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Requirements for paradigm shift*

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Since Noam Chomsky's famous 1959 review of B. F. Skinner's *Verbal Behavior*, a linguistically based paradigm for research in first language acquisition has been strong, even in some senses, dominant. Even Piaget, whose main concern was the nature of cognitive development in general, did not deny the essential claim of a linguistically based paradigm for the study of language acquisition: 'I (Piaget) also agree with him (Chomsky) on the fact that this rational origin of language presupposes the existence of a fixed nucleus necessary to the elaboration of all languages' (Piaget in Piatelli-Palmarini, 1980: 57). This linguistically based paradigm has led to a developed theory of what it is that the child must acquire when s/he acquires language, and to precise scientific hypotheses regarding the nature of this knowledge. These hypotheses can be, and are being, subjected to empirical test, thus advancing the scientific foundations of the field. In this paradigm, the postulation of a 'Language Faculty' in the mind of the human species, and in the child, has allowed the formulation of specific components of linguistic knowledge which are now being tested in language acquisition as well as in grammars of languages of the world.

Presumably the volume that Sabbagh & Gelman review, i.e. the collection of papers in MacWhinney (ed) 1999, has the same object of inquiry as does the linguistically based paradigm, i.e. it seeks to explain language acquisition. (It is actually not clear what 'language acquisition' is taken to refer to in this volume, and thus it is not clear whether in fact the object of inquiry actually is identical to that in the linguistically based paradigm. That is, it is not clear whether the term, 'language acquisition', here actually refers to acquisition of the knowledge of the 'system' of language, with all the properties we now know that system to have, or whether it refers merely to the acquisition of specific verbal behaviours or to certain generalizations based on those behaviours.) However, the essential theoretical thrust of this volume opposes the postulation of a specific linguistic faculty of mind as a necessary component for explanation of language acquisition, and seeks to replace this with domain-general inductive 'learning mechanisms'. It thus appears to

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promise the possibility for what we may call a ' paradigm shift '.[1] Presumably, the new paradigm would overcome essential problems that characterized the early Skinnerian approach to language acquisition.

This volume thus raises the issue of what would be necessary for a form of 'paradigm shift' or 'paradigm replacement' to take place in the field of language acquisition. This one would seek to displace the current linguistically based paradigm at least from a central position. How can we render its proposals scientific and use them to advance the field of language acquisition?

As the Sabbagh & Gelman commentary cogently suggests, we cannot address this emerging paradigm precisely, given the widely different forms which it can and does take at present. For example, certain forms of what is referred to as 'connectionism' appear to eschew all symbolic representational content (e.g. Elman, Bates, Johnson, Karmiloff-Smith, Parisi, & Plunkett, 1996). Other forms integrate subtle, sophisticated knowledge of grammar, as in certain current approaches to 'optimality theory' for example (Smolensky, 1999). We assume these approaches would be diametrically opposed in their fundamental assumptions about the nature of linguistic knowledge and its acquisition.

We will refer here generally to the 'Emergence of Language' paradigm (EL) in its strongest form, as a proposal for a 'domain general' approach to explaining language acquisition, which excludes postulation of specifically linguistic knowledge of any form, e.g. principles, parameters, rules, or constraints of a linguistic nature. We will contrast this with a 'linguistically based' paradigm which draws its hypotheses from linguistic scholarship and theory. We will raise a number of general issues that we consider it necessary to confront if scientific inquiry in the field of language acquisition can advance.

We can only deduce, but never directly perceive, any 'symbolic representation' that exists in the mind. Thus debates between a paradigm that does accept such, and one that, like EL, does not, can not be scientifically argued in these terms alone. However, we can and must evaluate paradigms in terms of their scientific worth. To do this, we assume the following:

(1) We assume that a 'paradigm shift' involves a replacement of an existing paradigm by a new paradigm that can account for all previous evidence, but also adduce new evidence which was inaccessible to the old paradigm. (2) We assume that a new paradigm in a 'paradigm shift' must not only describe such evidence, but 'explain' it through a theory that is both more powerful and valid.

[1] This term is not actually fully accurate here, as both rationalist and empiricist approaches to the study of language acquisition in fact have always existed side by side in the field, and surely will continue to do so.

The evidence

Sustained empirical research in the study of language acquisition has been led over the last several decades by hypotheses derived from the linguistically based paradigm and has now provided us with large amounts of fairly precise evidence on the nature of various aspects of the child's linguistic knowledge at early periods. This knowledge is now being tracked through development and is evidenced both within specific languages and cross-linguistically. (Lust, Hermon & Kornfilt, 1994 and Lust, Suner & Whitman, 1994 provide collections of examples of such research.)

If an alternative paradigm is to be adopted which is divorced from linguistic scholarship, it must hold itself accountable for this complexity of precisely defined language knowledge in the child, and for this wide set of empirical evidence which now exists regarding the role of linguistic knowledge in language acquisition. For instance, to take one fundamental example, knowledge of a linguistic principle of 'structure dependence', with consequences across many different linguistic structures and operations, has now been evidenced across languages, and at very early periods in language acquisition. One set of important consequences of structure dependence has been evidenced at very early periods of language acquisition in the child's knowledge of various anaphoric forms. Here language acquisition must include empty categories where there is no direct perceptual evidence that the child can use in order to perform induction. The attested knowledge thus must be at least in part deductively derived (e.g. Lust, Chien, Chiang & Eisele, 1996; Cohen Sherman & Lust, 1993; Somashekar, 1995, Foley, Nunez del Prado, Barbier & Lust, 1997 to name just a few relevant research studies). If the EL proposal can demonstrate that it can both describe and explain such knowledge, it will have achieved a first step towards suggesting that the proposed alternative paradigm is, after all, at least equally viable in the area of language acquisition.

In addition, however, in order to provide not only a possible alternative model, but also a paradigm shift, it would be necessary for the new paradigm to make new predictions regarding the nature of language acquisition. Such predictions must go beyond what a current linguistically based paradigm would predict, and it would be expected that the new paradigm would lead the field in testing and confirming the predictions. The evidence will have to involve psycholinguistic reality, if what we are trying to explain is how the child does actually acquire language. In keeping with this goal, it will have to account for the evidence we now have on the indirect relation of the child to the input s/he receives (e.g. Valian, 1999, Landau & Gleitman, 1985).

In addition, simply modelling a behaviour computationally or mechanically, with weak generative capacity given to the computational apparatus,

will not in itself provide conclusive evidence regarding the actual nature of the child's language knowledge or language acquisition. Thus fundamental issues regarding methodology in developmental psycholinguistics will have to be addressed by the EL paradigm, as well as by the linguistically based paradigm. These issues relate to the question of what actually constitutes evidence that the child does or does not have aspects of linguistic knowledge (e.g. Lust, Flynn, Foley & Chien, 1999).

Creating a powerful theory

The greatest strength of a linguistically based theory, e.g. a theory of 'Universal Grammar' as a model of the 'Language Faculty' (as in Chomsky's proposal), derives from its attempt both to account for why languages across the world share certain universal structural principles, and, at one and the same time, to explain why individual children can acquire any language of the world in about the same amount of time (i.e. three years). There are no significant learning discrepancies across superficially dissimilar languages. If an alternative paradigm were to become viable now, it would have to attempt an alternative account for these linked facts. (Presumably some multi-dimensional version of 'functionalism' would have to be developed to do so.) The essential challenge to the EL paradigm here will lie in the fact that it is by definition solely inductively based; the child in all such learning scenarios is necessarily working on language-specific data. It is not clear how a level of universal generalization that is necessary to capture both the cross-linguistic facts and the universal constraints on language acquisition can ever be inductively derived only from positive experience of specific events in specific languages. Such higher order generalizations would appear in principle to be only 'accidental' in a solely inductively based paradigm, without a complementary linguistic theory to supplement and constrain it.

The paradigm of the future

Sabbagh & Gelman suggest that in the end, when the questions they raise are answered by the EL paradigm, there may be motivation for revision of this proposed new paradigm to include 'domain specific principles that interact with the environment to create complexity'. This, in essence, provides the basis for development of a more comprehensive theory of language acquisition, one which does not attempt to eliminate linguistic principles and constraints which would guide and constrain a language learner's induction. It would therefore not depend on a 'paradigm shift', but attempt to complement an existing paradigm with more precise, informed investigation into the nature of the organism's interaction with environmental input. In fact, this complementary investigation is now necessary. This concern for the interaction of linguistic knowledge with a learner's necessary induction from specific language input has long been a concern of Gleitman, Gleitman,

Landau & Wanner (1988) and Gleitman's students, although it is fair, we believe, to suggest that the linguistically based paradigm of inquiry into the nature of language acquisition has not extensively followed Gleitman's lead in this area.

This revision would bring the EL proposal into convergence with current studies of learning. These have come to discover the role of organism-specific innate programming in the learning process, e.g. in animal learning of even the supposedly 'simplest' stimulus-response connections (e.g. Gould & Marler, 1987; Gallistel, 1990). These studies have precisely revealed the impact that innate programming has on the ability of each organism to learn what must be learned.

Fundamental issues persist in the field of language acquisition today. What is specifically biologically programmed in the human species such that it can and does lead to the complex knowledge that is knowledge of language, any language? What are the biological foundations for this program? What specific linguistic content is biologically programmed? What is the true nature of development in this knowledge over the temporal course of language acquisition? Only with a complementary approach, not one which seeks a paradigm shift by attempting to eliminate a role for linguistic theory, can we, in a scientific manner, continue to advance the investigations which will ultimately allow us to answer these questions. Only then will we be able to explain why it is that a human being can and will acquire language, when a chinchilla does not and will not.

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