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# SEMANTIC GRADING AND ITS STRUCTURE

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A number of years ago, Edward Sapir published a paper which he called Semantic Grading. He pointed out at the time that semantic grading has interesting psychological applications , but unfortunately, his work has never received the attention that it merits. Today I would like to present a set of operational definitions for the grading process and then show how the grading phenomenon can contribute towards the solution of a tricky psychological problem concerning the acquisition of learning.

Let me first of all present the problem. It is a well-known fact that the child learns certain groups of words at characteristic stages. For instance, among the first words that he uses and apparently applies correctly are mother, milk, walk. At subsequent stages of development, he begins to use words such as hot, up, back. At a still later developmental stage, he begins to learn the words for colors, numbers and time. The question that I would like to ask is, "Why is it that there is an apparently regular sequence in acquisition?" The common sense explanation of this fact would be that the child learns first those words that are important to his life such as mother or milk, and that the sequence is simply a function of the importance of the word. This would also square with psychological theory, and we might expect that the higher the reward for learning a given word, the faster the word is acquired. This thesis can be tested empirically. Could any word be learned at any particular stage provided the reward or motivation for learning the word is held constant? It is a well documented fact that this is not the case. There is a stage at which the child may have a fairly wide vocabulary, say at the age of $2\frac{1}{2}$, yet he is unable to use color words the way adult persons use it. It is, of course, possible to make him learn that a particular object is called "the red so-and-so" (red fire engine) yet the child will still not be able to use this word red in all the physical contexts in which the adult speaker uses that word. The same thing is, of course, true of number and time. So motivation alone cannot account for this phenomenon, which is not to say, that motivation is an irrelevant factor in language learning. Another thesis might be the frequency of occurence of the word. The thesis is quickly disposed of by taking a look at the Thorndike-Lorge frequency list. Many words of high frequency of occurance are nevertheless not learned until a very late stage of development. So frequency of occurence cannot account for the sequence.

We must therefore look towards a particular property in the words themselves which makes some words harder to learn than others. A favorite explanation of this sort is to construct a scale ranging from concrete and abstract, and then if a word is not learned readily at an early stage of development, to explain this fact by saying that the word is too abstract to be learned so early. The Goldstein School adheres to some such theory though considerably refined. Nevertheless, it can be shown that the concrete-abstract notion will make it necessary to make rather absurd assertions about a number of words in order to fit them into the scale of concrete and abstract. For instance to claim that the word for color is more abstract than the word hot is ridiculous. There is plenty of evidence for the immediacy in experience of color. The concrete-abstract thesis has always something of an *ad hoc* air about it.

I believe that a certain aspect of grading might provide an interesting and yet a perfectly objective answer and explanation to the problem just mentioned.

Words do not refer to individual stimuli but always to categories of stimuli. These categories have certain structural properties that characterizes them. Examples of various groups are illustrated on the hand-out.

Take the continuum of humidity. On this continuum our language superimposes a two-fold classification. Some of the stimuli in the continuum are classified and labeled dry and others wet. Each category, dry as well as wet, ranges from a point which is the most typical instance within the category--a non-plus-ultra--to a transition area where the classification becomes fuzzy, i.e. where a stimuli may either be assigned to the class dry or to the class wet so that these categories are delimited on one side by a perfect example, on the other side by an adjoining category.

Turning now to example two, volume of sound. Here we have again a two-fold classification but there is an important difference between the way this continuum is divided up and the way the continuum humidity is divided up, namely the transition area between the two categories is much broader than that in the previous example.

The next example shows a continuum on which we have superimposed a three-fold classification system; the two transition areas are more or less the same as in 1 but the category gray is quite different in structure from the categories dry, wet, or black. The most typical occurrance of this category occurs in the center, not in one of its extremes. On both sides of the category there are transition areas so that the range of this category is defined by the ranges of its neighbours.

Example four is distinguished from the previous three examples by yet another feature. In this case the delimitation of any one category depends on the delimitation of neighbouring categories so that in this continuum the range of every category depends on that of every other category. There is no absolute and most typical instance beyond which we cannot have an instance taken from the same continuum. Also the transition area, i.e. the probability gradient with which one stimulus is called one thing or the other, is asymmetrical as is shown on the diagram. The other gradients, it will be noticed, have a congruous structure.

Example five is radically different from the other one insofar as there is not any continuum whatever. It is a self-sufficient category. "Tables" are not delimited by any other category. It is true that we can think of a series of furniture which goes all the way from a table to a bench, or a table to a desk, yet it would be absurd to claim that the learning of the word table depends on the learning of the word desk. Also, there is an infinite possible number of instances of this category whereas the previous examples had finite numbers of possible instances. The number of instances is determined by our sense-apparatus. Furthermore, there is not only one or two or three ways of ordering tables, but we might say that there is an infinite number of possible series in which tables might be arranged. In our experience we hardly ever encounter an object which leaves any doubt whether it is to be called a table or anything else.

The interesting aspect of this situation is that there are very small numbers of parameters of dimensions in terms of which we can describe all the important structural properties of each category. The parameters are four: First and most important one , which divides all categories into two distinct groups, is whether the stimuli within a category have a natural and logical way of being ordered or whether there are an infinite number of arbitrary ways of ordering the stimuli, or whether the stimuli cannot be ordered at all.

The next dimension is the width of the category which can be illustrated by the following example. In the case of numerals every category consists of one and only one possible instance. In the case of color terms, there are a number of stimuli to all of which we are likely to respond with one and the same word yet even here, there is a difference in number of stimuli contained in each category, e.g. green has more discriminable colors than yellow.

The dimension, type of transition area, is well illustrated by a comparison of examples one and two. There can be a wide transition area or a narrow transition area, or there can be asymmetric and incongruous transition areas.

The last dimension is actually a number of closely related variables. An important one is the number of categories that are superimposed upon the continuum; then, the existence or absence of reference points with which I mean the terminal points of a continuum which at the same time constitute the most typical instance of the category (the blackest black is also the end of the continuum). Characteristically, examples one, two, and three have reference points of this nature. Examples four and five lack them. Then the final parameter is well illustrated in the diagram.

Now, suppose we assign to each dimension values (which, of course, need not be numerical values but can be simply a <u>high</u>, <u>low</u>, or a <u>yes</u>, <u>no</u>) than any category can be described in terms of values of these dimensions. It is my thesis that we can derive groups of categories all of which are characterized by the same values on all four dimensions. Nevertheless, the constituents of such larger groups may have quite different qualitative aspects, e.g. we might find a group of categories containing mother, milk, and table, all of which are qualitiatively different yet each of these categories may have the same structural features. The classification of categories thus derived is hypothesized to be of considerable psychological interest because any constituent of such a group, I claim, will have the same psychological properties as well as difficulties when the respective words are to be learned. Let me illustrate this claim with a few examples.

Let us consider why red, or color terms in general, are more difficult to be learned than words referring to temperature, hot and cold. Hot and cold belong to a group of categories all of which have a dichotomous structure, i.e. they come from continua that have a two-fold classification, whereas color terms belong to a continuum which in our language has a six-fold classification (other color terms in use do not refer to the continuum hue). Thus, when the child has to learn to use the word hot correctly, all he has to learn is hot and non-hot or hot and cold. He need necessarily not learn at the same time the word cold but all he needs to learn is to make the distinction between hot and non-hot. In the case of color words, however, he will not be able to use any one color word correctly unless he learns the use of all the principal color words, because each color category delimits the range of its neighbouring category. When the child asks, "Is this blue?", as he does, we usually answer not merely yes or no but are likely to say, "No, this is green." When the child asks, "Is this yellow?", we might say, "No, it's blue." Thus we feed into the child all five color words or make him learn all five categories all at once which is distinctly different from the learning task with which the child is faced in the case of hot and cold. Thus we can explain in extremely simple terms that are entirely consistent with everything else we know about learning why hot is easier to learn than red. In the one case, the child learns only two things; in the other case, he has to learn all at once at least five things together.

Let us take another example. What would be easier, to learn the word wet or to learn the word loud? My thesis is that wet should be easier to learn, to apply correctly than loud because in this case a large number of stimuli are clearly and persistently classified into that category. In the case of loud, a large number of stimuli cannot be unequivocally assigned either to the category loud or to the category soft. Such a classification continuously changes with context or even with certain idiosynchrasies of the speaker. Thus a child is faced with much greater indeterminacy in the case of loud and soft than in the case of wet and dry.

Another illustration. What is harder to learn, table or gray? In the case of table, the child is not forced to select out a single attribute as he is in the case of colors. In the case of table, the learning task is different. There is no continuum to be found and no classifications to be learned on that continuum; instead, the stimulus category appears to be autonomous for the child inasmuch as there is practically no transition area surrounding this category. In the child's experience, the descriminatory task is considerably easier whenever such complex stimulus objects have to be labeled than is the case when a single sense-attribute has to be selected and then labeled.

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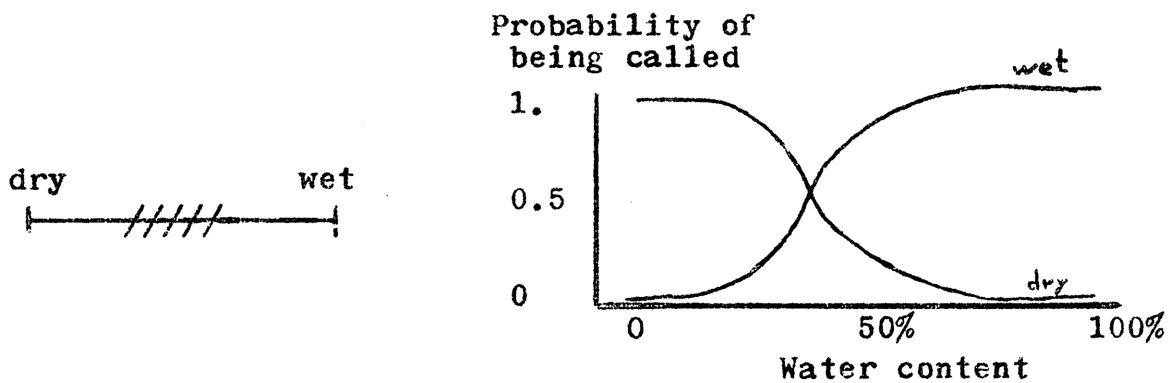
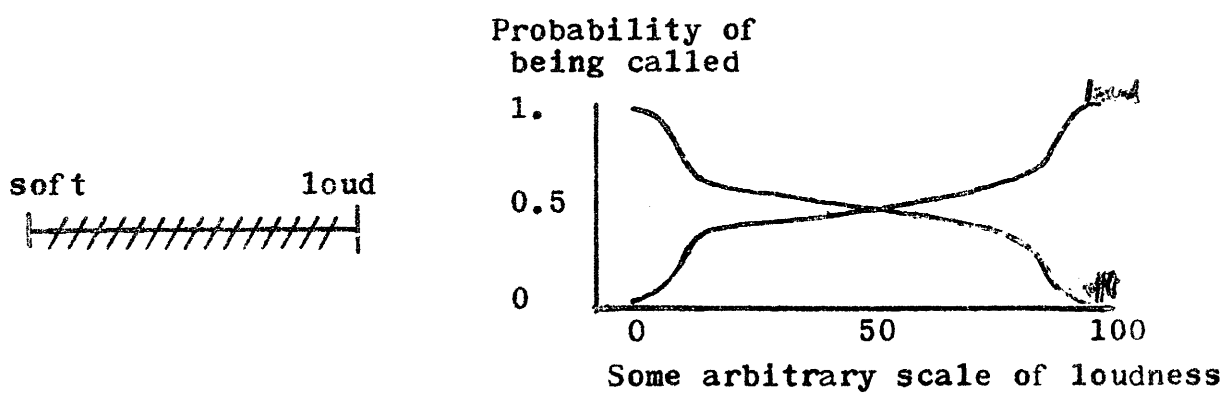
## E X A M P L E S

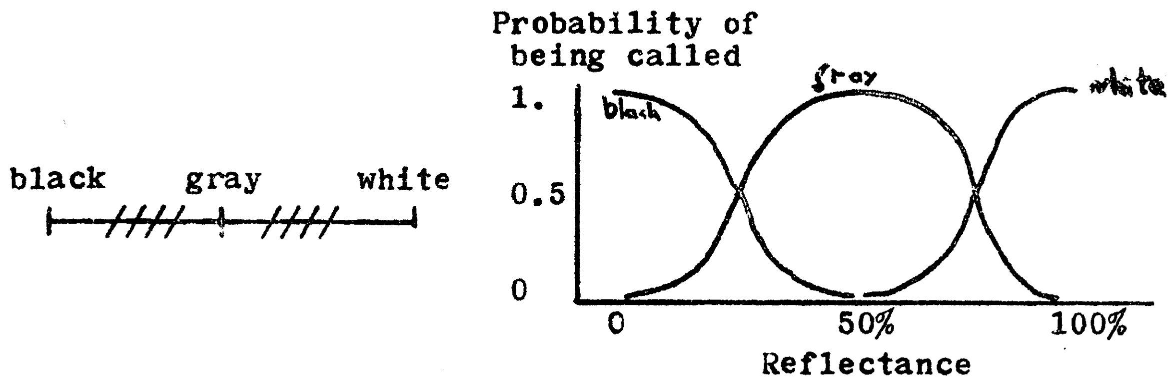
1. Verbal response given to stimuli in the continuum "humidity"



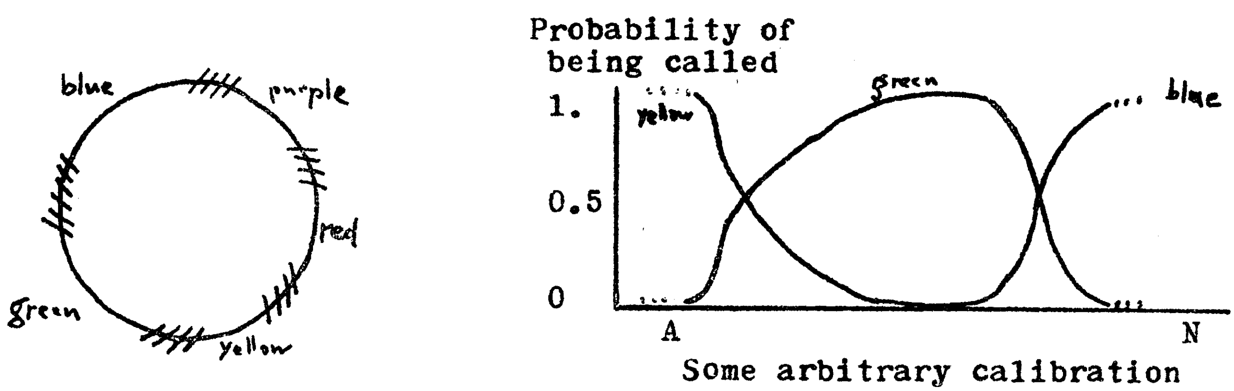

2. Verbal response given to stimuli in the continuum "sound volume"



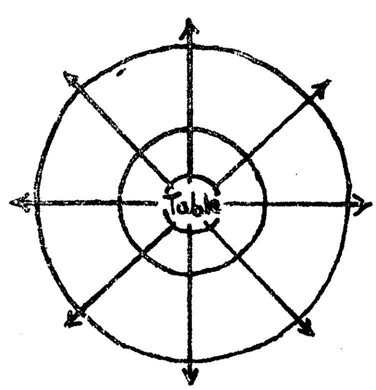
3. Verbal response given to stimuli in the continuum "achromatic colors"




4. Verbal response given to stimuli in the continuum "hue"




5. Verbal response given to a particular kind of stimulus object such as various kinds of furniture



## LIST OF DIMENSIONS

(Paramaters)

1) Ways of ordering stimuli (0 to $\infty$)

2) Width of category (Minimum - maximum)

3) Type of transition areas (probability gradients)

4) Type and structure of matrix (actually a number of closely related variables: number of categories; reference points; linear or star-like structures)