and so on, will have influence over every aspect of that development.

Conclusion. I have been deliberately vague, and not only due to lack of space. For I hope to have at least suggested that some ideas that have been thought beyond the pale are in fact easily conceivable, even if they lead us into areas we have trouble seeing clearly. The history of science, knowledge, culture and even cognition tells us that this is much what we should expect: that cognition itself will develop in ways we can scarcely comprehend, especially if we remain open to such possibilities.

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