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AUTHOR Templeton, W. Shane
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ABSTRACT

This paper reviews recent theoretical developments and empirical findings in the area of the development of word knowledge in children. Advances in both linguistic and cognitive theory are described and synthesized, and children's word knowledge at various stages of development is outlined. The point is made that asking meaningful questions about how children deal with words in various phases of reading instruction depends upon first asking meaningful questions about what children think words are. (AA)

Developmental Word Knowledge:

A Linguistic and Cognitive Perspective

W. Shane Templeton

Emory University

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> "Vocabulary (development). . .is in large measure a consequence, reflection, or symptomatic expression of an underlying and more fundamental cognitive change." (Flavell, 1963, p. 434)

The parameters of investigations into developmental word knowledge are continually being shoved further back. We are gaining insight into how children organize words as well as how they are able, tacitly and consciously, to think about this organization and the concept of "word" itself. Nowadays, to explore such areas requires casting into ever deeper waters. Before addressing developmental word knowledge per se, therefore, I would like to establish a methodological perspective.

The term "psycholinguistics" was coined to describe an area of intellectual functioning that resisted analysis by the more traditional procedures of either psychology or linguistics. Until the last decade, however, linguistic paradigms still held sway in the investigation of language, and matters of cognitive functioning were in the service of these linguistic structures. Not that powerful cognitive theories were not afoot; they were often simply excused as falling within the concerns of performance, or the actual behavior of individuals. The more (apparently) interesting concern--competence, or the mechanisms underlying behavior--was considered better examined from a linguistic standpoint, specifically that represented by Chomskian transformational-

generative grammar.

For those of us investigating the development of word knowledge in children, however, it is difficult to avoid the impression that we are now the beneficiaries of the best of both competence and performance worlds. Cognitive concerns have recently at least achieved parity with, if not in fact overtaken, matters linguistic, and the classroom world with which we are ultimately concerned is as a consequence drawn into sharper focus. Specifically, exciting pedagogical implications have emerged as to what we can and perhaps cannot do with regard to young children learning about words.

As the purpose of this paper is to survey a theoretical terrain, I will not be fundamentally concerned with classroom practice. Where an obvious pedagogical question might otherwise be left begging, however, implications are at least suggested. This paper will address two basic concerns: (1) the theoretical paths that have led to the present state of affairs regarding word knowledge, and (2) what the current state of affairs actually is.

Theory: Primarily Linguistic

I will pick up the theoretical thread where it is customarily seized, that is, with the noted American linguist, Leonard Bloomfield. Bloomfield's conception of language (1933) reflected the psychological biases of the second quarter of the twentieth century: behavior--linguistic or otherwise--was conceived as being most reliably and validly investigated through scrupulous attention to observable phenomena. Although Bloomfield did not discount the existence of

"mentalistic" processes (indeed, he embarked on linguistic study an avowed mentalist) he asserted that these processes lay beyond the realm of observation and were therefore empirically unjustifiable. Those aspects of language that linguists were able to observe existed at the level of sound. The analysis of language, then, involved the consideration of repetitive or nonrepetitive occurrences among "utterance tokens" (Postal, 1968). The primary unit of analysis was the phoneme.

As Miller (1974) pointed out, until well into the 1950's vocabulary study followed a methodological orientation similar to linguistic analysis. The growth of children's vocabulary was quantitatively rather than qualitatively assessed. In effect, investigators were concerned with the number of entries in the child's internal dictionary rather than with the information structured within and among the entries.

A more cognitive perspective in language study did not perceptibly emerge in the United States until the latter part of the 1950's, most notably as reflected in Noam Chomsky's transformational generative grammar. Well before the publication of Chomsky's Syntactic Structures (1957), however, other linguists had begun to pry beneath the veneer of surface language and suggest that syntax and meaning ought to be considered in specifying what occurs at the surface level of sound. Morphophonemics (Swadesh and Voegelin, 1939), for example, emerged in American linguistics in contrast to the earlier Bloomfieldian autonomous phonemics.

Faithful to the perceived confines of their discipline, however, linguists continued to avoid speculation concerning how knowledge about language might be learned or structured within the human brain. It was Chomsky's singular achievement not only to extend the scope of analysis of language to include the emerging linguistic construct of deep structure, but also to fire substantial broadsides into contemporary behavioristic notions of language acquisition.

Contrary to vocabulary study of earlier years, this newer theory considered the lexicon, or "dictionary," that each individual possesses in terms of content rather than number of items. Chomsky's description of the lexicon is rather complex; for our purposes, however, we may characterize it in the following way.

The lexicon comprises the basic units of the language. Each lexical item has only enough phonological information specified within it to determine the pronunciation of that item in various spoken contexts--the actual phonetic representation will be determined by the appropriate rules in the phonological component of the language. Each lexical item also contains minimal syntactic and semantic specifications. The nature of the latter information is problematic, and several of Chomsky's students have endeavored to work out an adequate theory of semantic structure in lexical representations.

Chomskian theory invested the greater proportion of language-generating variables within the human organism than within the environment. The manner in which this linguistic competence is actually represented in the brain intrigued psychologists in the

Sixties; research seemed to be aimed at validating Chomsky's linguistic constructs (Weimer, 1974), rather than exploring how humans really processed language. The Seventies have witnessed a large scale move away from this effort, the characteristics of which we will consider a bit later.

We might say, then, that it is the spirit rather than the specifics of Chomskian theory which has left its imprint on psycholinguistic research. Notably, transformational-generative theory has served to highlight two apparently valid criteria in accounting for language development: creative construction and cognitive economy (Pollio, 1974). Chomsky observed that it is possible to generate an infinite number of sentences from a finite set of rules; obviously children do not learn every possible sentence in a language as a discreet item, yet they are able to generate any number of novel utterances. They must learn, or generate rules of construction. Furthermore, these rules must be few in number and complexity; otherwise, children would be overwhelmed by the task of learning them.

Although Chomskian theory has been appealing and, for a while at least, quite revolutionary, several inadequacies have been noted. Critics have suggested that the contributions of the "real world" have been inadequately incorporated into the theory, and that postulated linguistic constructs have their basis in cognitive structure (Sinclair deZwart, 1973). In response to such criticisms Chomsky (1975) conceded the role of cognitive structures in the description of lexical items:

> "...lexical items might be related by principles that form a kind of central core of common-sense beliefs...Under this assumption lexical items are located in a "semantic space" generated by the interaction of the language faculty and other faculties of mind." (p. 42.)

And, with regard to language in general:

> "it may well be impossible to distinguish sharply between linguistic and nonlinguistic components of knowledge and belief. Thus an actual language may result only from the interaction of several mental faculties, one being the faculty of language." (p. 43, emphasis added.)

There seems to be little doubt, then, that whatever the nature of the internal lexicon might be, its development involves give-and-take between the structuration of cognitive entities and the requirements of the objective environment; or the world "out there."

Theory: Primarily Cognitive

The genetic epistemological theory of Jean Piaget currently offers the most powerful framework from which an investigation of developmental word knowledge can be approached. The significant variables in the interaction between cognitive structuration and objective environment are established during what Piaget has termed the sensorimotor period (birth-2½ years; Flavell, 1977). The

qualitative nature of subsequent language and cognitive development depends upon this interaction.

It is possible that, as Bierwisch (1970) suggested, a set of "semantic primitives" interpret an individual's initial experiences in terms of perceptual features, and that these "primitives" are the genesis of universal cognitive structures. There is evidence that, for example, infants are perceptually predisposed to interpret visual information in a certain fashion without benefit of action upon the objective environment (Bruner and Koslowski, 1972). From our perspective, however, the important observation is that very little time elapses before the infant is actively engaged with the environment. The cognitive development that ensues serves to structure the framework into which will fit the primitive elements of language that arise through interplay with the talking community.

There is strong evidence to suggest that the progressively complex grammatical structures that children use--and the increasing sophistication of differentiation among lexical items--reflects the development of increasingly complex cognitive structures (e.g., Clark, 1973). Such lines of research support, by and large, Piaget's assertion that this structuration is assembled through a process of induction which is itself continually developing. Sinclair-deZwart states, "Action patterns become established (to which lexical items may later be mapped), extended, combined with others, and differentiated under the influence of internal regulatory mechanisms..." (1973, p. 13).

The child appears to structure the objective environment first in

terms of its relationships to him or her and, later, in terms of the relationships of objects to one another. In the case of spoken language, particular phonological sequences are mapped to particular action-patterns. As a consequence of continued interaction and maturation--and the increasing sophistication of inductive generalizations--the phonological sequences and action patterns become further differentiated and discriminative.

Action, the critical element in Piagetian theory, is the source of knowledge. The child "knows" an object by acting upon it; the symbol or representation of the object is an "internal reenactment of activities originally carried out" with it (Bates, 1976; p. 11). Furthermore, children learn to take their own mental acts as the objects of higher mental acts. In this fashion, complex conceptual schemata develop based on procedures. Words become the labels for these procedures; Piaget commented ". . . the act of giving a name to an object is not merely that and nothing more, but the statement of a possible action" (1962, p. 222).

The growth of a lexicon thus depends on the quality of actions that differentiate procedures, that is, ways of knowing about and acting upon the real world. This general developmental characteristic has been variously described, most notably by Gibson ("progressive differentiation", 1969) and Campbell and Wales (vocabulary "extension and restriction", 1970). What appear to be rather specific terms are used by children to refer to more global action-patterns. These action patterns are then differentiated as a consequence of learning

about the real world, and the resulting subpatterns become tagged by other terms, or phonological sequences. To elaborate on Campbell and Wales' conceptualization, as cognitive structures are developed, vocabulary ~~is incorporated~~ that represents these structures. In turn, each vocabulary item is restricted as to the degree of procedures it labels.

Working within a Piagetian perspective, Papandropoulou and Sinclair (1974) investigated the degree of "metalinguistic awareness"--the ability to reflect on language as an object of study in itself--manifested by children at various age levels. Their study offers a new twist to word knowledge; how children <u>think</u> about words, as opposed to how they <u>use</u> words, is an exciting and an essential aspect for educators to consider. Papandropoulou and Sinclair note that "metalinguistic reflection should show close resemblance with general cognitive development, and in particular with the constitution of mental operations" (p. 249). In this regard, two things must occur; (1) children must be able to assume a perspective that is at some distance from their own verbal activity, and (2) they must abstract the linguistic elements to be studied from the corresponding reality. I will consider below the manner in which these abilities develop.

<u>Theory: Cognitive and Linguistic</u>

As with any aspect of human knowledge, it is hardly possible to circumscribe effectively the study of how children learn, use, and think about words. At least a few cognitive psychologists have

recently thrown open the speculative floodgates (Weimer and Palermo, 1974), and it is not only exciting, but beneficial as well to see where their concerns might lead in the investigation of developmental word knowledge.

As opposed to behavioristic psychology, cognitive psychology has pointed out that we know far more than we have learned; we have already seen how this applies in the case of language--the child is able to construct all sorts of novel utterances that have never before been heard. This is because rules, rather than specific facts, are generated from the limited amount of input information. This suggests some sort of hierarchical organization of cognitive structure, as opposed to a simple linking together of a single response to a single stimulus. Children generate phonological utterances, not yet conceptualized as "words," that correspond to underlying procedures of cognitive functioning. As cognitive growth occurs, so does the sophistication of the procedures that underly the phonological utterances.

Recently, cognitive psychologists have become fascinated by "tacit" versus "conscious" knowledge, and the distinction may be a valuable one for the investigation of word knowledge. Much of what we know operates at a tacit level, a level about which we are unaware. Much of what we learn appears to be rules of inference that, for the preoperational child, may also operate at a tacit level. In other words, the preoperational child cannot think about how he or she thinks.

With the passage to the level of concrete operations, children are freed from "stimulus bondage" (Elkind, 1967). To a limited degree, they are able to pull back from the here-and-now and reflect on their own mental operations, and they are able to examine consciously rules of inference. In addition, as Papandropoulou and Sinclair's (1974) research suggests, they are able to think in interesting ways about the combinatorial elements of their language--words.

What happens when children begin to pay attention to print? How might they tacitly conceptualize the correspondence between sound and graphics? Most children are exposed to print before they have anything approaching an adult conception of what a word is. We might expect that, when they realize that the marks on a page somehow represent the language they hear, there is a fairly gross differentiation of both their "phonological utterances" and the graphic array. In a Piagetian sense, their development of this new correspondence is based not only on an assimilation of the graphic features into existing phonological schemata, but also on an accommodation of these schemata to the new graphic information. Lest this development be overlooked, I would like to emphasize what it suggests.

Contrary to time-honored opinion (e.g., Hall, 1961), children do not appear to map a to-be-learned system of orthography to an already existing phonological competence--this is far too simplistic a notion of what they must do in learning to read--rather their phonological system interacts with and is modified by the characteristics of the orthography. There is a two-way relationship in this

process that can be seen to develop continually throughout a child's early years and on into adolescence and beyond. I will consider evidence for this later development below, but the point should be emphasized that the genesis of this two-way interaction occurs at the moment the child first inspects a graphic array.

Something else interesting seems to occur roughly during the transition from preoperational to concrete operational thought. As a consequence of accommodating a phonological system to an orthographic system, a child's concept of what a word is may be modified. At a conscious level, the level of metalinguistic awareness, print appears to serve in the abstraction of word-level segmentation in the speech stream, and may indeed mark the first introspectively-available symbolic characterization of individual lexical items.

As Papandropoulou and Sinclair (1974) have pointed out, children often refer to words in terms of letters; they rarely speak of sounds, yet at roughly the same time they tacitly abstract the nature of a second-order symbolic representation, that is, print to sound. This abstraction appears to serve the purpose of both objectifying words and laying the foundation for what I will term the orthographic overlay of lexical representation. It is at this point that the beginnings of a constant orthographic representation in lexical structure may emerge. While not discounting the influence of school in this process, Papandropoulou and Sinclair suggest "less superficial factors...the written word is in a sense a permanent result and, moreover, an objective product of verbal activity" (p. 257; emphasis added).

At this point I would like to examine Papandropoulou and Sinclair's (1974) study a bit more closely because I believe it best addresses the types of theoretical questions we now must ask. According to Papandropoulou and Sinclair, young children (roughly between four and five years of age) do not differentiate words from the reality to which they correspond. For example, a word is simply another feature of whatever it is associated with. A "strawberry" is a word because "it grows in the garden;" "turtle" is a word because "it has a shell:" A little later on (ages five to seven) words are both comments on things and names of things; a degree of separation between the linguistic elements and corresponding reality occurs. A "topic-comment" relationship is exhibited wherein words are conceptualized as both identifying elements in the objective environment and stating something about these elements. A "truck" is not a word, for example, but "a truck drives down the street" is.

At a third level (seven to eight years of age), children are able to segment both their own utterances and those of others. It is critical to note, however, that no corresponding segmentation of the total meaning of an utterance occurs: "words are seen as elements of a complex entity" (Papandropoulou and Sinclair, 1974, p. 247). Words are not conceptualized as isolable units of meaning because they are part of a unified meaning-whole. They are, as one child in the study expressed it, "bits of a story."

At a fourth level (ages eight to ten), words are conceptualized as both meaningful entities in themselves and as belonging to a system

of relationships in a more formal, grammatical sense. For example, children can understand why some words may be grouped together as "nouns," others as "verbs," and so on.

Recent research on the invented spelling of young children (Read, 1975) suggests that the criteria by which these children assign letters to segments of the speech stream are every bit as "rule-governed" as the criteria by which they generate spoken language. It should be remembered, however, that whatever the rules are that might be operative during the pre-operational stage, they are tacit. We might hypothesize, then, that much of the concern about helping children to understand that writing is a code (e.g., Levin and Mitchell, 1969), although well-intentioned, may be overemphasized. Read (1975) states that children tacitly assume the principle of spelling, that is, of the correspondence between sound and print. In order to bring this principle to the level of awareness, we ought to provide more graphic information rather than more (perhaps tangential) "coding" games. Since children appear to abstract the principle of spelling with little effort, it is the facts of the spelling system that they will need to learn (Read, 1975).

Whatever the facts of English spelling are, they vary in number and in scope depending upon the level of analysis. One may choose to study more superficial sound-symbol correspondences, underlying structural relationships, or the interplay between these two levels. Despite differences in recent analyses of English orthography (Chomsky and Halle, 1968; Venezky, 1970) one common denominator emerges: there

do exist in the spelling system of English more regular, underlying relationships beyond the level of sound-symbol or sound-spelling pattern correspondence. These underlying relationships reflect what has been termed the derivational or morphophonemic aspects of the system; these aspects are subsumed by the underlying level of lexical representations (Chomsky and Halle, 1968) to which I referred earlier.

As children develop, and as their individual lexicons expand to include a broader range of items, so too does the interaction between phonological system and orthographic system become more sophisticated. Children are able to note the derivational relationships in the orthography as expressed in such word pairs as equator-equatorial and advantage-advantageous. As Moskowitz (1973) suggested, the symbolic system itself appears to exert an influence on the structure of lexical items. Moskowitz was referring to the way in which individuals might store phonological information, but it appears that common semantic relationships may be more easily identified and stored through orthographic structure as well. This is a claim that has been strongly forwarded by transformational-generative theory (Chomsky and Halle, 1968; C. Chomsky, 1970).

For older students, orthography becomes a tool by which syntactic, semantic, and higher-order phonological relationships may be explored. It allows one of the few glimpses into what may be a commonality of structure in the lexicons of literate individuals. This is not to say that, because the orthography manifests orderly underlying structure, our lexicons must reflect a similar organization. We must

become consciously aware of this structure in order to put it to any advantage. Just as print may serve to objectify our knowledge of what words are, so too can the structure of orthography objectify other aspects of our language, a language over which we have a tacit command. Our introspectively-available lexicons may reflect a disheveled organization if our conscious inspection of orthographic structure is similarly disheveled.

If students are consciously attuned to rules of inference when examining orthographic structure, then they will use this structure to induce the higher-order phonological rules associated with the derivational aspects of orthography. For example, if a student sees the word spectrography and does not know its pronunciation (and has never, to his or her knowledge, heard a word which might correspond to this visual representation), the student can figure out (1) where to assign stress, and (2) whether the vowel in the second syllable is long or short, by noting a structural similarity between this word and photography, which is known. The student may not be aware of how to generalize this knowledge until he or she has consciously taken note of stress placement in a number of such words. After the student has seen other words that follow the photography-spectrography pattern, a phonological principle concerning stress placement and the quality of vowels (whether they are long or short) may be generalized.

The preceding example suggests a rather novel but apparently well-justified conclusion: there comes a point at which sound is no longer productive for an analysis of English spelling; the orthography

must then be used as a tool to analyze both itself as well as the sound system of English.

Reflections on a Perspective

I have emphasized that words suggest procedures or processes; by their very nature they are not paired associates with elements in the objective environment. Like the whole of language itself, they may refer to things and actions, but they can not directly mean something. In effect, our lexicons are intersecting "open sets" (Templeton, 1977) in which words refer to various procedures and processes.

Perhaps the only way we can subjectively note the imperfect correspondence between the level at which the cognitive play is enacted and the words with which we ultimately tag that deeper level exists in the situation so aptly described by William James (1890). The underlying cognitive play provides the "ideation" and, subsequently, the words to mark that ideation. Once we have got the words, however, the "anticipatory intention" is gone--that ineffable meaning has flown--and yet we know whether the words "fit" or not. In effect, James anticipated the current concern in cognitive psychology with the fascinating issue of tacit knowledge.

The procedures to which our lexical items correspond may initially arise from what Miller (1974) termed "generalized perceptual tests" (p. 410). So, too, does it appear that the introspectively available orthographic overlay of our lexical items is, over time, generalized. Children may indeed tacitly assume the principle of spelling, that is,

mapping sound to print; the facts of English orthography, however, remain to be discovered (generalized) through the active exploration of observed patterns.

The facts in the objective environment that partially constitutes the "stuff" of lexical representation cannot be exactly specified. The situation in which these facts might be abstracted can be attended to; it is in this fashion that, because a child's attention has been verbally directed to a particular phenomenon, it is often erroneously concluded that the child has therefore been taught an actual relationship. Such is probably not the case, although such a phenomenom was assumed for many years in some educational circles. The child, through behavior, implies understanding, but this understanding has to be subjectively abstracted; there appears to be no other way around it (Weimer, 1973).

Our task is the investigation of the trade-off between the child's tacit assumptions about the relationships between spoken and written language and the influence of patterns reflected in the orthography. At the present time our goal is not, and perhaps never can be, specifics in the tightly organized matrix of a scope and sequence chart of word-study activities. We can aim, however, to specify at least the general environment and the pedagogical attitudes that will allow for a near-optimal systematic "extension and restriction" of the student's lexicon. The goal of course is to provide for the active exploration of words within a conceptual framework that the student brings to the search.

Some may argue that it is unwise to raise such apparently global theoretical concerns regarding matters such as "tacit" vis-a-vis "conscious" knowledge in the case of words. It might be argued that, if the cognitive psychologists have not worked out these issues, how in the world can we expect teachers to make any sense of all this in the classroom? I hope that, by now, the answer is fairly obvious. We cannot ask meaningful questions about how children deal with words in all phases of reading instruction until we have asked meaningful questions about what in fact children think words are--at both a tacit and a conscious level.

Throughout the long history of reading instruction, it has been only recently, for example, that anyone has thought to ask children what they thought words are. Furthermore, it has been only recently that a systematic procedure for exploring children's tacit knowledge of words has been developed. It is our responsibility as researchers and teachers to establish a suitable framework within which we can evaluate these concepts. The scope of the issues involved is broad, nevertheless it describes those areas with which we must be concerned if we intend to investigate meaningfully children's knowledge about words.

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