

strengths on search time may be had from a comparison of the percentage frequency with which each of the two targets were detected in less than 120 seconds. The two *db* pip was detected in less than two minutes approximately 46 per cent of the time, and the threshold target roughly 22 per cent.

The two brightest pips, on the other hand, were discovered comparatively rapidly. The median search time for both the 12 and 14 *db* pips was 2.7 seconds. The fact that the curve becomes flat at these points does not necessarily imply that 2.7 seconds is a minimum search time which cannot be reduced by any means. The sweep rotation rate, it will be remembered, was 30 rpm, or one revolution every two seconds. Some percentage of the obtained minimum search time is due to the average elapsed time between the beginning of search and the moment sweep crossed the pip. No estimate can be made of what the percentage is since no systematic relation was maintained between the location of the pip and the location of the sweep at the moment search began.

The relationship between search time and signal voltage is, apparently a logarithmic one, with a minimum search time under the conditions of this experiment of 2.7 seconds reached with pips 12 or more *db* above threshold.

E. SUMMARY

Visual search time on the radar scope was studied as a function of signal strength. Search time in seconds was obtained from three subjects for eight signal voltages—0, 2, 4, 6, 8, 10, 12, and 14 *db* above threshold. The target was a small pip, $\frac{1}{2}$ microsecond pulse length and one degree beam width, giving an angular subtense of approximately $3'31''$ in its radial dimension at a viewing distance of 12 inches.

Results show the relationship between search time and signal voltage to be logarithmic. Targets 12 and 14 *db* above threshold were located, on the average, in 2.7 seconds, the minimum search time under the conditions of the experiment. Pips at threshold and two *db* above were not located, on the average, within a 120-second time allowance.

REFERENCE

1. WILLIAMS, S. B., & BARTLETT, N. R. Visibility on cathode-ray tube screens: Problems and methods. *J. of Psychol.*, 1948, **26**, 401-417.

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DEVELOPMENT OF WORD MEANING THROUGH VERBAL CONTEXT: AN EXPERIMENTAL STUDY*¹

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A. THE TEST

In the main, a child learns the meaning of a word in two ways. One way is direct and explicit, i.e., the adult names a thing or defines a word for the child. The other way is indirect and implicit, through experience with concrete and/or verbal contexts.

This study is concerned with the acquisition of word meanings through verbal contexts. The children participating in this investigation ranged from $8\frac{1}{2}$ to $13\frac{1}{2}$ years of age and were divided into five age groups with 25 children at each age level. The interquartile *IQ* range was from 101 to 111.

The test was as follows: The child's task was to find the meaning of an artificial word, which appeared in six different verbal contexts. In all, there were 12 sets of six sentences each. The 12 artificial words denoted either an object or an action. For example, the artificial word in the first set of six sentences was CORPLUM, for which the correct translation was "stick" or "piece of wood." The contexts for CORPLUM were as follows:

1. A CORPLUM MAY BE USED FOR SUPPORT.
2. CORPLUMS MAY BE USED TO CLOSE OFF AN OPEN PLACE.
3. A CORPLUM MAY BE LONG OR SHORT, THICK OR THIN, STRONG OR WEAK.
4. A WET CORPLUM DOES NOT BURN.
5. YOU CAN MAKE A CORPLUM SMOOTH WITH SANDPAPER.
6. THE PAINTER USED A CORPLUM TO MIX HIS PAINTS.

B. PROCEDURE

The experimental procedure was as follows: After the child was made thoroughly familiar with the task, he was presented with a card on which Sentence 1 of Series I was printed. After the child responded to the first sentence, he was asked how and why the meaning he gave for the word fit

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into the sentence. He then was presented with the second sentence while the first context was still in view. After having given his interpretation of the word as it appeared in the second sentence (which may or may not have differed from his first response) the child was again asked how and why it fit and also whether it could be applied to the preceding sentence. This procedure was carried out until all six contexts had been presented to the child. The child's responses were carefully recorded.

C. ANALYSIS AND RESULTS

Although correctness was not the major aspect of the study, it may be briefly mentioned that correctness of responses increased significantly from age level to age level.

Our main concern was with the ways children gave signification to the artificial words; we were especially interested in the development of the signification process. For the purpose of analysis, three judges derived 60 criteria from a preliminary inspection of the protocols. These criteria, pertaining to linguistic as well as semantic characteristics, were then employed by the three judges in the final analysis.

Studying the protocols one is impressed with the great variety of processes by which children acquired and generalized word meanings from verbal contexts. Many responses of the younger children indicate a *lack in the differentiation between the meaning of the word and the given verbal context*. Instead of conceiving the word as referring to a circumscribed meaning, many of the younger children regarded the artificial word as carrying the meaning of the whole or part of the context in which it appeared. We may call this type of conception a *sentence-core concept*. For instance, one sentence, containing the artificial word, BORDICK, (faults) was the following: PEOPLE TALK ABOUT THE BORDICKS OF OTHERS AND DON'T LIKE TO TALK ABOUT THEIR OWN. One child, dealing with this sentence, remarked: "Well, BORDICK means 'people talk about others and don't talk about themselves,' that's what BORDICK means." That this child seriously thought that BORDICK meant the whole sentence became clear when he tried to fit this meaning into the context: PEOPLE WITH BORDICKS ARE OFTEN UNHAPPY. The child fitted his sentence-core concept into this context as follows: "People talk about others and don't talk about themselves—they are often unhappy." To the question: "How does this meaning fit?", the child had this answer: "Say this lady hears that another lady is talking about her, so she'll get mad at her and that lady will be very unhappy."

A frequent method of fitting a sentence-core concept, formed for one sen-

tence, into another context was by a process we have termed *assimilation*. The child interprets the context of a new sentence as the same or similar to the context of the previous sentence. Through such assimilation, the concept for the previous sentence now fits into the new sentence. To illustrate, in one series the artificial word is HUDRAY (for which such concepts as "increase," "enlarge" or "grow" are adequate). Sentence 6 of this series read: YOU MUST HAVE ENOUGH SPACE IN THE BOOKCASE TO HUDRAY YOUR LIBRARY. One child said: "Hudray means 'to have enough space.'" He took a part of the context as the referent for HUDRAY. Returning to the previous sentences, he said that the concept, "to have enough space," fit all six sentences. For example, it fit Sentence 1 (IF YOU EAT WELL AND SLEEP WELL YOU WILL HUDRAY): "If you eat well, that is, if you do not overeat, you will have enough room in your stomach and won't get too chubby; if you sleep well, but not too much, you don't get overlazy; so you leave some room for more sleep—so you leave space—like."

Not infrequently, the child derived two independent sentence-core concepts pertaining to two successive sentences. In attempting to apply the second solution to the first sentence, he often combined the two solutions. For instance, for the two sentences:

JANE HAD TO HUDRAY THE CLOTH SO THE DRESS WOULD FIT MARY.
YOU HUDRAY WHAT YOU KNOW BY READING AND STUDYING.

one child gave as respective solutions: "Jane had to 'let out the hem' of the cloth" and "You 'learn by books' what you know." Coming back from the second to the first sentence the child said, "'Learn by books' fits here. Jane had to 'learn by books' how to 'let out the hem' in the cloth. Jane used an encyclopedia of sewing." For this girl, the first solution "let out the hem" was so completely embedded in the sentence context that it became a part of the sentence and no longer a substitute for HUDRAY. The child could now introduce the subsequent solution ("learn by books") above and beyond the first, original solution. At times, we obtained as many as three independent solutions combined in one sentence.

Another indication that word and sentence were not clearly differentiated at the earlier levels was the frequent manifestation of what we have called *holophrastic gradient*. Here, the concept was not limited to the unknown word, but spread to neighboring parts, thus carrying pieces of the sentence with it; e.g., for the word, LIDBER (collect, gather), one child stated for the sentence: JIMMY LIDBERED STAMPS FROM ALL COUNTRIES, "Jimmy 'collected' stamps from all countries." The concept was extended from "collect"

to "collect stamps." Thus the concept, "collect stamps" was applied to another sentence: THE POLICE DID NOT ALLOW THE PEOPLE TO LIDBER ON THE STREET, in the following manner: "Police did not permit people to 'collect stamps' on the street."

Thus far, we have considered only those forms of signification of a word which are based on an intimate fusion of word and sentence (or sentence-parts). In our analysis, we found other forms of signification, in which the concepts, though they did not display sentence-word fusion, were still lacking the circumscribed, stable character of the more mature concepts. We called such products *simple contextual or simple holophrastic concepts*. Here the word meaning was definitely set apart from the context of the sentence; nevertheless, it differed from conventional word meanings in that it bore a wide situational connotation rather than a circumscribed, stable one. The artificial word did not refer, for the child, to a single object or action, but to a more inclusive context. Sometimes the broad situational connotation of the word was explicitly stated by the child, i.e., he employed a whole phrase to express the meaning of the word. In other cases, the child used a single word, seemingly delimited in its meaning, which on probing was found to be far more inclusive than it appeared on the surface. The following may serve as examples of explicitly stated holophrastic concepts.

The artificial word, ASHDER (obstacle), appears in the sentence, THE WAY IS CLEAR IF THERE ARE NO ASHDER. One child responded: "The way is clear if there are no 'parts of a radio that don't fit in right' (together)." In the mind of this child, the word, ASHDER, referred to a radio-repair situation.

In the case of the sentence: THE POLICE DID NOT ALLOW THE PEOPLE TO LIDBER ON THE STREET, one child's translation of LIDBER was "throw paper around" (i.e., cluttering up the street by throwing paper around).

An illustration of implicit holophrastic concepts is the following, involving the word ONTRAVE (hope): ONTRAVE SOMETIMES KEEPS US FROM BEING UNHAPPY. A child substituted for ONTRAVE the seemingly circumscribed word "want." However, on probing, it became apparent that "want" referred to a broad contextual situation: "If you 'want a bow and arrow set and you get it,' that keeps you from being unhappy."

For this same sentence, another child came to the solution, "mother." "Mother keeps you from being unhappy." However, "mother" actually meant "mother when she gives you things you want."

One may note an important characteristic attached to such situational word meanings; the word has not only a broad situational content, but this

content is fluid and lacks closure: i.e., the concept may change in range from sentence to sentence, elements being added or subtracted etc. This can be seen from the way children quite typically expanded a concept in order to fit it into another sentence. This process of expansion, denoting fluidity of conceptualization, we have termed *contextual or holophrastic expansion*. An example of this holophrastic expansion is the following: One child had developed the concept "books to study" for HUDRAY. "Books" became expanded to "throwing books" when the child attempted to fit the concept into the sentence: MRS. SMITH WANTED TO HUDRAY HER FAMILY. The child stated: "Mrs. Smith wanted to 'throw books,' at her family."

Another child, who had arrived at the concept "long" for one sentence, expanded it to "get long hair" in another: THE OLDER YOU GET THE SOONER YOU WILL BEGIN TO SOLDEVE, ". . . the sooner you will begin to 'get long hair.'"

On occasion the contextual expansion was more systematically employed. The child formed a conceptual nucleus, which remained constant throughout the six contexts; and added to this nucleus elements varying with each sentence. We have termed this procedure *pluralization*. For example, one child formed a nucleus for all the sentences of one series containing the artificial word, LIDBER. This nucleus was "collect." In one sentence LIDBER meant "collect ribbons" (ALL THE CHILDREN WILL "collect ribbons" AT MARY'S PARTY); in another sentence, it was "collect autographs" (THE PEOPLE "collected autographs" from THE SPEAKER WHEN HE FINISHED HIS TALK); in a third sentence, it meant "collect information" (PEOPLE "collect information" QUICKLY WHEN THERE IS AN ACCIDENT), and so on.

We should like to mention two other forms of signification of a word, that were essentially based on contextual or holophrastic conceptualization. One we have termed *generalization by juxtaposition*; the other *generalization by chain*.

In the case of juxtaposition, a concept of an object *A* obtained in one sentence is applicable to a second sentence through the mediation of a concept of an object *B* that is spatially contiguous to the object *A*. For instance, a child gave the solution "plaster" for CONTAVISH in the sentence: BEFORE THE HOUSE IS FINISHED, THE WALLS MUST HAVE CONTAVISHES. "Plaster" also fit into the sentence, A BOTTLE HAS ONLY ONE CONTAVISH. Here the child used "label" for CONTAVISH, saying, "A bottle has only one 'label.'" Nevertheless "plaster" was retained as the solution because "plaster," as the child explained, "is used to put on the 'label.'" In other words, the concept of an object such as "plaster" could be used as an over-

all solution because the juxtaposed object ("label") fit into the sentence. Most likely, the concept was contextual: not just "plaster" but "plaster +."

A similar mechanism seemed to be operative in generalization by chain. This type of generalization probably differs from juxtaposition only insofar as the two objects in question are conceived of as temporally rather than spatially connected (e.g., cause and effect). As an example, "honor" was substituted for SACKOY in one sentence: WE ALL ADMIRE PEOPLE WHO HAVE MUCH SACKOY. In the next sentence, "guts" was the meaning attributed to SACKOY. "You need 'guts' to fight with a boy bigger than you." But "honor" still fit because, as the child explained, "If you have 'guts,' you are 'honored' aren't you?"

Finally, the two main groups of immature signification discussed in this paper may be briefly compared statistically. As will be recalled, in the first group, the word carries with it the whole or parts of the sentence context; in the second group, the word is clearly differentiated from the sentence context, though it still possesses a broad contextual meaning. Table 1 summarizes the occurrence of these two types of contextual word meanings at the various age levels.

TABLE 1

Age	8½-9½	9½-10½	10½-11½	11½-12½	12½-13½
I Sentence-contextual	11.9	9.2	1.8	0.2	0.5
II Non-sentence-contextual	11.7	10.8	7.9	4.6	3.3

The figures represent the mean occurrence per child at each age group. Both forms of word meanings decreased as age increased; however, there is a clearcut difference between the two developmental curves. Signification based on sentence-word fusion (Type I) decreased most sharply between the second and third age levels (around 10-11 years), with practically no occurrence after the third age level. The other type of contextual signification (in which there is no fusion of word meaning and sentence) showed an entirely different developmental trend: it gradually decreased, and even at the 13-year level there were as many as 3.3 such solutions per child.

The abrupt decrease of Type I, the most immature form of signification, around the 10- to 11-year level suggests a rather fundamental shift in language attitude, toward a task, which, as in our test, is on a relatively abstract verbal plane. This points to important implications which will be treated at greater length in a future paper.

In closing, we should like to mention briefly that there are aspects of

language development other than semantic, discussed in this paper, which showed similar abrupt changes at the same age levels. This is particularly true with respect to grammatical structure. The data indicate that there is a growing comprehension of the test sentence as a stable, grammatical structure. Younger children manipulated the sentence as a fluid medium, lacking closure; that is, in the case of giving meaning to the artificial word they frequently altered the grammatical structure of the test sentence. The frequency of such manipulation showed an abrupt drop at the end of the second age level with practically no occurrence at the fourth and fifth levels.

One of the most significant and little explored problems of language development concerns the relationship between the semantic and grammatical aspects of language. The close correspondence of the developmental curves, indicated by our data, between two seemingly independent aspects of language lends support to those theories that assume a genetic interdependence of meaning and structure.

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