Concreteness-Abstractness of Verbal Stimuli:

Is it a Dimension

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ABSTRACT

The concreteness-abstractness of verbal stimuli (words, phrases, sentences) is a variable of wide interest. It has been found to influence other variables such as imageability and ease of paired-associate learning. The relationship between concreteness-abstractness and imageability has been found to be so strong that the two make up a single factor of <u>imagery-concreteness</u>. But recent evidence suggests that concreteness-abstractness may not be a variable at all, and hence that previously established results should be examined for a possible re-interpretation.

Specifically, it is proposed that two alternative models of concreteness-abstractness may be advanced in addition to the prevailing model, which holds that it is a continuous variable. One alternative holds that there are in fact two continuous variables, one associated with concreteness and another associated with abstractness, and that the two are essentially uncorrelated. A second alternative holds that there are no continuous variables at all in concreteness and abstractness, that they do not vary in degree but are qualitative or categorical descriptors.

If so, how would the experimental data produce varying scale values? The suggested hypothesis is that for any English word there are multiple meanings, one or more of which may be used by a given subject in rating the word for concreteness. The appearance of a continuous variable of concreteness-abstractness is produced by variability in subjects' interpretations.

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In recent years research has accumulated to demonstrate that imagery constitutes a separate and powerful mode of processing information. Paivio (1971, 1974a, 1974b) has proposed that imagery and verbal processes be conceived as two separate but interdependent systems. Each system has long-term and short-term memory. Objects and events have direct perceptual access to the imagery system, while words have direct perceptual access to the verbal system.

Through repeated co-occurrence, it is hypothesized, words can become conditioned stimuli for certain images, which are conceived as conditioned sensations (Paivio, Yuille, and Madigan, 1968). Concrete words (such as "brick") are especially likely to form such conditioned connections with images, since concrete words refer to objects or events which produce sensory experience. The predicted positive relation between concreteness of word and ease or speed of evoked imagery has been confirmed (Paivio, Yuille, Madigan, 1968: Toglia et al., in press).

It is implied that there is one psychological process of imagery and one linguistic dimension of concreteness-abstractness and that these are closely aligned. Indeed Paivio (1968) tested precisely this hypothesis using 96 nouns, each scored on several dimensions from the pooled ratings or performance data of subject groups. The result was a large factor on which rated imagery and rated concreteness had loadings of .83 and .90 respectively. Paired-associate learning speed, imagery reaction time, and rated vividness of imagery all had loadings of about .7 on this factor. The evidence for a single dimension of concreteness-imagery was very strong.

Recent studies by Toglia et al., (in press) confirm the factor of imagery-concreteness in the mean ratings for 2854 words, with loadings of .90 for both variables (each mean rating based upon a sample of roughly 60 persons).

Yet studies of the individual rating data have repeatedly shown that there are at least two factors, one for the concrete words and one for abstract words (Cartwright and Durrett, 1975; Cartwright and Marks, 1975; Cartwright, Durrett and Marks, 1977). Moreover, Richardson (1976) has shown experimentally that concreteness of nominalizations is a separate variable from their imageability. Barrow (1976) finds that effective strategies used by subjects in paired-associate learning are quite different for concrete and for abstract words. For example, a word-association strategy is correlated +.44 with number recalled for concrete words and +.86 for abstract words, but an imagery strategy is significantly correlated with number recalled only for abstract words (+.41) (+.12 for concrete words).

It can be argued that results for group data should not be expected to be consistent with results for individual data since group means are by definition uncorrelated with the individual observations upon which they are based. But in that case the variable of concreteness with respect to group mean data must be uncorrelated with the variable of concreteness with respect to individual data. The model of "conditioned sensations" posited by Paivio, Yuille, and Madigan (1968) appears to imply that the basis for connection between concreteness and imagery lies in processes that occur within individual organisms and not between members of interacting groups of organisms as in group correlations (cf. Robinson, 1950; Goodman, 1953; Cartwright, 1968, esp. pp. 205-212). Hence the results of studies using group data would be less appropriate as a test of the conditioning hypothesis than would results from individual data.

In this paper it is proposed that concreteness-abstractness is not a continuous variable, as would be required by the conditioning model and by the use of a seven-point scale of measurement with calculation of means and variances. Rather, concreteness is viewed as one category and abstractness is viewed as another

category. An alternative proposal would suggest that concreteness is itself a dimension ranging from high to low, and abstractness likewise a dimension; but that the two are linearly independent. This second alternative will be pursued in a later paper.

A general theoretical framework will be described, in terms of which a model of concreteness and abstractness will be formulated. Then some particular hypotheses will be developed, each deriving from the assumption that concreteness and abstractness of words are categorical descriptors. Results of some tests of these hypotheses will be briefly described.

General Theory

The general theory providing a framework for the present discussion is that developed by Horowitz (1970, 1976) in his studies of image formation and stress response syndromes. One of the most important constructs in these works is visual imagery, which reveals an underlying conception of imagery as a quasi-sensory mode of thought representation. There is substantial experimental evidence for this general hypothesis that imagery uses at least some of the same channels as does perception, and hence competes (often successfully) for channel space. Another central conception is that of representation of thought, by which Horowitz means that underlying thought processes gain representation in conscious experience via one or more media: enactive, lexical, and imagery. The enactive medium or mode is essentially behavioral, and like Bruner's (1964) conception of enactment, it refers to the person's usage of gestures and actions to convey or express a thought. Lexical representation uses words and refers essentially to language, or to what Bruner (1964) more generally referred to as symbolic representation. Imagery is the use of visual sensory reproductions to represent thoughts. The elements come partly from perception (current) and partly from memory of events and fantasy. An

outstanding example is the pathological continued revisualization of a terror-filled accident scene. In Bruner's (1964) developmental scheme, the imagery or iconic mode of thought representation follows the enactive mode but precedes the symbolic mode, and is therefore midway in a sequence of development in the direction of greater abstraction and freedom to represent matters distant from the observer. In Horowitz's account no developmental implication is intended. Indeed, his view holds that all three modes of representation are likely to occur in one person's thought sequence, with the particular mode being selected in accordance with the immediately best strategy of approach.

Horowitz has been expressly interested in images that are unbidden, ones that occur or recur spontaneously, as in dreams, hypnagogic imagery, and presentation of stress-related images. His model of recurrence of unbidden images requires that there be an active memory which presses for representation of its contents until it is cleared. Termination of storage of contents in active memory is accomplished by cognitive completion. While cognitive completion is a very general tendency (and may be seen in the Gestalt principles of pregnanz, or in Lewin's construct of task-induced quasi-needs, for example), Horowitz has given it a very specific meaning in his theory, namely that processing reaches a stage in which it is possible for the contents of active memory to be transferred to long-term memory. This possibility rests upon there being an appropriate schema in long-term memory that can receive the current contents of active memory. Horowitz hypothesizes that the reason a given set of contents cannot be transferred immediately to long-term memory is that no appropriate schema exists there to receive it, and so cognitive processing takes place with a view to transforming existing contents of active memory and the most relevant schemata in long-term memory so that transfer may occur. In order to accomplish the work of

cognitive processing, some representation must be given to the schemata from long-term memory, so that two representations may be compared and simultaneously processed: the current contents of active memory and the most relevant schemata for those contents. The processing consists of categorization and modification of meaning: Given new information in active memory, available categories are summoned up for representation, and the representation of that new information is compared with available categories (schemata). So long as a fit is not achieved, no completion occurs. Upon demand of other living tasks for representation, the unfitted new information is transferred back to active memory along with the representation of yet unmodified schemata from long-term memory. There they remain, pressing for renewed presentation as soon as opportunity arises. Upon resumption of representation, work proceeds with modification of meaning and accomodation of schematic categories until a fit is obtained. At that point both representations are transferred to long-term memory, active memory is cleared of those contents, and the tendency for related images to recur in unbidden fashion fades.

A Model of Concreteness-Abstractness Ratings

A theoretical model employs a selection of constructs and hypotheses from a general theory in order to describe and explain a particular narrow domain of phenomena. In the present case, Horowitz's theory provides the ingredients of the model.

Of particular interest is the hypothesis that a given thought may be represented in any one of the three modes or even in all three by a process of translation. The representation/translation function is a central construct in the theory. The special importance to be attached to this function in the present proposal derives from two considerations. First, in the typical experiment on

imagery or concreteness, some verbal instructions must be given the subject, and frequently the particular stimuli presented to the subject are verbal, either single words (such as "BARN") for which the subject is asked to produce an image, or collections of words in phrases, sentences, or paragraphs. This experimental operation assumes that the subject is able to translate the stimulus into a thought which can be represented in an image. Second, the construct of a representation/translation function provides a hypothetical mechanism whereby the communication between experimenter and subject can assume a reasonable amount of error. The alternative assumption (commonly made tacitly) is that the two persons understand each other perfectly. The experimenter's meaning for instructions and stimuli is expected to be understood and acted upon perfectly by the subject. To take but one series of examples (Paivio, Yuille, and Madigan, 1968), the experimenter may present nouns as follows "DEED...DETERMINATION...DEVELOPMENT...DIRECTION...DISCIPLINE...DRESS...", but each of the first four may have meanings differing widely (for example, "deed" can mean an action or a paper document), and the last two can equally well be verbs or nouns. A subject responding under instructions to rate the imagery value or the concreteness of these words will perforce rate the imagery or concreteness of whatever he or she understands. The effective stimulus is thus the interpreted stimulus.

The set of constructs and hypotheses employed in the present model includes visual imagery (which is actually a short way of referring to all kinds of imagery in various quasi-sensory modalities); representation in conscious experience through enactive, lexical, or imagery modes; the representation/translation function; active memory; schema; and long-term memory. As applied to the research findings that English words vary continuously in mean rated concreteness, the model allows

the hypothesis that the continuous variation is actually produced by raters' differences of interpretation as to the meaning of a word. Phrased in terms of the model, the research question asks whether variations in rated degree of concreteness-abstractness for a given word or set of words reflect differences in translation from stimulus word to appropriate schema (differences in interpretation) and hence also differences in the information represented. For one and the same word stimulus as presented by the experimenter, two subjects may differ sharply in translation, hence in representation, and hence in judgment as to degree of concreteness-abstractness. One implication of this hypothesis is that, if it were correct, then also it would be correct that concreteness is a single-point or categorical attribute of words, and abstractness is likewise.

In order to envisage the experimental situation accurately, it is helpful to review the procedures employed by Paivio, Yuille, and Madigan (1968) and by Toglia, et al. (in press). Words are printed in booklets, and each of a large sample of subjects (usually thirty to sixty university students) rates each word (or a large subgroup of the words) according to these instructions:

"Words differ in the extent to which they refer to concrete objects, persons, places, or things which can be seen, heard, felt, smelled or tasted, as contrasted with abstract concepts that cannot be experienced by our senses. The purpose of this experiment is to rate a list of words with respect to their 'concreteness' in terms of sense experience. Any word that refers to objects, materials, or persons should receive a high concreteness rating; any word that refers to an abstract concept that cannot be experienced by the senses should receive a high abstractness rating. For example, think of the word CARPET which can be experienced by our senses and therefore should be rated as high concrete; AMBIGUOUS cannot be experienced by the senses as such and therefore should be rated as low concrete (or abstract)."

There follows a description of the seven-point scale, which ranges from 1 = Highly Abstract to 7 = Highly Concrete in the work by Paivio, Yuille and Madigan (1968). It ranges from 1 = Low Concreteness to 7 = High Concreteness in the work of Spreen and Schulz (1966) and in that of Toglia, et al. (in press). In the latter instances of course, the phrasing in the main instructions would vary appropriately.

One immediately asks the question: Is it possible for a word to refer to something with an intermediate degree of potential for sensory experience? What would it mean to have such an intermediate degree of potential for sensory experience? Would it mean that there might or might not be a person, object, or material referred to by a word? Might or might not implies doubt. Indeed, the absence of doubt is a prime characteristic of instances in which nobody hesitates and everybody agrees. In ratings of concreteness such events occur with low frequency in the work of Paivio, Yuille, and Madigan (1968, pp. 10-25), where occasional words are rated with a standard deviation of zero. All such words have a mean rating of 7.00: AMBULANCE, ANKLE, ARROW, ... WHEAT, WINDOW. There is no doubt whether these words refer to persons, objects or materials. Now consider one of the words receiving the lowest mean ratings; MORAL has a mean of 1.39, standard deviation of 1.11. This means that most subjects rated it 1 = Highly Abstract, but some gave it a higher rating. Could it be they doubted whether it had meaning except regarding people? Or perhaps some interpreted the word to mean a moral person, i.e., using the word as an adjective instead of as a noun as the experimenters intended. What could possibly be the sense experience referred to by the MORAL of a story? Possibly all those who interpreted it in this way gave it a 1 = Highly Abstract.

In both extremes, then, it seems that all or most people had no doubt whether the word refers to persons, objects, or materials that can be experienced by the

senses, or whether it does not. But what would it mean if a word receives a mean rating of 4.0 on concreteness, right in the middle of the scale? In some cases it may be that half of the subjects conclude that the word refers to something that can be experienced by the senses, and give a rating of 7; half conclude the word refers to something that cannot be experienced by the senses and give a rating of 1. The result is a mean of 4.0 with high standard deviation. Alternatively, most subjects may experience doubt as to which of several interpretations (translations) of the word they should judge by. Depending upon the balance, they output a rating of 4 (or 3 or 5, 2 or 6). Pooling both possibilities, where the translation of a word stimulus to fit a schema is open to several different outcomes, some of which refer to sense experience and some of which do not, the result will be a distribution of individual ratings about some intermediate mean on the scale. In cases where subjects tend to select one or other interpretation this distribution will tend toward bimodality; where a substantial proportion of subjects output a response based upon indecision among equally probably alternatives the result will be a distribution with mean centered around 4.0 and substantial spread. When both possibilities are active the distribution will tend to be trimodal. But when the possible interpretations are either mainly concrete or mainly abstract, with a relatively small proportion of divergent alternatives, then the distribution will tend to be skewed.

So far we have been considering distributions of individual ratings. There are implications for distributions of group mean ratings also. While the former distributions could involve only one word stimulus, the latter must necessarily involve a large number of stimuli, each receiving its mean rating and entering the distribution with that value. Whereas individual ratings will have a distribution over the scale points as integers (1, 2, .., 7) the mean ratings will have a distribution over all numbers in the range 1 through 7. In general, if the individual

distribution on a particular word is positively skewed, the mean rating will tend toward 1.0; if negatively skewed the mean rating will tend toward 7.0. Skew and unequal bimodality in the individual distribution will thus tend to shift the mean rating toward one or other extreme. Such shifts will occur whenever a word has one interpretation with probability sharply exceeding the probabilities of other interpretations in the given language community. It is expected that such words would be in the majority for a viable language community, although not completely so if the community is living and changing as well as viable. Hence it would be expected that the distribution of group mean ratings of concreteness-abstractness would show a sharp bimodality which is nevertheless not as perfect as two pillars.

It might be noted that the individual ratings show continuous variation (so far as integers are construed as continuous) which is due to both individual doubt as between alternative interpretations, and also differences between individuals in the interpretation they select. Thus the distribution of individual ratings is hypothesized to be continuous only as a result of doubt or of definite interpretive variation. Did these not exist there would be two clear pillars of ratings, one on 1 for abstract words, and one on 7 for concrete words. The dimension that appears between these extremes is therefore properly a dimension of interpretive doubt, within and also between individuals. The dimension that appears in group data is not itself a dimension of doubt; but is a dimension of mean doubts and differences in interpretations.

Several pilot studies have been carried out to test some hypotheses generated by the foregoing model. These hypotheses, the tests, and the results will be briefly described in the following section.

Tests of Hypotheses Generated by the Model

Hypothesis that concreteness and abstractness as distinct categorical descriptors will produce bimodality in the distribution of mean ratings on concreteness. A sample of 371 nouns was taken from those given by Paivio, Yuille, and Madigan (1968) (every fifth forward beginning at 1, and every fifth backward beginning at 925). Two modes were found: 131 at value 6.51-7.00; and 33 at 2.51-3.00. A second set of 342 words from the list given by Paivio, Yuille, and Madigan was also included in the study by Battig et al. (1973). This distribution (rated according to a unipolar scale of high to low concreteness) yielded two modes: 115 at value 5.51-6.00, and 36 at value 3.01-3.50. Thus while there is evidence of sharp skew in all distributions, there is also evidence of definite bimodality.

The distribution of mean ratings for concreteness-abstractness on 2854 words is given by Toglia et al. (in press). The words include adjectives and verbs as well as nouns and a few nonwords. The distribution is clearly bimodal, with a mode of 420 at the value 3.0 - 3.5; a mode of 525 words at the value of 5.5 - 6.0. The low saddle point of 237 words comes at value 4.5 - 5.0.

Hypothesis that concreteness and abstractness as categorical descriptors will produce bimodality or trimodality in the distribution of individual ratings for words with mean near 4.0; skewness for words with extreme means. From page 11 of the booklets used by Toglia et al. (in press) to obtain normative data on 2,854 words, the first three words with a rating on concreteness between 3.80 and 4.20 were selected, as were the word with highest and the word with lowest mean in the set. Results are shown in detail in Table 1.

Table 1
Distributions of Ratings on Concreteness for Two Words with Extreme Mean Rating and Three Words with Mid-range Mean Rating[a]

Word:	THAT	QUESTION	WEST	URBAN	BUTTER	Rating Values
Mean:	2.28	3.91	4.03	4.16	6.24	
Distribution	28	12	9	11	1	1
of individual	13	3	6	3	1	2
ratings	4	10	12	7	2	3
	6	8	6	7	2	4
	2	12	8	15	4	5
	3	4	6	5	11	6
	2	9	11	10	37	7

[a] Data courtesy Toglia, et al. (in press).

Results appear to fit the expectations; however, the sample size of 58 is too small for proper statistical tests on modality. Nevertheless, it is clear that an alternative expectation of normally distributed data with central tendency moving smoothly from low to high with relatively constant variance is far from matched by the evidence in Table 1.

Hypothesis that subjects giving different concretenss values to the same word are responding on the basis of different translations to schema. While the data on distributions are pertinent to the issues of interpretive differences, a more direct approach is desirable. This requires examination of particular words in detail.

Three large sets of words from the highest, middle, and lowest mean concreteness (C) ratings in the Paivio, Yuille, and Madigan list (1968) were selected. These were then refined so that frequencies and meaningfulness would be comparable across high, medium, and low lists for concretenss. The three lists are reproduced here:

C = 1.0-1.7	C = 3.8-4.2	C = 7.0
JOY	LORD	TREE
CHANCE	SHOCK	CAR
MOOD	DEED	TRUCK
KNOWLEDGE	PRESENT	WINDOW
MORAL	MARRIAGE	PENCIL
ANGER	VISION	ARROW
PASSION	SERIES	TRUMPET
ANXIETY	DISASTER	STRAWBERRY
LOYALTY	DYNASTY	MICROSCOPE
DEVOTION	LEGISLATION	AUTOMOBILE

a. Thesaurus study. The first question to be asked is whether these words do have alternative interpretations available in the language community. A study of Roget's thesaurus provided initial answers.

The number of different Thesaurus meanings of these words ranged from 1 to 19, with a comparable range in all three lists. However, putting each meaning into the frame "X is a sense object" yielded values consistent with each list. Two words had a total of four such meanings in the low concreteness list; eight words had a total of 21 such meanings in the middle list; ten words had a total of thirty such meanings in the high list. But of greater significance was the ratio of such

sense-object meanings to total meanings: Mdn = .00 for the low list, .33 for the middle list, .67 for the high list. Thus a random selection among alternative interpretations for the low concrete list would yield none having sense-object reference, while the probability of a sense-object reference in the interpretations of the high list would be .67.

b. <u>Rating study</u>. Thesaurus meanings probably include many that are unavailable to many people, but the data are suggestive of the next step. Accordingly some of the possible interpretations for each list word were taken, omitting those instances in which little variation was found and either no sense-object or all sense-object meanings were assigned. These were included in a rating task using a seven-point scale ranging from High Abstractness to High Concreteness, following Paivio, Yuille, and Madigan (1968). Results were obtained from 128 subjects. At this point, then, we had the mean concreteness ratings for two possible interpretation words for each of the original list words under study. For example:

<u>Original Word</u>	<u>Alternative 1</u>	<u>Alternative 2</u>
MORAL - 1.39	ETHICAL - 2.22	LIKENESS - 2.79
DEED - 4.19	ACTION - 3.14	OFFICIAL PAPERS - 4.98
TRUMPET - 7.00	BOASTING - 3.08	MUSICAL INSTRUMENT - 6.31

It will be noted that alternative 1 is the less concrete of the two. Alternatives 1 and 2 were chosen in the expectation that they would vary in concreteness. The results are clearly not straightforward. In the first place the alternatives do not receive ratings of either 1 or 7, but rather are scattered across the range like the original words. However, it must be remembered that the subjects received the same instructions as did the original sample, and hence the interpretive variation would be just as operative on these alternatives as on the originals: there is a never-ending sink here. Secondly, the rated concreteness of a given

alternative is not its only important parameter. A variable of at least equal importance is the probability that a subject would be weighing that alternative interpretation in the balance of judgment. For example, though legitimate in the Thesaurus, LIKENESS would be quite improbable as an interpretation for MORAL among the student subjects in this research. Accordingly another group of subjects was asked: "Given the first word, which of the two possible meanings would you think of first? There might be others, but please circle just one of the two alternatives given." All thirty words from the high, medium, and low concreteness lists mentioned above were included. Alternatives were scored by the proportion of 26 subjects circling them. This value was taken as the probability that the interpretation would be selected. Mean concreteness ratings for the original words were then predicted:

$$
\begin{aligned}
\text{Predicted Mean Concreteness} = \ & \text{Mean Concreteness Interpretation 1} \\
& \times \text{Probability of 1} \\
+ \ & \text{Mean Concreteness Interpretation 2} \\
& \times \text{Probabilty of 2}
\end{aligned}
$$

Results for the three words mentioned above were:

MORAL	actual value: 1.39	; predicted value 2.22
DEED	actual value: 4.19	; predicted value 3.84
TRUMPET	actual value: 7.00	; predicted value 6.31

Comparable results were obtained for the remaining words. Recalling that the "actual values" were obtained several years ago in Canada on a different population of students, the obtained fit appears satisfactory.

Discussion

The work to date seems to justify the conclusion that mean ratings of concreteness in the middle ranges are probably due to interpretive variation rather than to middle values of actual concreteness. However, the evidence is not as clear as would be desired, and it seems that further work is required to deal with the problem of interpretive variation as it affects even the experiments which seek to clarify the nature and role of interpretive variation.

Two possible lines of work should be explored, both aimed at increased control over interpretive doubt. First, it would seem better to obtain a thesaurus study from a particular language community, namely that from which the samples of subjects are selected to examine interpretive variation and its effects on rated concreteness-abstractness. Second, the study of interpretive variation itself should be improved by using expanded dictionary definitions of alternative meanings for a given word. These definitions would seek to remove sources of doubt. With these improvements it is expected that support would be more clearly obtained for the hypotheses that concreteness and abstractness are not poles of a dimension but are separate categorical descriptors.

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