Language as an Interaction System

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In this article I present a programmatic outline of a new *kind* of model of language, plus offer some criticisms of standard approaches. The discussion begins with issues concerning representation because, so I argue, problems with standard approaches to representation are at the heart of notions of and problems with language.

The standard information flow view of cognition and language has environmental information being transduced at sensory surfaces, the encodings thereby generated being processed in internal cognition (whether of symbol manipulation or connectionist or neural net form, or all of the above), and further output encodings being generated for action, such as walking or eating. A special case of output encodings are those for language: these must appropriately control various muscle groups, but they crucially also involve encodings of mental contents, particularly representational mental contents, which are thereby transmitted via speech or writing to be decoded by an audience of one or more receivers.

It is becoming more and more widely recognized, however, that this picture is seriously flawed at every step: Perception is not a matter of transduced encodings (Bickhard & Richie, 1983; Gibson, 1979; O'Regan & Nöe, 2001). Cognition is not a matter of encoding manipulations, whether symbolic or connectionist (Bickhard, 1999). And, central to this discussion, though much less commonly recognized even in contemporary views, language does not involve encodings of mental contents. Language is a special system for special kinds of interactions, more akin to interacting with a child's toy block than to broadcasting encoded messages via sound waves. Replace the toy block with other peoples' thoughts — or social realities emergent in organizations of such thoughts — and there arises a first approximation of the model that I will be advocating.

The issues here encompass all of cognition, not just language, but they have particularly strong impacts on models of language. For obvious reasons of space, I will briefly mention a few selected points regarding other cognitive phenomena, but will focus primarily on language. Furthermore, there are both positive and negative aspects to the development of alternatives to standard views: both model construction and critiques of those standard views. Here too I will be selective, focusing primarily (though not exclusively) on outlining the model of language as an interaction system.

Encodingism Critiques

The problems regarding encodings in cognition (and the rest of the world) is not that encodings do not or cannot exist. They clearly do exist, and are quite important, especially in our technological world. The problem is that encodings are derivative forms of representation, and cannot serve primary epistemological functions.

In Morse code, for example, "…" encodes "s". That is, "…" stands-in for "s", it borrows its representational content from "s": it is a derivative representation. It is useful to have such derivatives for multiple reasons; one is that "…" can be sent over telegraph wires while "s" cannot. "…" succeeds in borrowing its content from "s" because there are users who know about dots and dashes, about letters of the alphabet, and about the Morse coding relation between the two. This manifests the sense in which encodings cannot serve primary epistemological functions: someone must already have the source or basis representation — "s" in this case — in order for it to be available for being borrowed from. The encoding cannot provide any representational content in itself. It cannot generate representational content. Encodings cannot capture the origin or emergence of representation, yet representation has to have emerged one or many times between the Big Bang and now.[1]

Morse code is conventional, but nothing in the above points turns on that. Consider, for example, a neutrino count from deep in a mine that encodes properties of fusion processes in the sun. The relationships here are strictly natural, not conventional,

[1] Once it is recognized that representation has to have emerged, and, therefore, must be capable of emergence, a new view of ongoing cognition arises as involving a dynamic mental "froth" of emerging and (some at least) disappearing representations, rather than the processing of inert representations. This yields a very different conception of cognitive processes (Bickhard, 2003).

but it nevertheless still holds that such an encoding relationship holds only for someone who already knows about, represents, neutrino counts, fusion processes, and the relationships between them.

Such natural cases do not alter the fundamental issues, but they do illustrate how the fundamental issues can become confused: There is a natural "informational" relationship between the neutrino counts and the sun's fusion processes, in the sense of "information" in which the term refers to strictly natural covariations in phenomena. In this covariational sense, any pair of causally or even non-causally correlated phenomena in the universe carry information about each other. Almost all of such natural "information" relationships are not representational relationships. They can serve as encoding representational relationships, however, if — and only if — some epistemic agent knows about the correlation and can make use of it. That is, if and only if someone already has the relevant representations to be borrowed from, and to ground the information-based inferences.

The difference between the natural case and the conventional case is that the relevant covariation, the informational relationship, is conventionally created and constituted in the second case, but none of the epistemological points is altered by this conventionality. From the perspective of someone who doesn't know about conventionality, in fact, such as a child, they are of the same form.

A confusion often arises, however, because a person attempting to analyze representational phenomena, or to design representational systems, will in general already know the relevant or desired informational relationships, and it becomes easy to attribute the consequent representational relationships to the informational relationships per se. This, in fact, is the standard position in much of the literature (Bickhard & Terveen, 1995; Morrison, 1997). In some cases, such observer or designer models of representation are recognized as such, but are proposed as all there is to representation (Bickhard, 2003b; Bickhard & Terveen, 1995).

Insofar as the aim is to model representation in and of and for a system itself, however, such adversion to external observers or designers is not acceptable. If the necessity for such an interpreter of something on one end of an informational relationship

is not understood, we get the classic presupposition of the internal homunculus who must be present in order to do the interpretation of otherwise contentless phenomena. In effect, observer or designer models of representation have simply moved the homunculus outside of the organism and acknowledged its presence, but they still do not have a model of the *homunculus's* interpretations and representations — the representations of the designer or observer or user or explainer.

Representational Error

I will outline two further, closely related, problems with encoding representations, both focusing on accounting for representational error. Consider the following problem for presumed encoding relationships between mind or organism and world: whatever the special kind of representation constituting relationship is taken to be — whether causal, lawful, structural, or purely informational — it either exists in a particular case or it does not. If it does, then, according to such a model, the representation exists, and it is correct. If the special relationship does not exist, then the representation does not exist. Those are the only two possibilities, but there is a third case the must be modeled: the representation exists but it is incorrect. Such models seem to make representational error impossible.[2]

There has been a minor industry in recent years attempting to address this problem of accounting for representational error (Cummins, 1996; Dretske, 1988; Fodor, 1990, 1991, 1998; Millikan, 1984, 1993), but they all purport to do so only from the perspective of an external observer of the system or organism. That is, even if they succeeded in accounting for representational error on their own terms (which is itself highly contestable: Bickhard, 2003b), they invariably make use of an external observer who is in a position to evaluate the conditions and relationships between the organism and its environment to determine whether or not an organism representation is in error.

The inadequacy of any such approach is highlighted by a strengthening of the problem of error: make the organism its own homunculus, and, therefore, its own detector of error. That is, the problem is not only to model the possibility of representational error

[2] Such issues of representational error, as well as of representing falsehoods and things that do not exist, have been vexing since the pre-Socratics (Campbell, 1992), and are still with us.

per se, it is to model the possibility of *system or organism detectable* representational error.

Lest this be dismissed as an irrelevant or unimportant side issue, note that without system detectable error, error guided behavior and error guided learning cannot occur. We know that such error guidance does occur, at least some times in some species, so any model that cannot account for it is thereby refuted. It is of interest, as well as revealing, that no model in the literature, with one exception, even addresses the problem of system detectable representational error.

Epistemic Boundaries

This has been but a sampling of problems with encoding models of representation, but I will for current purposes take it as established that encodingisms do not work. One special consequence of this is that encodings cannot cross epistemic boundaries, and that consequence will be important in the following discussion.

Because encodings must borrow their representational content, they must borrow it from representations that already exist and representations that are already available. This criterion of availability is my focus right now. Availability refers to the condition in which the representation to be borrowed *from* is accessible by an epistemic agent in the same manner as is the encoding representation to be established. In one sense, this is a functional condition: both the source and the encoding must be equivalently functionally accessible. If they are not, then there is no way in which the functional stand-in relationship can be established. So, in the external world, we can in principle set up most anything as encoding most anything else. Both are accessible via being represented in one or more individuals' minds, and the stand-in relationship can either be discovered or stipulated. Similarly, but not identically, phenomena internal to a system or a brain can, in principle, be functionally set up to serve as functional stand-ins for other phenomena that are also internal to that system or brain.[3]

[3] This differs from the external case in that the external cases are accessed via representations, while internal cases can be functionally accessed without having to represent them. Access via representation is not a necessity internally.

The crucial point here, however, is that an internal encoding cannot be directly set up as a stand-in for or borrower from an external property or phenomena. The internal encoding-to-be is a functional matter and is functionally accessible, while the external property is accessible only via being represented. It might be in principle possible to internally represent the external property and then set up an internal functional stand-in for the internal representation, but this assumes that the initial representational relationship already exists. In particular, the stand-in relationship cannot itself constitute a direct representational relationship from the mind into the world. Encodings cannot cross epistemic boundaries. Perception cannot be a matter of (transduced) encodings.

Equivalently, it is not possible for an external encoding-to-be, whether in the physical environment or in someone else's mind, to be set up as a direct encoding of the contents of a particular person's mind. Encodings cannot cross the boundaries of epistemic systems or domains. They can only occur within a given epistemic system or domain.

Therefore, not only can perception not be a matter of sensory encodings, language cannot be a matter of transmitting encoded mental contents.

Language and Interaction

If not the encoding, transmission, and decoding of mental contents, what could language be? Instead of the information flow model of cognition, including of perception and language — in which all of cognition is rendered in terms of encodings — the proposal here is that all cognitive phenomena are phenomena of organizations of kinds of interaction. All cognition (and all psychological phenomena more generally) are modeled in terms of interactive processes and systems.[4]

Such a view immediately raises the question of what makes language interactions different and special, distinct from other kinds of interacting? One initially attractive answer might be that language interactions interact with audience's minds, changing organizations of representations, goals, strategies, and so on. I argue that this is in part

[4] In this respect, the general interactive model is much more akin to the pragmatics of Peirce or Piaget (though also with deep differences) than it is to the signet-ring-pressed-into-wax transductions of the encoding tradition extending from Aristotle to Fodor.

correct, but that minds cannot be the proximate locus of interaction: utterances do interact with audience's minds, but they also transform the social realities that those audiences constitute. They alter what is taken as commonly understood. They induce changes from one social situation to another — from a gathering of people to a lecture situation, for example. They change frameworks within which, for example, pronouns are resolved.

Many properties of language derive from its functions for interacting with social realities, and elsewhere I develop a model of such social ontologies (which have consequences far beyond those for language per se[5]) (Bickhard, 1980, 2004). For current purposes, however, a construal of utterances as interactions with the minds of an audience is a sufficient first approximation. It turns out that this single shift from utterances as transmitted encodings to utterances as (inter)actions suffices to significantly re-organize the landscape within which language might be understood.

Properties of Language

Recognizing utterances as interactions requires taking into account several further considerations. First, interactions interact with something(s), and, to be successful, those interactions must be appropriately configured in relationship to the object(s) of interaction. A hand must be adjusted to what is being held. This holds, as mentioned, for the social ontologies that constitute the proximate object of language interaction, and for the mental processes and organizations that jointly realize those social ontologies.

Second, interactions are with phenomena that exist prior to the interaction, and that may or may not be changed by that interaction. Utterances, therefore, *transform* social and mental realities.

Third, not only must the nature of the social and mental realities be taken into account, so also must the differences between such realities per se and interactions with such realities. Interactions with Xs are not in general of the same ontological kind as are Xs themselves. Functions on the integers are not themselves integers.

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[5] Models of social ontology have important consequences not only for language, but also for modeling social and cultural processes and organizations more generally, for the social development of children, for the development of persons, and so on (Bickhard, 2004). The model developed within the general interactivist framework takes social ontology to be constituted as conventions about social situations: situation conventions (Bickhard, 1980, 2004).

Context Sensitivity

One of the clear implications of these points is that language is inherently context sensitive. The results of an utterance depend not only on the properties of the utterance per se, but also on the situation in which the utterance is produced. In some cases, there is a relative invariance across possible such situations, in which the context sensitivity is not manifest. In fact, one function of sophisticated communication, especially written communication, is to succeed in a desired communicative result across ranges of possible audiences, and, thus, of possible contexts. That is, one function of sophisticated communication is to *reduce* context sensitivity. When this theme of taken to its asymptotic limit, the ideal becomes one in which there is no context sensitivity, even in principle, in which the same result or consequence is achieved no matter what the context is. This is the language equivalent of a constant function: the same result no matter what the argument. If reference is the focus of concern, and this limit case is taken as inherent in language, then we have the classic ideal of the Name as the model for language: every word has some appropriate entity or property as its encoded meaning.

Note, however, that even if we have a constant function, on the integers, say, there is still a difference between the function and its result (not to mention its arguments). For language, even if some mental representation of a particular (kind of) entity or property is invariably achieved by using some word, there is still a fundamental ontological and dynamic difference between the utterance that results in that representation and the representation itself. Or, at the level of a full utterance, even if an utterance were invariably to result in a representation of a particular state of affairs, the utterance and that representation are nevertheless ontologically and dynamically different.

Language is Not Representational

In this model of the dynamics of language, it is the utterance that results in a representation that has a truth value. Similarly, it is an utterance or some part of an utterance that results in a reference to something, in a representation of that something. But the utterances, and the parts of utterances, are not themselves representations: utterances and parts of utterances *result in* representations with truth value and

representations that accomplish reference, they *are* (ontologically) neither directly. Using utterances to generate representations with truth value and that refer are accomplishments of language use, but language is not a directly representational kind of phenomenon.

Using Context Sensitivities

Of course, the ideal Naming relationship not only doesn't hold for any of language, there are other equally powerful aspects of language and language development that move in quite opposite directions. Child language is highly context dependent, and, as mentioned, one of the directions of language learning and sophisticating is coming to be able to address broader and broader audiences — to reduce context dependencies. But another direction is to become more and more skilled at making use of contexts, in conversation, discussions, arguments, meetings, community addressed communications, and so on. That is, one of the directions is to increase the ability to deploy and exploit the natural context sensitivities of language, both those within language itself, and those between language and its broader situated contexts.

In some cases, this can create a double context sensitivity, which, nevertheless, we have no difficulty in either producing or understanding. Partee's classic sentence, for example. "The man who gave his paycheck to his wife was wiser than the man who gave it to his mistress." (Partee, 1972) involves such a double sensitivity. "his paycheck" context sensitively creates a representation of someone's paycheck. In the given context, it is of the first man's paycheck. Later in the sentence, "it" context sensitively evokes a preceding-in-the-context generator of a representation. In this context, it evokes "his paycheck", which is itself already context sensitive. In the second context, "it" evokes "his paycheck", which, in that second context, generates a representation of the second man's paycheck. The pronoun here is not co-referential with its antecedent because the antecedent is already context dependent, and the pronoun is in a relevantly different context.

The myth of the Name arises from ignoring the context sensitivities of processes of differentiation — thereby assuming that all differentiations are of (representations of) unit sets, and ignoring the difference between a unit set and its single element (and the

relevant representations thereof). The myth of the Name assumes successful unique differentiation and then takes the element differentiated as constituting the semantics of the relevant (sub)utterance. We construe our world, however, not in terms of names with strings attached to that which they name, but with patterns of multifarious differentiations and relationships among the partitions that the differentiations induce (Bickhard, 1980; Bickhard & Campbell, 1992).

Accomplishing Reference

Reference, then, is an aim and accomplishment of some language, one that may or may not be achieved, and one that can use multiple tools, even those that seem in some literal sense to be formally "inappropriate": In a restaurant: "The roast beef at table three needs water." (Fauconnier, 1985). Furthermore, representation, and reference, need not even aim at differentiating a single unique entity, nor is it necessary that evocations of the same differentiations involve presumptions of or aims at co-referentiality:

Contrast:

John lost *a black pen* yesterday and Bill found *it* today.

With:

My home was once in Maryland, but now *it's* in Los Angeles.

John thinks *my home* is in Maryland, but Bill thinks *it's* in Los Angeles.

We need *a secretary* and we need *her* soon.

John couldn't catch *a fish* if *it* jumped into his lap.

(Partee, 1972)

"Particulars" based models of language, and of cognition, have difficulties handling such phenomena; context sensitive differentiation based models do not. We do not in general, and certainly need not, have any particular house in mind when we would like to buy one, nor any particular fish in order to like to catch one. Similarly, it does not

make sense to inquire whether or not the dagger in one novel is the same as the dagger in a second novel, unless the novels themselves make such a connection (Bickhard, 2003c).[6]

Context sensitive differentiation is inherent in all of language. It is not limited to functions from context into encoded content for restricted kinds of language such as demonstratives and indexicals (Kaplan, 1979; Almog, Perry, Wettstein, 1989). There is no directly encoded content anywhere in this model, either in cognition or in language.

Semantic Externalism

One source of this point being obscured is that, in general, we would like for our language and our representations to be transparent; we would like to think and talk about the world, not about our thinking or our talking. There are important exceptions, of course, but, nevertheless, thinking and talking about the world is the fundamental functional nature of these phenomena. Insofar as semantics is taken as being constituted by what we want to do with (representation and) language, and what we in fact much of the time seem to be able to do, then some sort of externalist semantics (in this sense) is appropriate. Externalist semantics attempts to capture what our most common kinds of *aims* are in using language. It attempts to do so, however, by overlooking the actual psychological and social dynamics by which such accomplishments are achieved, and shifting to an impossible encoding model of how words and utterances function. This kind of model encounters failure for many reasons, among which are the ubiquitous context sensitivities of language and cognition. But the lure of taking the sense in which an external symbol or map or picture can encode some other external entity or property (overlooking that we must represent *all* of this in order for the encoding relationship to exist) to be the sense in which cognition represents the world — it encodes it — is enormously powerful. And, within this view, it is a direct next step to assume that language is one further level of encoding. Encodings, of course, are transitive — if X borrows its content from Y, and Y borrows its content from Z, then X borrows its content from Z — so cognition and language are equivalently representational, in this view.

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[6] There are additional consequences: one is that there is no difficulty in this model to account for the representation of, or reference to, or statement of, non-existents and falsehoods. Nor fictions, hypotheticals, and so on (Bickhard, 2003c). It is, however, difficult to set up an encoding relationship with something that doesn't exist (Campbell, 1992; Hylton, 1990).

Externalist semantics, however, are *not* parts or aspects of what words and sentences are. Instead, such external foci are parts and aspects of what we sometimes use language to *do*.

Syntax, Semantics, Pragmatics

One of the interesting consequences of these points is that the standard way of dividing the domain of language into syntax, semantics, and pragmatics cannot be maintained within this model of language. Syntax is supposed to be the study of well formedness conditions, generally presumed to be formal in nature, for strings of possible encodings of mental contents. Semantics, in this view, is concerned with the encoding rules, commonly assimilated to some form of externalist semantics. Among other aspects of this view is the notion that declarative sentences, at least, involve encodings of truth conditions about the world. And pragmatics addresses the kinds of uses to which such well formed strings of encodings can be put.

But if utterances are interactions with social and mental realities, then these categorizations of language phenomena are disrupted. Truth conditions and truth values, for example, are not properties of sentences or utterances, but of what utterances can be used to create. Representational intentionality, then, inheres not in the "semantics" of language, but in "pragmatic" consequences and aims of using language. It still makes sense to consider the interactive power of sentence forms, but those will be more akin to the functional power of constructions within recursive function theory (for example) than to encodings with truth value. The properties that are normally gathered into "semantics" and into "pragmatics", then, are distributed differently: some semantic properties are instead properties of the use of language, and some pragmatic properties — the sorts of things that can be done with words — become the fundamental linguistic power of words and sentences as interactions. The distinction between semantics and pragmatics cannot be made in any standard way.

Frege captured part of this point when he imported mathematical concepts such as of operators into his model of language. Operators are transformative interactions: e.g., quantifiers operate on predicates. But he did not give up the basic encoding intuitions, and ended up with a rather awkward hybrid of interactive transformational conceptions

with classic Naming intuitions. The shift to an operator perspective was a major step away from encoding notions — which had had aporetic difficulties for centuries in attempting to characterize what "nothing", for example, represented — but it did not abandon encodings as a model of language, and contemporary work is still caught in some version of the same kind of hybrid.

If anything like the interactive model of language is correct, then the syntax, semantics, pragmatics framework is based on false encoding assumptions. Whether or not the interactive model is correct, however, its mere conceptual possibility demonstrates that the syntax, semantics, pragmatics distinctions are not theory neutral divisions of the subject matter. They make sense only from within an encoding view of language. Even if the interactive model is rejected, its very conceptual possibility demonstrates that the layout of issues as syntax, semantics, and pragmatics is a theory dependent view.

What About Syntax?

I have to this point focused on semantics and pragmatics, but the general moral holds for syntax as well. Encodings can be relatively arbitrary, and so impose very weak constraints on how well formed encodings could be constructed out of some base set of atomic encodings. Consequently, syntax as concerned with well formedness and semantics as concerned with encodings seem to be cleanly separable, and syntactic well formedness can be rendered in a purely formal manner, leaving out issues of meaning.

This pure conception of syntax, of course, has become rather strained as more and more functional and semantic issues and constraints have been built into the supposedly "formal" syntactic rules, but the underlying basis for assuming that any such separation can be made is undercut in an interactive view of language. In particular, if sentences are constructions of interactive types of operators out of a (large) basic class of operators, then the functional constraints imposed on which kinds of operators can combine with which other types of operators under what conditions — partially akin to categorial grammars, but in which the categories are operator types (Bickhard & Campbell, 1992) — can impose strong constraints on what will produce a well defined, functional interaction in a current situation.

Functional grammars are well developed and generally convergent with this point, except that they universally reserve a representational function for language, to be realized in some form of encoded propositional representation (Bickhard, 1980). When the additional functions involved in interacting with social and mental phenomena are recognized, and with representation reserved for what utterances operate on and create, the constraints become universal and open up the possibility that syntax is *not* fundamentally arbitrary (Bickhard, 1995). In any case, utterances as operators ubiquitously forces concerns with well formedness to address *functional* well formedness in a broad interactive sense, not just formal, and therefore arbitrary, well formedness.

Universal Grammar and the Poverty of the Stimulus Argument

For example, suppose (as is likely the case) that mental representation is constituted in vast organizations of functional relations (Bickhard, 1980; Bickhard & Campbell, 1992). Furthermore, there are no encoded naming relationships that inherently reference any part of any individual's cognitive organization. How could an interaction accomplish any kind of transformation of such an organization?

As a first decomposition of the task, some location within such a relational organization would have to be differentiated as a locus for change, and then some kind of change — constituted in the elimination or creation of the same kinds of relations that make up the overall organization — would have to be specified. That is, to change a non-named relational organization requires a differentiation between the task of specifying a logical subject and that of specifying a logical predicate. The task breaks into two parts that form a structure akin to a classical proposition. But the underlying cognitive organization is not that of propositions. The simple possibility of this point already renders Fodor's argument that cognition must have propositional organization because language does invalid. This is a counterexample.

Furthermore, if we consider how such subtasks could be accomplished, we encounter further powerful functional constraints. Differentiating a locus for change, for example, could involve tracing a path through the relational organization by invoking relevant types of relations at each point, with each such invocation indicating a next step in the path. Something like such trajectory tracing is necessary because there are no

names for any locations in the overall relational organization. In general, these constraints will be various kinds of locality constraints: constraints that arise from the necessity for the relevant relation being invoked to be recoverable from the utterance and situation within a local domain of relations around the current focus.

Elsewhere I have shown how these considerations can yield a version of Universal Grammar (Bickhard, 1995). That is, I have shown how strictly functional considerations can be shown to yield a supposedly arbitrary grammatical framework. I will not rehearse this derivation here for two reasons: The first is simply space, but the second is the more important reason — the version of UG that I derive is that of Koster (1987), and it may be that (so it might be claimed) I characterize Koster incorrectly, and/or that Koster hasn't really captured UG, but the most important consequence of the derivation of UG would remain even if both of these challenges were correct. The most important point is that the very possibility of a functional derivation of Universal Grammar invalidates Chomsky's poverty of the stimulus argument, and, thus, the ground for Chomsky's metatheory of language:

The Poverty of the Stimulus Argument

The large scale architecture of the poverty of the stimulus argument is that of an argument by elimination: it assumes an exhaustive set of possibilities, eliminates all but one of them, and concludes the remaining possibility. In this case there are only two possibilities considered, so only one has to be eliminated.

The argument begins by assuming that syntax is a formal matter, and, thus, that issues of semantics and pragmatics are not relevant to syntactic learning. Given that assumption, the language learner is faced with an unbounded space of mathematically possible formal grammars, with the purported consequence that no finite amount of experience could suffice to specify any single grammar.[7] Therefore, it is concluded, there must be strong constraints on the space of grammars that are relevant in language learning in order for such learning to be possible at all.

Already there is a circularity in the argument. The assumption is that language acquisition requires the learning of the syntax of strings of abstract formal symbols. Such

[7] This could depend on the internal structure of that space of possibilities, not just on its unboundedness.

an assumption of the nature and boundaries of kinds of system activities is an assumption about what constitutes unitary phenomena in the processes of the system. It constitutes an assumption about how the activities of the system are structured — in this case, that syntax processing is autonomous relative to other kinds of activities. In contrast, if language is, for example, a fundamentally social communicative activity, and syntax is emergent in various and multifarious functional constraints on that activity, then syntax is not autonomous. The simple logical possibility of such a communicational nature of language suffices to show that the assumption of the autonomy of syntax is not logically forced: it is an ungrounded assumption of the manner in which the language learning task is defined — as the learning of the grammar of an unbounded set of formal symbol strings. The characterization of the language learning task in terms of grammars of formal strings, then, already presupposes the autonomy of syntax conclusion that Chomsky wishes to reach in the poverty of the stimulus argument. He defines the task in a way that presupposes the conclusion he will reach: circularity.

Beginning with this circular assumption of the autonomy of syntax, the problem of learning some particular grammar within the unbounded space of mathematically possible formal string grammars emerges, and, therefore, the problem of how language acquisition is possible at all. Some further constraints on the space of possible grammars are necessary (given the autonomy assumption). At this point, the further assumption is made that these necessary constraints derive either from the environment or are innate, and the argument proceeds to eliminate the environment as a possibility.[8] These sub-arguments to eliminate the environment as a sufficient source of constraint purport to address possibilities such as learning, imitation, and reinforcement. In fact, these are remarkably bad arguments: first, they address the possibility of environmental constraints on the learning of grammar solely from within an associationist and conditioning framework of what constitutes learning. That may have been roughly appropriate in the 1950s, but it is simply disingenuous fifty years later. Contemporary models of learning are not restricted to the simplicity and sequentiality of associationism.

[8] Note that Chomsky's constraints on grammars are and must be logically arbitrary. Their only relation to function is that they impose sufficient constraints on the space of mathematically possible grammars that learning with finite experience becomes possible.

Furthermore, the form of these arguments is almost always that learning is sequential while language requires structure dependency, not sequence dependency per se. This is certainly correct about language and syntax, but it is also true of virtually any even semi-complex task structure. Tasks involve subtasks, with multiple constraints on how they can be organized — and the constraints apply to the task and subtask structure, not to some sequence of primitive motions. Language is not unique in this respect at all, and learning is clearly competent to such structure dependencies.

Suppose we nevertheless grant for the sake of the argument that the environment does not provide sufficient constraints for language learning to occur. At this point, the conclusion is drawn that the constraints must therefore be innate. Two possible sources of constraint are considered; one of the two, the environment, is eliminated; so innatism is concluded.

But here is where the functional derivation of UG mentioned above is relevant. Even if details of that argument were incorrect, its existence illustrates an entire realm of possible sources of constraint on the space of *mathematically* possible *formal* grammars that the poverty of the stimulus argument does not consider: *functional* constraints. There are at least three possibilities here, not just two. Even if we grant the elimination of the environmental possibility, something that the egregious arguments offered do not require, the overall argument is still invalid. Only one possibility, at best, has been "eliminated", so the conclusion of "innate" is unsupported. The poverty of the stimulus argument commits a simplistic error.

There is an implicit assumption in the argument that the space of formal mathematical possible grammars is the relevant space for consideration of learning issues. As adumbrated above, if functional issues are at all relevant, then this assumption is simply false. The relevant space must be that of — almost certainly non-formal — *functionally* possible grammars. We know relatively little of the size or the structure of that space, in part because we know relatively little about what such functional constraints might be, in part because the formal encoding approach to language marginalizes such functional considerations into pragmatics. It is clear, however, that such functional constraints do exist; that they could potentially induce constraints equally

as strong as UG; and that their mere possibility renders Chomsky's argument invalid. It is also relevant that such constraints would function via feedback of communicational errors, ambiguities, misunderstandings, and so on — a kind of "environmental" feedback that is not considered in the basic poverty of the stimulus argument: it is ruled as irrelevant to the formal task of "learning" a formal grammar.

A purely functional approach to language opens a new perspective on what language is, on what its dynamics are, on how and why it works, on what the constraints are, on how it develops, and on how it could have evolved. Language is not, in this view, an elaborate Morse code for mental contents, but much more akin to Wittgenstein's tool box — a tool box from which we select what works and what is easiest, within whatever level of knowledge and skill that we have.[9] And sometimes, when our tool box is limited, as for a toddler, we use whatever tools we can find: "I chalked the wall", or "I buttoned the calculator." Most importantly, such usages succeed. Sometimes in creative writing we modify the tools on the fly, or use them in novel ways. The historical evolution of language involves modifications of what tools are available, of what kinds of tools make up a good tool kit, and, more rarely, a re-organization of what kinds of tools are taken to be central and what kinds are taken to be auxiliary with respect to tasks involving interacting with social realities and the minds that constitute them.

Innatism and Scaffolding

Language acquisition is strongly scaffolded. This is clear both from the pace at which acquisition occurs and from the relative ubiquity of acquisition — there is no bell curve of language acquisition. Evidence and arguments for such scaffolding are at times offered as evidence for Chomskyan style innatism (e.g., Landau, 1999), so I would like to point out that these arguments too are invalid.

Given language acquisition scaffolding, the claim that such scaffolding supports innatism makes the assumption that the scaffolding of some development requires a condensed or compressed — a miniature — version of what is to be developed as the scaffolding support for that development. So, to scaffold the development of X, some

[9] It is, however, a tool kit for interacting with a special realm of the world — social realities and minds. Contrary to Wittgenstein, then, language does have an aim (Bickhard, 1987).

miniature version of X is required. Elsewhere, I have dubbed this version of scaffolding "homuncular scaffolding" (Bickhard, 1991).

The problem, simply, is that this is a false assumption, and, therefore, the argument is invalid. Scaffolding does not require homuncular versions of what is being scaffolded. One example that demonstrates this is the embryonic development of pecking in chicks, studied by Kuo (1967). As the check heart begins beating inside the egg, it presses the developing head against the shell, which forces the head to bob in a roughly "pecking" kind of motion. When Kuo interrupted this relation between heart beat and the head bobbing against the egg shell, those chicks were never able to peck, not to remove themselves from the shell nor to peck and eat. It is clear that the head bobbing induced by the heart beat scaffolds the development of the ability to peck. Yet there is no homuncular pecking knowledge in the genome. Instead, there is a developmental emergence out of multiple developmental constraints. Evolution creates and exploits such constraints, rather than wasting resources creating and maintaining through evolution single dedicated homuncular supports.[10], [11]

Consequences

Language is a dynamic, functional phenomenon — interactively dynamic and functional. Utterances interact with social realities and organizations of mental processes, and, therefore, must be appropriately sensitive to the properties of social realities and mental processes — *any* interaction must be appropriately sensitive to what it interacts with. As a functional phenomenon, language involves intrinsic functional constraints and related forms of functional failure. Being intrinsic, therefore, functional language constraints are universal.

There are a number of consequences of even this brief outline of issues, arguments, and approach to language. One strong consequence is that formalism in

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[10] It should also be mentioned that the evolution of any support for any ability X that is both necessary to X and exclusive to X, such as anything like a Language Acquisition Device purports to be, encounters very severe difficulties. If it is necessary to X, it has to precede X, while if it is exclusive to X, it should evolve after X in response to some contribution it makes to X. So, such a support for X would seem to have to have evolved both before X but only after X. There are complicated scenarios that can get around these difficulties, but they are indeed complex (Bickhard, 1979).

[11] This is a point made by Bates, though I have not been able to find the exact reference.

models of language is completely unnatural. Formalism imposes a distinction between form bearing elements and the functional properties of those elements that can be partially approximated in formally designed artificial languages, but has little relevance to human language. The relations between the dynamics of language and the functions of language are not arbitrary as formalism presupposes, and neither dynamics nor function is composed out of elemental dynamic or functional units. Language approximates in its constructions various unit-like bases for exploiting the power of combinatoric spaces — though the approximations need only be sufficient to be able to serve the functional distinctions required. But language is not constructed out of elemental bricks, neither sound bricks nor meaning bricks (Port, this issue).

Linguistic process is a constructive process. The interactive power of utterances are constructed out of sub-processes that compose in a manner reminiscent of the recursive construction of functions out of a base of generating functions. Differences from recursive function theory include that the linguistic constructive resources are themselves the results of language- and culture-specific decompositions; those resources are themselves context dependent guides to and constraints on interpretation, not formal functions; and those resources manifest multiple kinds of functional dependencies and incompatibilities among themselves — akin to categorial grammars, but with intrinsic functional grounds — that generate grammar.

In this view, then, syntax is not formal, and is not formally differentiated from function. Syntactic aspects of grammar, therefore:

- will include “semantic” considerations in their composition and decomposition possibilities (Goldberg, Casenhiser, & White, this issue),
- will be sensitive to processing costs, yielding a graded framework of grammatical constraints (Hawkins, this issue),
- and will be sensitive to learning constraints, including, in particular, frequency effects in language, and other psychological phenomena such as analogy (Diessel, this issue).

Finally, language is in interaction with social realities, and social realities are inherently emotive as well as cognitive. Language, and language learning, therefore, centrally involve emotional issues (Greenspan & Shanker, this issue).[12]

Conclusions

Exploring the functional dynamic properties of language and language learning is strongly rewarding — language *is* a functional dynamic phenomenon, and investigation from within that perspective is, therefore, inherently maximally revealing and fruitful. More generally, *psychological* phenomena are *all* functional and dynamic phenomena, and will not be understood until that is taken into account.

There is an interesting history involved here. All sciences have gone through a historical period in which the basic phenomena have been understood in terms of some sort of substance. This could be in the form of some postulated divisible stuff, or indivisible atoms, or more complex structural units. Virtually all sciences have progressed beyond this phase and realized that the basic phenomena are phenomena of process: fire is no longer modeled as the release of the substance phlogiston, but as a process of combustion; heat is no longer conceptualized in terms of the substance caloric, but as random kinetic energy; life is no longer rendered in terms of vital fluid, but as complex thermodynamic process; matter is no longer modeled in terms of indivisible atoms, but in terms of organizations of quantum field processes; and so on.

Studies of mental phenomena, however, are still caught in a substance framework. Perception is supposed to be grounded in the transduction of light in the retina into representational elements or vectors; cognition is supposed to be the manipulation or

[12] As editor for this special issue, I have the advantage of an overview of the other papers in the issue, thus allowing this kind of meta-comment. These contributions have such a strong central consistency concerning the dynamic, constructive, and functional characterization of language — a consilience (though not a complete convergence: there are differences and disagreements). Furthermore, it should be pointed out that this general consilience is wide spread, including not only the authors in this issue, but also other major contributions of Bates, Tomasello, MacWhinney, and many others (Bates, Elman, Johnson, Karmiloff-Smith, Parisi, Plunkett, 1999; MacWhineey, 1999; Tomasello, 1998, 2003, 2003b; Tomasello & Bates, 2001).

processing of symbolic units or vectors; and language is the encoding of cognitive contents into formally well formed strings of sound and meaning units.[13]

Substance conceptions are just as inappropriate in the study of mental phenomena as they were in all other sciences, but, nevertheless, have remained dominant much longer than in other sciences. The historical shift to process, however, is now underway, even with regard to language, a redoubt of formal atomistic thinking. It's about time (Port & van Gelder, 1995; Bickhard & Richie, 1983).

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