

SOME DIFFERENCES BETWEEN FIRST AND SECOND LANGUAGE LEARNING¹

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Yesterday afternoon a young man interested in language learning came to me with a problem. He had read about my address this evening on some differences between first and second language learning, and he wanted to attend. On the other hand, he related he had promised to take a girl to the movies this evening. He didn't state the question bluntly but it clearly amounted to: which did I think would be more rewarding—my monologue or a movie.

I asked the young man if he had learned a second language in addition to English and he said he knew two foreign languages. "Why, then," I replied, "you can judge for yourself the differences between first and second language learning." "I know some things from my own experience," he answered, "but you are a psychologist and could tell me much more." "Why so?" I asked. He didn't answer, but apologized for intruding and left. I do not know if he is here after all; perhaps he struck a compromise between his two goals and took his date to a foreign film.

This student was clearly not a psychology major. A psychology major could readily answer my question: Why can a psychologist tell you more about language learning than you know from your own experience? An "A" answer on an examination might go something like this:

"The psychologist can tell you more about second language learning than you know from your own experience because a psychologist limits his experience. He studies limited samples of language learning under limited conditions. The relations between behavior and the environment are, therefore, simpler and more easily apprehended. A knowledge of these basic relations between language and the environment enables the psychologist to discriminate among relevant and irrelevant variables in the exceedingly complex language learning situation."

¹An address to the English Language Institute, University of Michigan, April, 1961.

I would like this evening to put the student's answer to a test. How far will the findings of the laboratory and the concepts derived from these findings carry us toward an understanding of first and second language learning and their differences?

As soon as we attempt to characterize first language learning in terms of research findings we are at a standstill because of the first critical difference between first and second language learning. Second language learning is what we make it. First language learning is rarely planned or controlled. It is for this reason that psychologists and linguists have traditionally settled for a descriptive account of first language learning but insist on criticizing and improving upon second language learning. Although there is a dearth of studies concerned specifically with the infant learning to vocalize under controlled experimental conditions, our knowledge of the principles of learning based on research with other humans and subhumans behaving under controlled conditions may aid us in giving a plausible, if not proven, account of infant speech development.

Let us start with a description of early speech development in the child and then see what basic behavioral principles may be introduced to account for these developments. Since we did not participate in the manipulation of the child's speech we must inquire of the parent instead: "What did you do to your child and what, in turn, did the little fellow do?" Now here is a pretty mess. Most adults give very poor detailed accounts of their own behavior and distort extensively and variously in recounting the behavior of their children and the conditions which brought this behavior about. To quote from McCarthy in her classic review of the literature on language development in the child:

"Although this wealth of observational material has proved stimulating and suggestive for later research workers, it has little scientific merit. For each of the studies employed a different method; the observations have, for the most part, been conducted on single children who were usually either precocious or markedly retarded in their language development; the records have been made under varying conditions; and most of the studies are subject to the unreliability of parents' reports."

A general outline of the development of speech in the infant may, nevertheless, be drawn from such biographical accounts and from secondary sources such as those by McCarthy (1946) and Lewis (1951). Soon after birth, any stimulus produces a state of undifferentiated excitement in the infant. Many

observers report that within the first few hours two "states" may be distinguished: distress and delight. To quote Lewis, "Each state is accompanied by a specific vocalization, crying in the former case and soft gurgling noises in the latter." Most writers agree that the differentiation of these affective states and associated reflexive vocalizing are the starting points in the development of speech.

The next major development in the vocalizing of the infant occurs some time during the second month of life when, among the sounds uttered in states of comfort, some babbling of isolated sounds appears. This babbling period continues for eight to ten months, during which time the phonetic structure of vocalizing is undergoing drastic but regular change (Irwin, 1951).

The third development that I shall single out in the acquisition of speech by the infant is called imitation. Although imitative behavior is usually reported after the ninth month, and seems to arrive abruptly on the developmental scene, Lewis suggests that its earlier traces may be observed concurrent with the development of babbling. It seems to be the consensus that the child imitates only those sounds that have already appeared in his babbling repertory; the imitation of the speech of others is then based on novel combinations of these sounds (Curti, 1938; Shirley, 1933; Guillaume, 1925).

Observations of subsequent linguistic development reveal an increasing complexity of performance which is equaled only by the complexity of the theories elaborated to account for it. Studies of language during the second year of life and beyond introduce such processes as the comprehension of speech, the mastery of conventional forms, the expansion of meaning, the development of reference to past and future, and so on. These topics take us beyond the present sketch.

We are, therefore, given these three highlights in the development of infant speech: (1) reflexive vocalizing, (2) development and articulation of the babbling repertory, and (3) imitation. This is, as you can see, a purely descriptive classification. Let us accept this synthesis of various descriptive sketches and see how plausible an account of these developments can be given in terms of behavioral principles.

Three basic principles must be introduced for our present discussion of first language learning. We will rely on these principles again in our discussion of second language learning. The first principle is reinforcement, the second is discrimination, the third is differentiation. The principle of reinforcement states simply this: a large part of human and subhuman behavior

is controlled by its consequences in the environment. The consequences are called reinforcing events and the behavior which is controlled or changes is called operant behavior, since its defining feature is that it operates on the environment.

I am told that all great truths are immediately understandable. If the observation that behavior is controlled by its consequences seems eminently reasonable to you and hardly worth elevating to the rank of a principle, I invite you to consider how rarely we act on this understanding. Is the language learning situation engineered so that each student's behavior has immediate reinforcing consequences? Rarely so! And yet we would change the behavior of the student.

The second behavioral principle is discrimination. Behavior that is reinforced only under certain conditions will come to be emitted only under these conditions. This principle is readily demonstrated by the fact that one speaks French in French class, German in German class, and jargon in psychology class. Or to use a more vivid example, one sings hymns in church and bawdy songs in fraternity houses and rarely the reverse—because of the reinforcing contingencies that obtain under these separate conditions.

The third principle we must introduce at this point, the principle of shaping or differentiation, provides that the form of a response may be altered by selective application of reinforcement, so that totally new responses may be shaped out of the current behavioral repertory.

As a result of discrimination learning, the subject comes to respond under the appropriate conditions. As a result of differentiation or shaping, the response has the appropriate form. An example of the relation between these behavioral processes, which are typically coordinated in the control of human behavior, is provided by the mastery of Morse Code:

"When one learns to *receive* code, his problem is mainly *discriminative*, since the written or spoken responses have already been well differentiated; in *sending* code, however, the problem is one of differentiation, since the discriminative work was done when the student learned to read his ABC's." (Keller and Schoenfeld, 1950)

Each of these three principles, reinforcement, discrimination, differentiation, has been the subject of extensive laboratory research using humans and subhumans behaving under highly controlled conditions. Let us see how much power these principles of operant control have in accounting for the three stages of infant speech development that I highlighted earlier:

(1) changes in reflective vocalizing or crying, (2) development and articulation of the babbling repertory, and (3) imitation.

The account is, of necessity, speculative. It is offered in the same spirit as the more comprehensive treatment of verbal behavior presented by B. F. Skinner (1957) and it would be well to quote his introductory remarks as a prologue here:

"The emphasis is upon an orderly arrangement of well-known facts, in accordance with a formulation of behavior derived from an experimental analysis of a more rigorous sort. The present extension to verbal behavior is thus an exercise in interpretation rather than a quantitative extrapolation of rigorous experimental results."

It is in the selective reinforcement of crying that we find the first evidence of operant control in vocalizing. In a biographical sketch of his infant's speech development, Charles Darwin wrote: "after a time the crying sound differs as to the cause such as hunger or pain . . . he appeared to cry voluntarily." We see that crying is an early way of operating on the environment for the infant; the infant is reinforced for crying by the presentation of food or perhaps the removal of a wet diaper. This brief account of behavior also exemplifies the operation of discrimination and differentiation. Undifferentiated cries must have only a modicum of success. However, two responses of different form, each under discriminative control—that is, one cry when hungry, another when wet—have the effect of always producing the "right effect." As the parent learns to discriminate among the two cries he can more often respond appropriately. As a result, the differentiation of crying is reinforced.

If crying is reinforced frequently and intermittently it may pre-empt the development of other forms of social behavior in later months. Whining, prevalent in the older child, may represent a "regression" to an earlier form of successful vocal behavior. Williams (1959) reports the extinction of crying at bedtime of a child, 21 months old, by simply discontinuing parental attention to crying at this time. He presents extinction curves (responses emitted as a function of time) that resemble those for other human and subhuman operants.

In terms of the dichotomy proposed by Lewis (*supra*), I have suggested that the vocal behavior of the infant in a state of discomfort is amenable to operant control. It is unlikely, however, that crying is the raw material out of which complex speech is formed. A much more likely source for this performance is the babbling of the infant, associated with states of comfort

Irwin and Curry (1941) have recorded phonetically more than one thousand vowel-like sounds from forty babies observed during the first ten days of life. We have reason to believe, therefore, that sufficient variability exists in the very earliest repertory of the infant for the differential reinforcement of approximations to English.

Irwin and Chen (1946) have traced the number of native-tongue phonemes emitted by 95 infants in their home environments during the first three months of life. The mean number of phoneme types (arrived at by observer agreement) was found to grow as a negatively accelerated increasing function of the age in months. Although the mastery of phoneme types grows at a decreasing rate, the frequency of production of these phonemes is a positively accelerated function of age (Irwin, 1947). Most biographical accounts concur with the more rigorous empirical studies performed by Irwin and his colleagues in reporting an over-all increase in the frequency of babbling and increasing approximation of the babbling repertory to English (McCarthy, 1946; Lewis, 1936; Leopold, 1939).

If we were to attribute the former finding, the increase in the rate of babbling, to operant control, it would not be entirely speculative. First, we have an analogous finding in experiments with chicks, parakeets, and cats; we now know that the rate of subhuman "babbling" may be manipulated by reinforcement (Lane, 1961; Ginsburg, 1960). Furthermore, Rheingold, Gewirtz, and Nelson (1959) have demonstrated the operant conditioning of babbling in 21 infants, median age three months. Regular reinforcement (smile plus three "tsk" sounds plus a light touch applied to the abdomen) of vocalizing produced an increase of over 100 percent in the number of vocal responses per session, while discontinuing reinforcement led to a drop in responding back to the original baseline level.

In order to account for the increasing articulation of the babbling repertory, however, we must introduce the notion of selective reinforcement: we assume here that the child's verbal community is under the discriminative control of the child's speech with respect to its reinforcing practices. A mere disposition to reinforce the child for vocalizing at all is not sufficient. We are assuming that planned and unplanned contingencies operate selectively to enhance the strength of English approximates and to neglect or extinguish non-English sounds. When the child speaks English, we act and his speech has a reinforcing effect. When he speaks nonsense we call it senseless and rarely reinforce.

Selective reinforcement of responses appearing in the babbling repertory may be responsible in large part for the increasing approximation of the infant's phoneme repertory to that of the adult linguistic community. Furthermore, relatively simple words and compounds in the two-year-old's vocabulary are probably differentiated directly out of the babbling repertory. Since babbling is characterized by short, repetitive sequences, we may expect reduplicated monosyllables, such as *ma-ma* and *pa-pa*, to arise earliest directly from this repertory, and without imitation. Baker (1955) is led to related conclusions from an etymological analysis:

"This interlocked issue of appropriations by elders and the weight of conditioning imposed by the linguistic community into which the child is born, operating as they do to shape spontaneous infant vocalizations into phonemic forms, is highly complex both in its range and products. We have seen how, in certain words for father, *p* and *b* sounds have been interchanged. Precisely the same thing happens with *t* and *d* sounds, both of which (once again) Lewis has recorded among infant utterances. Compare English *dad*, Welsh *tad*, Irish *daid*, Breton *tat* and *tad*, Greek *tata*, Sanskrit *tata*, all applied to father. And from the other side of the world: Sentani *adai*; Malagasy *dada* and *daday*, Fiji *ta* and *tata*; Pampang and Guaham also have *tat* for father; in Formosa *ta* is used as a prefix for the names of men.

"What is being suggested here is that infant vocalizations—the spontaneous and instinctual utterances that the child brings into the world—form the matrix of language. [Not all words,] but certain nuclear words are formed by and drawn from the matrix of infant utterances." (p. 328)

Once a basic repertory begins to develop, vocal behavior will tend to be reinforced in preference to other motor behavior:

"At the same time that the child is being rewarded for making more responses to words as cues, he is gradually learning another aspect of language, namely, how to make the response of uttering words. If a cookie is out of reach the response pattern of pointing at it with the body and eyes and reaching for it with the hand is often rewarded by inducing some older person to give the child the cookie. If this gesture is accompanied by a sound, it is more likely to be rewarded. If the sound seems to be some appropriate word, such as 'Look at,' reward is still more likely. Eventually the more effortful parts of the gesture drop out, and the verbal response, which is least effortful and most consistently rewarded, becomes anticipatory and persists. The mechanism of reward gradually differentiates language from its original matrix of other, more clumsy, overt responses. The child learns to talk because society makes that relatively effortless response supremely worthwhile." (Miller and Dollard, 1947, p. 82)

You may agree at this point that our principles of operant control account well for the development of the elements of speech in the infant. But how to deal with the more advanced process of imitation? Imitation is generally given the lion's share in an account of the development of speech and is the third major development in the acquisition of speech by the infant that we noted earlier. One use of the word as an explanatory concept is clearly circular, and this facile circularity has no doubt contributed in large measure to the popularity of the term. The datum to be accounted for is the increasing complexity of the child's speech or, in other words, the increasing approximation of the child's speech to that of his elders. Descriptively, the child comes to *imitate* the vocal behavior of the linguistic community and especially that subcommunity which his parents comprise. An explanation of this imitative behavior by reference to the process itself gives the circular account: a child imitates because he imitates.

Lewis (1936) describes the development of imitation in this way:

"... for a very long time the forms used by the child in imitation of adult language consist of his own familiar sounds spoken as approximations to those that he hears. Only gradually, as he attends more closely, are the movements of his vocal organs subordinated to his auditory perceptions. At first he is satisfied to make broad, crude attempts: as time passes his vocal movements become more and more refined. Slowly he comes to pronounce his mother tongue in the accepted fashion, under the stress of social selection, *that is, the responses made to his attempts by others*" (italics mine).

Lewis' description exemplifies what we have called differential reinforcement of verbal behavior. Once again, we may point out that the positive disposition of the parents to reinforce "proper speech" facilitates this acquisition process, for it is primarily the parents who respond to the child's vocal attempts. Increasingly accurate approximations by the infant to the language of the community are reinforced not only because they are likely to be more effective (more rapid, more reliable) in parental control, but also because parents often actively shape the speech of their progeny at this stage of linguistic development.

As B. F. Skinner has put it: "Echoic behavior, like all verbal behavior, is shaped and maintained by certain contingencies of reinforcement. The formal similarity between stimulus and response is part of these contingencies and can be explained

only by pointing to the significance of the similarity to the reinforcing community." (1957, p. 59)

This fact is rather entertainingly underscored in a passage from Samuel Butler's *Way of All Flesh*:

"Ernest," said Theobald . . . , "don't you think it would be very nice if you were to say 'come' like other people, instead of 'tum'?"

"I do say tum," replied Ernest. . . .

Theobald noticed the fact that he was being contradicted in a moment. . . .

"No, Ernest, you don't," he said, "you say nothing of the kind, you say 'tum', not 'come'. Now say 'come' after me, as I do."

"Tum," said Ernest. . . .

". . . now, Ernest, I will give you one more chance, and if you can't say 'come' I shall know that you are self-willed and naughty." (cited in Skinner, 1957, p. 60)

To summarize, our account of infant speech acquisition in terms of reinforcement theory develops along the following lines:

1. Crying and babbling occur at a high unconditioned rate in the earliest hours of an infant's life.
2. There is some selective reinforcement of crying, so that it presently comes to exert social control.
3. There is generalized reinforcement of babbling so that it increases in rate during the first year.
4. There is selective reinforcement of babbling so that the phonetic structure of the babbling repertory comes to approximate that of the language. Furthermore, certain elemental words tend to occur as a result, are reinforced, and increase in frequency.
5. Adults generate a great deal of vocal behavior in the presence of the babbling child. In accordance with step 4, there is considerable overlap between the phonetic structure of the child's vocalizing and that of the adult. When a babbling response is emitted that has some formal similarity to the vocal productions of the adult, it tends to be reinforced.
6. As a result, phones emitted by the adult tend to evoke similar phones emitted by the child. Novel words emitted by the adult tend to evoke their phonetic components.
7. Approximations to the words of adults emitted by the child are reinforced. As the vocabulary of the child increases in breadth, the criteria for a "good approximation," and hence the contingencies of reinforcement, become more stringent.

If the principles of operant control are at work in first language learning it is clear that they are not employed to full

advantage. As parents we are inconsistent in our reinforcing practices. We permit correct responses to go unreinforced and fail to reinforce desired behavior. Furthermore, reinforcement practices are inconsistent from home to school and from school to street in later stages of speech development. That we have some success, nevertheless, is testified to by the many Americans who speak English. That we are grossly inefficient is testified to by the differences in verbal prowess among individuals and across socio-economic levels.

Practically speaking, we need not engage in these undesirable practices in teaching the second language; once again, this is the overriding difference in the learning of these two languages. We can and we will take advantage of scientific knowledge in arranging second language learning.

A second difference between first and second language learning is in the nature of reinforcement control. In second-language learning we must rely on such spurious reinforcers as a nod, a smile, a little approval. It is clear that such secondary reinforcers are limited in their control of behavior. In contrast to primary reinforcers, such as food, the efficacy of secondary reinforcers is entirely determined by the prior conditioning history of the student. Most of all—it must be admitted—we rely on punishment and the threat of punishment. The grade and the prerequisite serve us as well—or as poorly—and little more subtly than the birch rod served our forebears. Our reliance on punishment is an explicit acknowledgment of this difference between first and second language learning. We do not have the absolute control of the parent over the child, nor the use of primary reinforcers, and we fear or find that secondary reinforcers such as approval will not serve alone.

A third difference derives from the fact that the student learning a second language begins with a highly articulate verbal repertory. This verbal ability is usually seen as expediting the second-language learning process but in particular cases the two repertories may actually conflict. The clearest example of repertories in conflict occurs when the second-language learner is confronted with a foreign word that has an English cognate or that has been "borrowed" into the English language. Language programmers tell me that they leave such words as "mesa" and "adiós" in Spanish, and "bonjour" and "parlez-vous" in French for very late stages of their programs when vocal skills are well mastered, and the tendency to say these responses as an American is relatively weak compared with the tendency to render the correct pronunciation. Similarly, many language teachers report that the introduction of "realia," or "meaning," or

Latin orthography, usually leads to a decrement in pronunciation. We may expect that this degradation is due to the elicitation of English vocal responses by these stimuli, whether objects, concepts, or letters. These English responses then compete with, or even override, the newly formed foreign responses with the result that pronunciation is impaired.

The fourth and final difference I would like to cite between first and second language learning I believe to be the most critical and the least widely known. The nature of this difference has become clear to me only after some six months of research in conjunction with the Language Laboratory here at the University of Michigan. This critical difference is in the nature of discrimination learning. Earlier in this address, I stressed the importance of discrimination learning in the development of the first language. It is the process by which one learns to say the right thing at the right time. Imitation is dependent upon discrimination, as are most vocal skills.

The process by which behavior initially comes under stimulus control is a gradual one. Now it is difficult if not impossible to study initial discrimination learning in humans, for this requires a naive organism, to use the technical sense of the word. There seem to be three courses open to the researcher: First, he can employ very young infants; however, in addition to the obvious ethical problems impeding research there is the fact that the child very early comes to discriminate the components of the "blooming, buzzing confusion" that confronts him upon entering the world. Second, the behavioral scientist can employ adults and attempt to study discrimination learning under conditions where prior discrimination learning is not relevant. This has probably never been done, since the adult has an extensive and variegated history of discrimination learning. Finally, the researcher can employ subhumans, whose training history he can control. This approach to understanding discrimination learning has been pursued extensively, and the finding is, as I have said, that initial discrimination learning proceeds slowly.

Allow me to describe the course of discrimination learning of vocal behavior in the chicken and then to contrast this initial discrimination learning with the analogous process in second-language learning. At first, we bring the vocal response of the chicken under reinforcement control. We may increase or decrease the rate of chirping at will by appropriate contingencies of reinforcement. Then, to bring the response under discriminative control, we set up reinforcement contingencies that are

unique to the stimulus conditions. For example, when the word "chirp" is played repetitively to the chicken we reinforce chirps, by presenting food to a food-deprived chick contingent upon chirping. When the words "do not chirp" are presented, chirps have no consequences in the environment, they are not reinforced, chirping is, so to speak, extinguished. Now, observe the course of discrimination learning. Gradually, chirping in the "no-reinforcement" condition extinguishes. Over the course of a few hours, the rate of chirping in this condition may fall to zero. In the chirp condition, however, where responses are reinforced, the rate remains quite high. Thus by the end of the experiment, the bird chirps when the chirp stimulus is on and rarely or never chirps when the "do not chirp" stimulus is in effect.

Now let us examine the analogous experiment in auditory discrimination learning with second-language learners. For example, we present a Spanish sound, such as /a/; if the subject responds to this stimulus by saying "Spanish" or by pressing a button, he is reinforced—with points or the bleep of a tone. Then, too, there are negative stimuli, when responding is not reinforced: these are English approximate sounds such as /æ/. Here, too, the subject learns to discriminate one auditory stimulus from another. But now, the big difference: the process is *not* gradual. What we observe instead is a few trials on which errors occur and then, abruptly, the student is one hundred percent correct. He always responds to Spanish and never to non-Spanish. Why the big difference? Why isn't discrimination learning in the second language gradual? The answer is: because the student has already learned to make these discriminations in the course of learning his first language. He can "tell the difference" between /a/ and /æ/ just as you can. Indeed, he can tell the difference between allophones of the same phoneme, by virtue of his prior training. As a result, the errors that the student makes in second-language discrimination learning are usually errors of over-discriminating. He fails to respond to variants of the positive stimulus which the experimenter considers equivalent.

Mr. Dale Brethower has recently demonstrated this nicely with a non-Latin language, Thai. Students were given the task of simply saying whether two sounds were the same or different. The sounds of the pair were either both Thai, or one Thai sound and one English approximate. The finding: most Thai sounds, even the most difficult, have proven to be discriminable. There were no Thai sounds that all subjects failed to

discriminate from their English approximates. In learning to discriminate among the sounds of a second language, the subject is not learning a discrimination at all. He is learning to *transfer* discriminations that he is already capable of. As soon as he knows your set of rules, so to speak, he plays the game perfectly.

This phenomenon is not new to the psychological literature. Whenever a subject is given the task of learning a discrimination for which he has extensive prior training, the learning process is abrupt. For example, in an experiment by Heidebreder (1947) subjects had to learn the nonsense syllable names of a group of objects and abstract forms. They were already quite capable of discriminating among the objects and forms, such as faces, animals, colors, and so on. What they did not know was that certain of the obvious distinctions among these stimuli were irrelevant. To be right, it was necessary to consider a variety of animals, for example, as equivalent, and give the same nonsense-syllable name to each. The subjects' errors were, as in the case of second-language learning, errors of over-discrimination. The subject was capable of discriminating among allocons of the same concept, so to speak, although by definition, these differences were irrelevant. As a result, the learning curve shows many errors for a short while, and then an abrupt increment to perfect performance. The time from the first correct guess to one hundred percent correct naming was usually one or two trials. Contrast this with the thousands upon thousands of responses that are required in initial discrimination learning, before the discrimination is mastered. Heidebreder calls the process of transfer of earlier discriminative behaviors "concept attainment."

I believe that an appreciation of these differences between first and second language learning that I have singled out this evening should color our techniques as second-language teachers to a large extent. Allow me to recapitulate these differences. First, there is a great difference, practically speaking, in the measure of control that we can exert over first and second language learning. Second, there is a great difference in the nature of the reinforcers that are available to us. Third, we must remember that the second-language learner, unlike the infant, has a highly articulate verbal repertory. Fourth, we must remember that the second-language learner, unlike the infant, has had extensive discrimination training and is essentially faced with the task of "concept attainment" rather than discrimination learning in coming to respond appropriately to the sounds of another language.

May I repeat that these differences should color our techniques as second-language teachers. I would be very pleased if the effect of my lecture this evening were twofold: First, the development of a greater awareness of the basic behavioral principles that can be employed to optimize second-language learning: in particular, the principles of reinforcement, discrimination and differentiation. And second, a greater awareness of the student's point of departure in second-language learning: his discriminative abilities and his current vocal repertory.

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