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Probabilistic Adverbial Qualifications of Adjectives[1]

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In language messages the meaning implied by a given word is known to be a partial function of the associative context in which the word appears. Two *adjacent* words sometimes form a "word-mixture," the meaning of which is some function of the meaning of the component words. For instance, Osgood, Suci, and Tannenbaum (1957) compared empirical semantic effects of adjectival qualifications of nouns (e.g., "breezy thug") with effects predicted from Osgood's congruity principle. Ratings of the word-mixtures changed, additively, along each of the three primary dimensions of connotative meaning originally described by Osgood (1952), although the observed error in predictions derived from the congruity principle increased as a positive function of the angular displacement of the two component words in the semantic space.

Not all word-mixtures, even of the adjective-noun variety, however, involve two word-components having projections on all three (or, for that matter, any) of the three major dimensions of connotative meaning: in particular, such adjectives as *possible, occasional, immediate, extreme*, and such adverbs as *possibly, occasionally, immediately, extremely*—as well as the negative, *not*—are content-free in the sense that they themselves are without obvious evaluative connotation, for example, but serve only to alter the connotative meaning of other words which they qualify. This being the case, it not likely, as Cliff (1959) has pointed out, that the effects of such content-free qualifiers can be optimally conceptualized with an additive model; rather, a multiplicative model might provide a better solution. Cliff showed that evaluative ratings of adjectives (e.g., *evil, ordinary, charming*) presented in combination with intensive adverbs (e.g., *somewhat, quite, very*) closely obey a multiplicative function of the form

$$x_{ij} = c_i \cdot s_j + K$$

where

x_{ij} = the empirical scale of the ith intensive adverb combined with the jth adjective;

c_i = the multiplying value of the ith adverb;

s_j = the psychological scale value of the jth unqualified adjective;

K = a constant: the difference between the arbitrary zero of the scale values, and the psychological zero of the scale.

The excellence of the fit of Cliff's data to the equation is testimony to the existence of a multiplicative rule underlying the effects of intensive adverbial qualifiers upon evaluative judgments of adjectives.

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If one way of changing the meaning of a key term in a message is to qualify that term with an intensive adverb, then another way must be to qualify it with an adverb implying some degree of either doubt or certainty. A third way (among others) to change the meaning of a key term must be to combine the term with both types of adverbs at once. The studies reported in the present paper therefore explore: (1) the effects of "probabilistic" adverbs (e.g., *possibly*, *probably*, *certainly*) upon evaluative ratings of adjectives; and (2) the consistency of these effects when adjectives are *doubly* qualified (simultaneously) by both a probabilistic adverb and an intensive one. More general theoretical notions prompting these studies, since they appear to have heuristic merit, will be left until the Discussion.

In Study I, 10 adverbs denoting various degrees of doubt-certainty were combined singly with each of 14 adjectives; the 140 qualified and 14 unqualified forms of the adjectives were rated along a scale of Pleasantness-Unpleasantness. A test was then made of the applicability of the model stated above. In Study II, 4 intensive adverbs from Cliff's study and 4 from Study I were combined, both singly and in pairs, with 7 of the adjectives from Study I. The predictability of the effects of all *double* adverbial qualifications was then tested—using empirical information derived only from instances of *single* adverbial qualification—against certain modifications of the basic model.

Study I

Method

The Adverbs and Adjectives. Both sets of words are presented in Table 1, along with frequencies of occurrence observed by Thorndike and Lorge (1944). The variations in these frequencies, both within and between the two classes of words, bear no obvious relation to the nature of words (e.g., to the degree of polarity of the adjectives). Hence Frequency is not at all likely to be a confounded variable.

The adjectives evidently carry rather mixed connotations. They refer, and deliberately so, in part to feeling and emotion, in part to physical appearance, and in part to character traits. Whether the error resulting from such "confounding of dimensions" outweighs the generalizability of the results obtained is, however, an empirical matter. It will be noted that the adjectives consist of 7 pairs of associates (e.g., *beautiful* and *pretty*; *angry* and *annoyed*) bearing a synonymic relationship, one to the other. The adverbs were selected on the basis of their having nonevaluative denotations of doubt or certainty.

Table 1
Frequency Counts[a] of Adjectives and Adverbs

Adjectives	Frequency count	Probabilistic adverbs	Frequency count
Beautiful	100+	Undeniably	1
Lovable	3	Definitely	23
Delighted	6	Certainly	100+
Pretty	100+	Doubtless(ly)	30
Please(d)	100+	Apparently	50+
Likeable	1	Conceivably	1
Average	50+	Probably	100+
Mediocre	1	Supposedly	2
Apprehensive	3	Possibly	50+
Frighten(ed)	27	Doubtfully	5
Annoy(ed)	16		
Dislike(able)	23		
Angry	50+		
Loathsome	4		

[a] From Thorndike and Lorge (1944).

The Rating Booklet. Instructions to *S*s read as follows: "This study is concerned with the ways in which certain types of word-combinations carry different intensities of 'meaning.' One meaning carried by words has to do with the feeling of pleasantness-unpleasantness. On the pages following there appears a broad variety of verbal expressions that somehow refer to feelings, or to personality characteristics, or to things people might say or think of themselves or others. You should take each expression in turn and immediately decide whether you feel that it describes something pleasant, or something unpleasant, and *to what degree.* Then you should check one point between 1 and 11. You will find an 11-point scale for this purpose beside each expression."

The remainder of the instructions, which were fashioned after those set by Osgood *et al.* (1957, pp. 82-84) for their work on the measurement of meaning, used the following illustrative expression:

"Possibly dishonest"

1 2 3 4 5 6 7 8 9 10 11

Most pleasant — Neutral — Most unpleasant

All 14 adjectives were presented both in unqualified

form and in combination with each of the 10 adverbs. The set of 154 stimuli was preceded by a number of practice items containing other adverbs and adjectives. The 154 stimuli were arranged 7 to a page such that: (1) neither a particular adverb nor a particular adjective appeared twice on the same page; (2) "pleasant" adjectives and "unpleasant" adjectives were regularly alternated. An 11-point scale appeared directly to the right of each item.

Subjects. Sixty-seven male freshmen medical students at the University of Maryland School of Medicine satisfactorily completed the booklet. No *S* required more than 40 min. to complete the assignment; most finished the task within 20 min. The data for 10 other *S*s were eliminated because they each omitted one or more items.

Treatment of Data. Frequency counts of responses within each of 11 rating categories were made for all 154 items. Proportions of either less than .02 or greater than .98 were ignored, and the 11 × 154 block of data was scaled by the method of successive intervals described by Edwards (1952). Plots of empirical scale values of adjectives qualified by specific adverbs, against scale values of the unqualified adjectives (e.g., *probably angry* against *angry*, *probably dislikable* against *dislikable*, and so on) consistently showed clear linear relationships. The set of 10 such lines, initially drawn by hand, all passed through the same region—at or about the empirical scale value for unqualified *average*. The slopes of these lines furthermore varied systematically from that for the adverb *doubtfully* (the least slope) through that for *undeniably* (greatest slope).

Consequently, the regression constants, b_p, for each adverb were obtained by least-squares solutions. Values of b_p were then substituted for the d_p term, and the psychological scale values of the unqualified adjectives were substituted for the s_j term in the equation

$$x_{pj} = d_p \cdot s_j + K \qquad (1)$$

where the subscript p refers to some probabilistic adverb.[3] It should be noted that in Eq. (1), s_j, the *psychological* scale value of the jth unqualified adjective, is actually $(s_j' - K)$, where s_j' refers to the *arbitrary* empirical scale value of the jth unqualified adjective. Hence, substituting in Eq. (1) we have

$$x_{pj} = d_p \cdot (s_j' - K) + K$$

Least-squares solutions were thus obtained for K, both for each adjective separately, and for the entire set of data. This procedure differs from the one used by Cliff, who included *un*qualified adjectives in a matrix solution for his c_i (equivalent to d_p) and K terms, and obtained an estimate of the values of the c_i—which are theoretically unity—for the cases of unqualified adjectives. In the present study it is *assumed* that d_p for the unqualified adjectives is unity. The over-all results of the study will, however, be slightly in error to the extent that error occurs in the measurement of scale values for unqualified adjectives.

An estimate of the internal consistency of scale values was computed by means of the procedure described by Edwards and Thurstone (1952). The correlation between observed and predicted successive interval-scale values was then examined. Finally, analysis of variance of linear components was undertaken to show that the effects of the 10 adverbs upon the adjectives are discriminable, and not attributable to chance.

[3] The symbol d_p is adopted for clarity since in Study II c_i is used to to refer to the ith intensive adverb.

Results

The differences obtained among the distances between the boundaries of successive intervals indicate that the results to be obtained from application of the model to probabilistic adverbs would have been different using raw, rather than scaled rating data. The largest distances occur between Categories 6–7 and between 7–8. This finding may be due, as Cliff (1959) and as Jones and Thurstone (1955) suggested for Mosier's (1941) results, to the fact that the task clearly elicited *evaluative* judgments from the *S*s. The variation among category distances also suggests that the total one-dimensional space of pleasantness-unpleasantness was unevenly represented by the 14 adjectives. This conclusion is borne out in Table 2, in which are shown the empirical scale values for both qualified and unqualified adjectives; several extremely large, irregular gaps occur between

The internal consistency test described by the scale values of adjacent adjectives.
Edwards and Thurstone, which compares the theoretical with the empirical cumulative proportions of responses, yields an absolute average deviation of .028. This value compares favorably with values reported by Edwards (1952), Saffir (1937), Edwards and Thurstone (1952), Jones and Thurstone (1955), and others.

TABLE 2
EMPIRICAL SUCCESSIVE INTERVAL SCALE VALUES OF QUALIFIED AND UNQUALIFIED ADJECTIVES

Adverb	Beautiful	Lovable	Delighted	Pretty	Pleased	Likeable	Average	Mediocre	Apprehensive	Frightened	Annoyed	Dislikable	Angry	Loathsome
Unqualified	.215	.414	.572	.906	.916	1.440	3.212	3.355	4.633	4.873	5.007	5.053	5.112	5.836
Undeniably	.050	.024	.292	.511	.577	.441	3.289	4.063	4.779	5.185	5.178	5.815	5.375	5.893
Definitely	.017	.408	.621	.388	.781	1.036	3.252	3.488	4.551	5.220	5.143	5.533	5.642	5.693
Certainly	.180	.947	.580	.745	1.179	1.056	3.212	3.769	4.377	4.798	4.788	5.179	5.248	5.667
Doubtlessly	.260	.828	1.179	.833	1.223	1.385	3.258	4.513	4.116	4.998	4.617	5.136	5.200	5.308
Apparently	1.135	.627	1.340	1.588	1.556	1.575	3.226	3.945	4.129	4.585	4.281	4.457	4.609	4.773
Conceivably	1.522	1.311	1.649	1.395	1.123	1.483	3.184	3.897	4.077	4.339	4.342	4.413	4.311	4.788
Probably	1.277	1.447	1.571	1.649	1.444	1.802	3.155	3.697	4.146	4.211	4.342	4.946	4.342	4.776
Supposedly	1.065	1.640	1.802	1.684	1.561	2.093	3.212	3.756	4.200	4.209	4.520	4.239	4.585	4.759
Possibly	1.048	1.448	1.588	1.516	1.751	1.787	3.120	3.616	4.094	4.403	4.251	4.445	4.190	4.582
Doubtfully	2.337	2.447	2.158	2.172	2.241	2.733	3.559	3.646	3.980	4.001	4.185	4.104	4.301	4.523

Several striking features of the data in Table 2 are evident. First, while scale values for *average* show little variation regardless of the adverbial qualifier with which this adjective was paired, scale values for *mediocre* are consistently slightly larger (i.e., unpleasant) for all qualified instances than for the unqualified one. This result is anomalous since neither is it predicted nor does it occur for any other adjective. Otherwise, the pleasant-unpleasant connotations of all adjectives are considerably altered by the qualifiers. There is a difference, however, between the "lability" of the pleasant and that of the unpleasant adjectives used here. The two extreme qualifiers, *doubtfully* and *undeniably*, shift the scale values of pleasant adjectives over an average of about one third of the scale; of the unpleasant adjectives, over about one fifth of the scale. This discrepancy may be attributed to our unqualified pleasant adjectives being on the average more polarized than the unqualified *un*pleasant ones, so that there is more scope for movement toward the psychological zero of the scale.

The d_p values, which indicate the over-all multiplicative effects of the adverbs, appear in Table 3. In commenting upon this Table we shall use the term "positive" for an adverb that shifts the scale value of an adjective further toward a pole of the psychological continuum, and the term "negative" for an adverb that shifts the scale value toward the center (i.e., zero point). The adverb *undeniably* has the largest positive effect upon all adjectives, and close behind *undeniably* is *definitely*. Actually, these two adverbs are the only ones having over-all positive effects; the other eight (including, surprisingly enough, the adverb *certainly*) have negative effects. *Doubtfully* has the most negative effect, clearly a progressively stronger one than *possibly*, *supposedly*, *probably*, *conceivably*, *apparently*, and *certainly*. The noticeably high frequencies of occurrence of the adverbs *certainly* and *probably* in contemporary American speech behoove one further to explore the findings that *certainly* is not an "intensifying" qualifier, and that *probably* does not, at least for medical students, denote such high "probability" as one might subjectively have expected.

TABLE 3

VALUES OF d_p FOR PROBABILISTIC ADVERBS

Adverbs	d_p
Undeniably	1.16
Definitely	1.08
Certainly	.97
Doubtlessly	.91
Apparently	.74
Conceivably	.67
Probably	.67
Supposedly	.64
Possibly	.64
Doubtfully	.42

In Table 4 are shown values of s_j and K for each adjective. The mean value of K is 3.322 which, as one would expect, closely approximates the scale value of 3.312 observed for the unqualified form of *average*. While there is considerable spread among the individual values of K ($\sigma_{m_k} = .245$), it is parsimoniously assumed for the purpose of the analysis in both Studies I and II that all adjectives have the same (rather than a

TABLE 4

VALUES OF s_j AND K FOR ADJECTIVES[a]

Adjectives	s_j	K
Beautiful	—3.102	3.344
Lovable	—2.912	3.762
Delighted	—2.752	3.941
Pretty	—2.412	2.524
Pleased	—2.402	2.939
Likeable	—1.882	1.916
Average	—0.112	3.386
Mediocre	.038	5.812
Apprehensive	1.308	2.801
Frightened	1.548	3.527
Annoyed	1.688	2.891
Dislikable	1.728	3.993
Angry	1.788	3.467
Loathsome	2.518	2.202

[a] Negative values are on the "pleasant" side of the scale. Values of s_j were obtained using $K = 3.322$.

unique) zero point. Consequently, K is taken to have the value 3.322.

Theoretical scale values for all qualified adjectives were derived from Eq. (1), using the values of d_p, s_j, and K presented above. The product-moment correlation—which is linear—between empirical and theoretical values is .987 ($df = 138$). Even so high a value of r does not, however, in itself constitute proof of the validity of the model; a high coefficient of correlation could still occur even had the adverbs exerted either zero or only chance effects on the adjectives. An analysis of variance, of which the results are presented in Table 5, was therefore performed. The type of analysis adopted permits us to establish the magnitude and significance of: (1) the over-all linear trend for adjectives summed over adverbs; and (2) the interaction between the linear components for individual adverbs, and adjectives. Regardless of the occurrence of an over-all linear component it is crucial for proof of the model that a significant interaction term appear. It should perhaps be explicated that in this analysis (as well as in higher-order analyses performed upon the data of Study II) the various linear components are basically derived from the regression of empirical scale values for qualified adjectives *upon the empirical scale values for unqualified adjectives*; the various nonlinear components are therefore obtained from the sums of squares of deviations of qualified adjectives from the regression line. In Study I there will evidently be one such line for "adjectives summed over adverbs," and 10 lines for the adverbs.

The first line of the Table shows a highly significant over-all linear component ($P < .001$) accounting for over 90% of the total variance. This fact indicates that by far the most variation among scale values is a function of the adjectives rather than of the effects of adverbs on the adjectives. A significant interaction still occurs, however, between the linear components of individual adverbs, and adjectives ($P < .001$). This result proves that the slopes, d_p, for the adverbs, are significantly different from each other—they have different effects upon the adjectives. To this extent, therefore, the very high correlation between empirical and theoretical scale values is not a chance affair. It should be noted that the Adverbs variable (i.e., each adverb summed over adjectives) is a significant source of variance ($P < .001$) as well as a very small one (0.3%). Had the data fitted the model perfectly we should have expected the Adverb-means to be identical and the variance of these mean values to approach zero. Consequently, the very small proportion of variance accounted for by this variable is not surprising.

The effects of probabilistic adverbial qualifications are thus seen to be as broad and consistent as are the effects of intensive ones. In fine, when something *bad*, say, is made less *intense*, it is rated as less *bad*; and when something bad is made less *certain* it also is rated less *bad*, and vice versa. It makes sense,

TABLE 5
ANALYSIS OF VARIANCE: STUDY I

Source of variance	*df*	*MS*	*F*
Adjectives	13		
Linear component for sum	1	366.574	> 100.000*
Nonlinear component for sum	12	.399	9.732*
Adverbs	9	.154	3.756*
Interaction: Adj. × Adv.	117		
Linear component	9	3.122	76.146*
Nonlinear component	108	.041	

* $P < .001$.

therefore, to predict that such effects will combine with each other in an orderly and systematic manner when two types of adverbs simultaneously qualify an adjective. The second, and major experiment examines this hypothesis.

Study II

For the case in which two adverbs—one intensive, the other probabilistic—qualify an adjective, Eq. (1) can obviously be rewritten in several ways to take account of the double qualification. The expression, *definitely rather scared*, for example, is not idiomatically identical to the expression, *rather definitely scared*. In general, when the probabilistic adverb precedes the intensive one the former qualifies the "intensive-plus-adjective"; but when the two adverbs occur in the opposite order the intensive one qualifies the probabilistic one, which unit as a whole qualifies the adjective. One might therefore be led to expect that, over and above the effects of double vis-à-vis single adverbial qualification, the variable of "Adverbial Order" will evoke differential ratings from the *S*s. But regardless of the Order variable, one would expect double adverbial effects to be orderly and therefore predictable.

Let us then define c_i and d_p respectively as the multiplying values of the ith intensive adverb and of the pth probabilistic adverb, when each is used singly. A variant of the basic model is now required which allows for a different theoretical scale value for the two orders in which instances of the two types of adverbs can occur. This consideration implies that equations of the forms

$$x_{ipj} = \tfrac{1}{2}(c_i + d_p) \cdot s_j + K \quad (2)$$

$$x_{ipj} = (c_i \cdot d_p) \cdot s_j + K \quad (3)$$

$$x_{ipj} = (c_i \cdot d_p)^{1/2} \cdot s_j + K \quad (4)$$

may not constitute the most appropriate model since they yield the same value of x_{ipj} regardless of order. Cliff (1959, p. 42) suggested in a footnote to his paper that "Combinations which contain two different intensive adverbs, e.g., 'very slightly admirable,' seem to operate by having the two adverbs combine exponentially: 'slightly' to the 'very' power, but data on the latter rule are not clear-cut." He also obtained data strongly indicating that " 'very very' is 'very-squared' " (p. 42). In the present case the model is therefore rewritten

$$x_{ipj} = (c_i)^{d_p} \cdot s_j + K \quad (5)$$

$$x_{ipj} = (d_p)^{c_i} \cdot s_j + K \quad (6)$$

These two equations do provide for theoretical differences between scale values as a function of the Order variable. In this experiment Eqs. (2) through (6) are tested against the empirical data in the manner to be described.

Method

Adverbs and Adjectives. Four probabilistic adverbs from Study I and 4 from Cliff's study were selected, along with 7 of the adjectives from Study I. These items are presented in Table 6. It will be noted that from Study I as well as from Cliff's study the two adverbs were selected which respectively had yielded the highest and the lowest value of c_i and d_p. Some concern was felt at the outset that the ceiling thus imposed upon the usable limits of the scale might hinder the emergence of systematic between-adverb interactions at the two extremes of the scale. It was decided to carry this risk, however, in favor of establishing the most general result.

Table 6
Probabilistic Adverbs, Intensive Adverbs, and Adjectives Used in Study II

Type of adverb	Adverbs	Adjectives
Probabilistic	Doubtfully	Beautiful
	Conceivably	Delighted
	Certainly	Pleased
	Undeniably	Average
Intensive	Slightly	Annoyed
	Rather	Angry
	Quite	Loathsome
	Extremely	

Subjects. The 287 stimuli (see below) were satisfactorily rated by 103 sophomore medical students each of whom was paid $2.00 for his services. All *S*s were able to complete the task within 1 hour. The

ratings of 3 *Ss* were randomly removed to make a total N of 100.

Procedure. Administrative details were identical with those used in Study I. The rating booklet contained 15 buffer items designed to provide *S* with "ranging practice." Each of the 7 adjectives appeared in the rating booklet preceded by: (1) each probabilistic adverb (4 conditions); (2) each intensive adverb (4 conditions); (3) all possible pairs and orders of one probabilistic and one intensive adverb ($4^2 + 4^2$ conditions); and (4) no adverb. Each adjective was thus judged under $(4 + 4 + 2\ [4]^2 + 1) = 41$ conditions. No adjective was combined either with 2 intensive or with 2 probabilistic adverbs. Items were again placed 7 to a page. Neither a particular adjective nor any adverb (either singly or in combination with another adverb) appeared twice on the same page.

Treatment of Data. Frequency counts of *Ss'* responses within each of 11 categories were made by I.B.M. for all $41 \times 7 = 287$ items, which were to be scaled by the method of successive intervals as described in Study I. Certain differences in subsequent treatment of data were necessary, however, since the essential question with which Study II is concerned is whether the scale value for an adjective doubly qualified by one intensive and one probabilistic adverb can be predicted from knowledge of the effects of two adverbs used singly. This question becomes one of establishing the rule (or rules) according to which the multiplying values of two consecutive adverbs combine with each other. In the derivation of c_i, d_p, K (and hence s_j) values, therefore, only the $7(4 + 4) = 56$ instances of *single* adverbial qualification were substituted in a general form of Eq. (1), for which purposes the class distinction between the two types of adverbs could be ignored. In subsequent tests of the data against Eqs. (2) through (6), however, attention was focused exclusively on the $7(4^2 + 4^2) = 224$ instances of *double* adverbial qualification; and the desired combinations of c_i and d_p were computed from the c_i and d_p observed for the cases of *single* qualification. Five sets of theoretical scale values were thus obtained from Eqs. (2) through (6). The predictability of scale values for all instances of double adverbial qualification was tested against these five equations.

Following the computation of empirical scale values, adjective by adjective comparisons were made of the effects (which were but slight) of the Adverbial Order variable. The r's between empirical and (each of five sets of) theoretical scale values were obtained for each adjective separately and for all adjectives together, a distinction being maintained between the two adverbial orders. Finally, analysis of linear components contributed by adverb classes (i.e., probabilistic and intensive), and by adverbs *within* adverb classes, was performed to document that for neither adverbial order could the high correlation observed between theoretical and empirical scale values be attributed to chance effects of the 32 double adverbial qualifiers. In view of convincing evidence that the two adverbial orders are essentially equivalent, it was considered unnecessary to include the Order variable in the analysis of variance.

Before one turns to the results it may be noted that for the theoretical instance in which the multiplying value of c_i, say, is unity, the general function

$$x_{ipj} = f(c_i, d_p) \cdot s_j + K$$

becomes

$$x_{ipj} = f(d_p) \cdot s_j + K$$

When both c_i and d_p are unity, then

$$x_{ipj} = s_j + K$$

where, as before

$$s_j = (s_j' - K)$$

The method of analysis to be used assumes, but does not permit verification of, these deductions. This restriction bears no serious consequence, however, in light of the purposes of the study.

Results

The distances between the boundaries of successive categories were compared with those derived in Study I. The product-moment correlation between the two sets is .758 ($df = 7$, $P < .05$). In the second as in the first study the largest distances occur between categories 6–7 and 7–8.

Empirical scale values are shown in Table 7. The table is divided into 7 blocks, one for each adjective. The convention will henceforth be adopted of referring to adjectives doubly qualified by an intensive adverb *preceding* a probabilistic one as Order I; by an intensive adverb following a probabilistic one, Order II. In each block of Table 7 there are double entries in 16 of the 25 cells; the upper entry refers to Order I, the lower one to Order II. The scale value (s_j') for the unqualified adjective appears in the top left-hand cell of the block. The remaining four cells in the first row show the scale values for (single) intensive qualifications of a given adjective; the remaining four cells in the first column show scale values for (single) prob-

abilistic qualifications. It will be evident from visual inspection that the effects of both classes of single adverbial qualifiers are again clearly discriminable, and that these effects interact with the Adjectives variable. Also evident is an interaction between the effects of the two classes of adverbs; specifically, the *range* of effects (upon some adjective) produced by, say, a probabilistic adverb, increases as a positive function of the "strength" of the intensive adverb (and vice versa).

Interpretation of the data in Table 7 will be made the more vivid by inspection of Figs. 1A and 1B, in which the empirical scale values for all double qualifications have been plotted to illustrate the interaction effects between classes of adverbs, and between adverbs and adjectives. It should be noted that each plot for double qualifications was obtained (for economy of presentation) from the mean of the Order I and Order II scale values. Also indicated for each adjective in Fig. 1 are the value of s_j' and the empirical scale values for all 8 single adverbial qualifications (see caption).

Consider, for example, the plots for *beautiful* in Figs. 1A and 1B. Consider also, as shown in Table 8 (below), that: (1) the value of c_i for the strongest intensive adverb, *extremely*, exceeds unity, while (2) the value of d_p for the strongest probabilistic adverb, *undeniably*, is—most surprisingly—less than unity. Consequently, one should not now be surprised to find that in Fig. 1A the scale value for *extremely beautiful* is *more* polarized than the scale value for *extremely undeniably beautiful* (disregarding Adverbial Order). This phenomenon must occur because the adverb *undeniably*, having a d_p *less* than unity, depolarizes the scale value of any adjective which it qualifies. On the other hand, in Fig. 1B the scale value for *undeniably beautiful* is *less* polarized than the scale value for *extremely undeniably beautiful* (disregarding Adverbial Order). This phenomenon also must occur because the adverb *extremely*, having a c_i *greater* than unity, will polarize the scale value of the adjective which it qualifies. The effect described above will be found to have occurred for all adjectives (excluding, of course, *average*). While the illustrative graphic data are not offered as a formal proof of the argument made at the outset of Study II, they certainly (sic) constitute convincing prima facie evidence for the validity of that argument: the combined effects of two adverbs are indeed extremely orderly. Further evidence in this regard will shortly be presented.

A question of considerable interest in this inquiry is whether the Adverbial Order variable yields differential empirical scale values. It was pointed out earlier that an explicit, consensual idiomatic distinction is made between, say, the expressions *conceivably quite angry*, and *quite conceivably angry*. An idiomatic distinction in meaning will not, however, necessarily lead to differences in behavior; to wit, the over-all r between Order I and Order II empirical scale values ($df = 110$) is .992, and the correlation is statistically linear. Furthermore, this high association holds up even when the Order variable is studied *within* individual adjectives. For each of six adjectives (excluding *average*) the r's between orders range from .892 to .967 ($df = 14$, $P < .001$). Even for the "neutral" adjective, *average*, the r between Orders I and II is .705 ($P < .01$). Nor do the two orders generally yield different mean scale values within adjectives; only two, *pleased*, and *delighted*, show a (barely significant) mean difference ($t \leqslant 2.17$, $P = .05$) due to the Order variable. It may nevertheless be marginally noted that while Order I (intensive adverbs followed by probabilistic ones) generally yields arithmetically higher mean scale values for "pleasant" adjectives, Order II generally yields an opposite result. Interpretive comments upon this virtual identity between Orders appears in the Discussion.

The values of the c_i and d_p derived from the 56 singly qualified items are presented in

TABLE 7

EMPIRICAL SCALE VALUES OBTAINED BY SUCCESSIVE INTERVAL SCALING

Beautiful

Probabilistic adverbs	Intensive adverbs				
	—	Slightly	Rather	Quite	Extremely
—	.196[a]	2.147	1.103	.545	—.213
Doubtfully	2.443	2.587	2.560	2.637	2.318
		2.490[b]	2.219	1.923	1.985
Conceivably	1.882	2.086	1.672	1.439	1.103
		2.482	1.528	1.268	1.037
Certainly	.430	1.961	.996	.384	.181
		1.778	.827	.649	.028
Undeniably	.145	1.660	.587	.526	—.017
		1.830	.908	.468	—.170

Delighted

Probabilistic adverbs	Intensive adverbs				
	—	Slightly	Rather	Quite	Extremely
—	.701	2.297	1.629	.928	.145
Doubtfully	2.518	2.466	2.575	2.596	2.591
		2.510	2.456	2.186	1.906
Conceivably	1.830	2.334	1.932	1.726	1.385
		2.332	1.912	1.701	1.260
Certainly	.968	2.048	1.528	1.270	.613
		2.055	1.566	1.041	.617
Undeniably	.878	2.064	1.309	1.115	.488
		1.955	1.300	1.115	.545

Pleased

Probabilistic adverbs	Intensive adverbs				
	—	Slightly	Rather	Quite	Extremely
—	1.213	2.450	1.681	.834	.280
Doubtfully	2.796	2.507	2.767	2.592	2.534
		2.604	2.381	2.318	1.976
Conceivably	2.160	2.205	1.973	1.635	1.167
		2.259	1.670	1.824	1.528
Certainly	1.238	2.186	1.611	1.075	.873
		2.025	1.321	1.270	.427
Undeniably	.885	2.125	1.473	1.234	.701
		2.009	1.339	1.079	.441

Average

Probabilistic adverbs	Intensive adverbs				
	—	Slightly	Rather	Quite	Extremely
—	3.343	3.469	3.398	3.382	3.398
Doubtfully	3.606	3.588	3.505	3.590	3.546
		3.631	3.662	3.531	3.613
Conceivably	3.382	3.546	3.431	3.440	3.467
		3.444	3.404	3.421	3.449
Certainly	3.361	3.435	3.459	3.357	3.402
		3.414	3.443	3.393	3.407
Undeniably	3.433	3.589	3.477	3.470	3.486
		3.508	3.474	3.477	3.487

[a] The top left-hand cell contains s_j' (not s_j).

[b] Each cell containing a double entry shows the scale values for Order I (upper) and Order II (lower). See text for further explanation.

TABLE 7 (*Continued*)

Loathsome

Probabilistic adverbs	Intensive adverbs				
	—	Slightly	Rather	Quite	Extremely
—	6.289	4.648	5.493	5.849	6.409
Doubtfully	4.638	4.461	4.671	4.593	4.696
		4.587	4.689	4.828	4.996
Conceivably	5.074	4.849	4.995	5.148	5.413
		4.632	4.964	5.072	5.377
Certainly	5.878	4.993	5.571	5.723	5.989
		4.926	5.444	5.669	6.252
Undeniably	6.007	4.848	5.613	5.905	6.308
		4.926	5.632	5.858	6.271

Angry

Probabilistic adverbs	Intensive adverbs				
	—	Slightly	Rather	Quite	Extremely
—	5.581	4.260	5.001	5.700	6.101
Doubtfully	4.233	4.160	4.413	4.001	4.643
		4.016	4.609	4.769	4.816
Conceivably	4.682	4.222	4.868	4.980	5.204
		4.224	4.829	4.878	5.412
Certainly	5.365	4.458	4.805	5.382	5.484
		4.470	5.183	5.343	5.706
Undeniably	5.494	4.696	4.929	5.502	5.681
		4.394	5.180	5.595	5.832

Annoyed

Probabilistic adverbs	Intensive adverbs				
	—	Slightly	Rather	Quite	Extremely
—	5.181	4.240	4.955	5.495	5.821
Doubtfully	4.231	4.246	4.243	4.289	4.696
		4.247	4.244	4.636	4.588
Conceivably	4.480	4.200	4.797	4.848	5.121
		4.395	4.599	4.860	5.003
Certainly	5.353	4.606	4.944	5.020	5.446
		4.459	5.114	5.415	5.623
Undeniably	5.365	4.229	4.885	5.208	5.748
		4.494	4.942	5.312	5.737

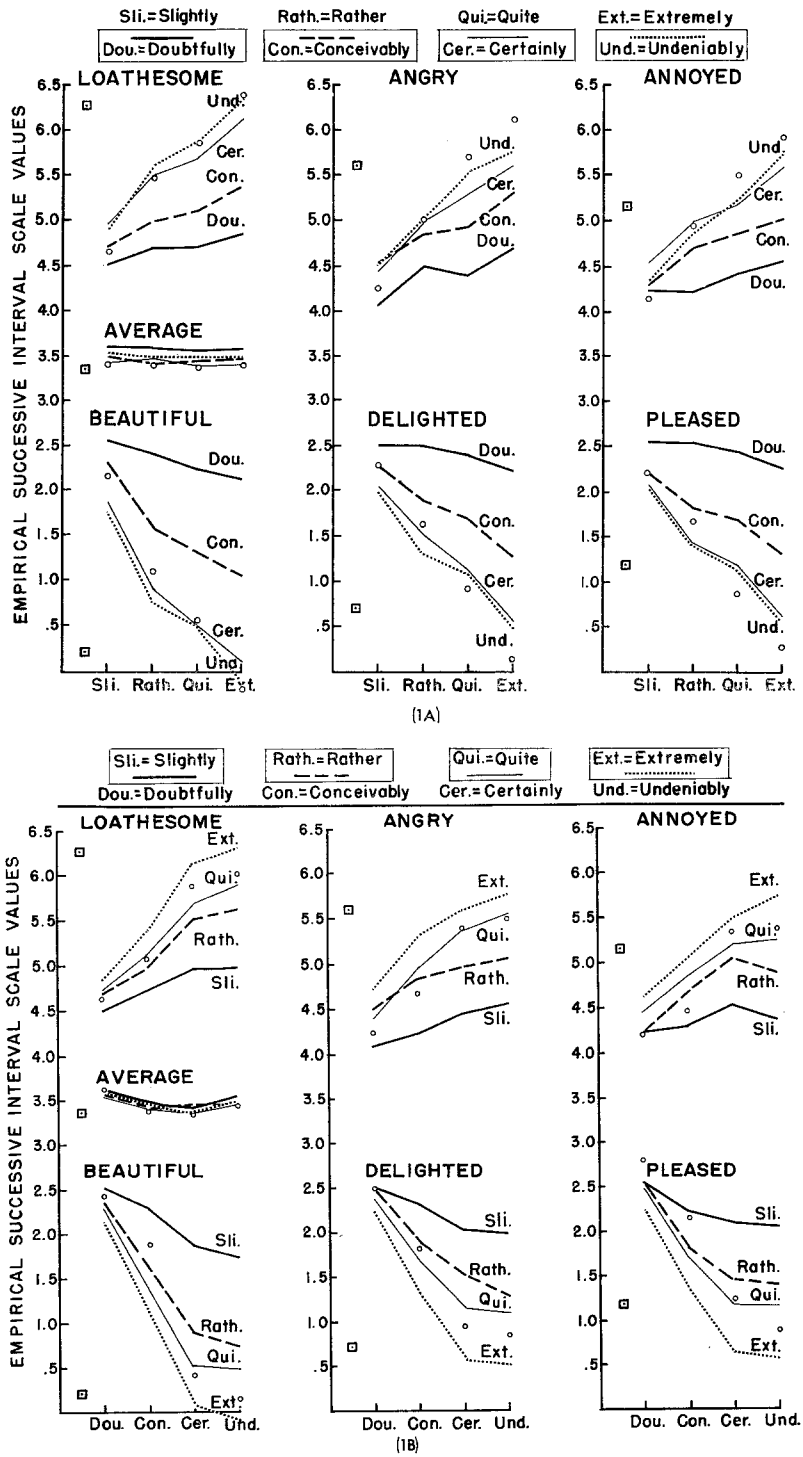

FIG. 1. Empirical scale values, by adjectives, for: double qualifications (joined by two types of either solid or broken lines); single qualifications (open circles); and no qualification (squares). Plots for double qualifications are means of Orders I and II data. The abscissae in Parts 1A and 1B of the figure contain arbitrarily equal spaces. (See text for further explanation.)

Table 8. As one has seen, the value of c_i for the strongest intensive adverb, *extremely,* alone exceeds unity, whereas the d_p for the strongest probabilistic one, *undeniably,* does

TABLE 8
VALUES OF c_i AND d_p, DERIVED FROM SINGLE ADVERBIAL QUALIFICATIONS

Intensive adverbs	c_i	Probabilistic adverbs	d_p
Slightly	.417	Doubtfully	.358
Rather	.732	Conceivably	.555
Quite	.966	Certainly	.925
Extremely	1.192	Undeniably	.991

not. While this fact will not necessarily lead to serious consequences, it must implicitly place a slight restriction upon the generality of our conclusions.

Estimates of K derived from analysis only of items involving single qualification, and the psychological scale values (s_j) of the unqualified adjectives, appear in Table 9. The

TABLE 9
PSYCHOLOGICAL SCALE VALUES (s_j) OF UNQUALIFIED ADJECTIVES, AND LEAST-SQUARES ESTIMATES OF K, DERIVED FROM TWO CLASSES OF ADVERBS

		Value of K[a]	
Adjectives	s_j	Intensive adverbs	Probabilistic adverbs
Beautiful	—3.338	4.234	3.711
Average	—0.191	3.740	3.693
Annoyed	1.647	4.873	4.075
Angry	2.047	3.760	3.403
Loathsome	2.755	2.310	3.249

[a] Each value of K is derived from data for all items involving *single* adverbial qualifications. The r between the two sets of K is .933 ($df = 5$, $P < .01$).

over-all value of K is 3.534. This value almost perfectly matches a least-squares estimate of 3.537 obtained from inserting the $2 \times 7 \times 16 = 224$ discrete empirical scale values for doubly qualified adjectives in Eq. (1), as though the 7 adjectives had been acted upon by 32 single adverbs. The former value of K along with double multiplying values derived from the data in Table 8 were therefore used to obtain theoretical scale values. As observed in Study I the two values of K cited above slightly exceed the empirical scale value for unqualified *average.*

One turns next to the question of the extent to which the empirical scale values for doubly qualified adjectives fit Eqs. (2) through (6). The 10 coefficients of correlation between theoretical and empirical scale values show that for all five equations and for both Orders the relation is large ($r \geqslant .943$, all $df = 110$, $P << .001$). All r's for Eqs. (2), (3), and (4)—ranging from .980 to .991—are seen by the z-transformation (McNemar, 1955) to be higher ($P \leqslant .02$) than those for Eqs. (5) and (6)—ranging from .943 to .958—regardless of Order. Moreover, the r's for Eq. (4) arithmetically exceed those for Eq. (2): for Order I the two-tailed value of P is about .15; for Order II, $P > .20$. No significant difference between r's appears as a function of the Order variable for any equation. The sets of data upon which the above correlation coefficients were based have been tested for departure from linearity. The r's using Eq. (2) are linear. Those using Eq. (3) show slight but very significant S-shaped curvilinearity ($P < .001$). When the geometric mean of the $c_i \cdot d_p$ term in Eq. (3) is used—as in Eq. (4)—the departure from linearity vanishes and the two values of r increase (as indeed they must): for Order I data the r increases from .980 to .987 ($P < .10$); for Order II data, from .980 to .991 ($P < .01$).

It was noted in Study I that such high r's could still occur between theoretical and empirical scale values even had the adverbs exerted only chance effects upon the adjectives. It is instructive in this regard first to examine the values of these r's *within* individual adjectives. For both Orders in Eqs. (2) and (3) all r's with the exception of the one for *average* are .901 or higher (all $df = 14$, $P < .001$); the r's even for *average* are, however, significant ($P < .05$). The r's for Eqs. (4), (5) and (6) are reproduced in Table 10. While these r's are consistently

TABLE 10

CORRELATIONS, WITHIN SPECIFIC ADJECTIVES AND WITHIN ORDERS, BETWEEN THEORETICAL AND EMPIRICAL SCALE VALUES, BY EQS. (4), (5) AND (6)

	Order I			Order II		
Adjectives	Eq. (4)[a] $(c_i d_p)^{1/2}$	Eq. (5) $(c_i)^{d_p}$	Eq. (6) $(d_p)^{c_i}$	Eq. (4) $(c_i d_p)^{1/2}$	Eq. (5) $(c_i)^{d_p}$	Eq. (6) $(d_p)^{c_i}$
Beautiful	.951[b]	.397[c]	.678	.985[b]	.558	.535
Delighted	.940	.453	.641	.985	.587	.498
Pleased	.925	.479	.577	.967	.536	.556
Average	.627	.299	.368	.516	.032	.517
Annoyed	.933	.659	.389	.973	.626	.478
Angry	.932	.555	.476	.959	.719	.309
Loathsome	.963	.464	.640	.980	.567	.546

[a] The expression in the box below the equation number refers to the double adverbial multiplying value used in that equation.

[b] For each adjective, within each Order, the value of r for data using Eq. (4) exceeds the r's for data using the other two equations ($P < .001$; all $df = 14$).

[c] With $df = 14$ an r of .426 is significant at the .05 level and one of .574 at the .01 level.

impressive ($P \leqslant .03$) for Eq. (4), they are considerably lower for the other two equations, and in 6 of 28 cases do not even achieve significance. One is left with a sharp impression, then, that Eq. (2), which uses the arithmetic mean of the c_i and d_p terms, and Eq. (4), which uses the geometric mean of these two terms, are more satisfactory predictors of the empirical scale values. But even here, as we have seen, use of the geometric mean yields slightly higher r's than use of the arithmetic mean.

One turns next to the statistical question of whether an interaction occurs between the linear components of variance for each double adverbial qualifier, and the adjectives. To evaluate this question an analysis of variance—identical to that summarized in Table 5 for Study I—was first performed for Order I and Order II data separately. It should be noted that only the $4 \times 4 \times 7 = 112$ instances of *double* adverbial qualification were included in each analysis. For the purpose of these *particular* analyses each double qualifier was treated as though it were a unitary one. For each order there is evidently one regression line for the Adjectives variable and 16 for the double adverbial qualifiers. Since the absolute outcomes are very similar for both orders they may be conveniently reported together. The following minimal results should thus be taken as true for *each* order.

The linear component for adjectives summed over adverbs accounts for over 85% of the total variance ($F >> 100.00$, $df = 1/5$, $P < .001$). This result indicates that by far the most variation among scale values is again attributable to the adjectives rather than to the effects of adverbs on the adjectives. A real interaction—accounting for over 10% of the total variance—occurs, however, between the adjectives and the linear components of the 16 *double* adverbial qualifiers ($F > 120.00$, $df = 15/75$, $P < .001$). This result proves that for each order the 16 double adverbial qualifiers are in fact exerting discriminably different effects upon the adjectives. Also, as observed in Study I—see Table 5—the mean square for the Sums-of-Adverbs variable is significant ($F \geqslant 3.556$, $df = 5/75$, $P < .001$) but accounts for considerably less than 1% of the variance.

When the total sum of squares *for the interaction term* is broken down for each order two important facts are revealed. First, the interactions between (1) the linear components of intensive adverbs (summed over probabilistic ones) and adjectives, and be-

tween (2) the linear components of probabilistic adverbs (summed over intensive ones) and adjectives, are significant ($P < .001$) and together account for slightly more than 90% of the interaction variance. Second, there is a significant triple interaction ($P < .001$) among the linear components of both classes of adverbs and adjectives, which for each Order therefore accounts for almost 10% of the interaction variance. The percentage of *total* variance explained by the linear component for the Order I triple interaction is 1.03; by that for the Order II triple interaction, about .60. Although the over-all magnitudes of the various interaction terms are very small, they are nevertheless real. The systematic nature of these interactions can be seen by further inspection of Fig. 1. It should be noted, though, that the graphic data are in part distorted out of line with the statistical data since the abscissae in Fig. 1 contain arbitrarily equal intervals.

Even though the bulk of variance is again attributable to the adjectives it is clear that the two classes of adverbs, both singly and in interaction with each other, differentially alter the scale values of adjectives. And here, of course, lies one source of the high correlations observed between theoretical and empirical scale values. For if the adjectives *in fact* account for the vast majority of variance, then the predictability of scale values will inevitably be high despite whatever unreliability there is in the effects of the adverbs. It thus becomes no idle matter to consider, as was done, the question whether improvement can be made on a correlation of, say, .980, between theoretical and empirical data. All in all, the data satisfactorily indicate, at least as a first approximation, that content-free adverbs of the two classes used here systematically combine with each other regardless of serial order, and that such double adverbial qualifications exert predictable multiplicative effects upon adjectives. So far as the data of Study II go the following optimal conclusion may be enunciated: if two adverbs (one an intensive, the other a probabilistic one) simultaneously qualify an adjective then, regardless of the serial order of the adverbs, the evaluative (connotative) meaning of the adjective will be altered in proportion to the geometric mean of the individual multiplying values of the two adverbs. This proposition accords with Osgood, Suci, and Tannenbaum's (1957, p. 283) general dictum, "the semantic effects of word combination are neither haphazard nor unique."

Discussion

Two major conclusions have emerged from these investigations. First, the scale value evoked by qualification of an adjective with a particular intensive adverb can also theoretically be evoked by qualification of that adjective with a probabilistic adverb. Second, the two classes of adverbs combine with each other in a highly predictable fashion, such that any specified scale value can theoretically be evoked by several different combinations of one intensive and one probabilistic adverb qualifying a given adjective, with but little error resulting from the order in which the two adverbs appear.

An immediate implication of these conclusions is that intensive and probabilistic adverbs have something in common psychologically; a central mechanism evidently elicits the same reaction to an intensifying qualifier as to a "definite" one, the same reaction to a diminutive qualifier as to an "improbable" one. Stated generally, *S*'s reaction to a verbal stimulus can be equivalently changed by manipulation *either* of the strength *or* of the implied probability of the referent to that stimulus. In this regard the results are distinctly reminiscent of a class of observations long established in studies of animal behavior: that running speed toward the goal is a function of (among other variables) the incentive (Hull's K), of the probability of reinforcement, and of some reciprocal relation between these two variables; and that in theory one can evoke any

specified running speed by appropriate manipulation of the variables mentioned. In the present context one can likewise in theory evoke some specified degree of polarity of ratings by manipulation of the intensity, and/or of the certainty/uncertainty of the verbal stimulus being judged. This analogy (homology?) is the more cogent in view of the fact that the Adverbial Order variable turns out not to yield differences of any great moment. At any rate, if some construct akin to the r_g (fractional anticipatory goal-response) were to operate in the rating situation, it should be no surprise in future to find that equally predictable ratings are obtained when adverbs denoting, say, frequency (*occasionally, often*) or temporal proximity (*immediately, eventually*)—akin to Hull's $\dot{N}$ and J ?—precede adjectives. It may also be anticipated that verb tense, verb mood, and the double negation "not un—" also influence adjectives in highly predictable ways.[4] Of crucial interest, then, would be the specific question whether the joint effects of "not" and "un—" can be predicted from Eq. (4); and the general question whether the effects of adverbs will similarly combine with the effects of verb tense, say, such that a verbal stimulus denoting relative "certainty and past-ness" (e.g., "definitely was upset") has an Unpleasantness scale value approximating that of a similar stimulus denoting relative *un*certainty and *present*-ness (e.g., "possibly am upset"). The potential for thus rigorously moderating and attenuating the arousal value of verbal stimuli seems infinite, as Osgood and Sebeok (1954) less directly suggest.

One may suspect that the human S, in as well as outside the experimental laboratory, is discriminatively responsive to verbal qualifications partly because, as Carroll (1959) has pointed out, his first and most primitive response to a stimulus is predicated by the implicit question of whether that stimulus is symbolically punishing (unpleasant or "bad") or rewarding (pleasant or "good"). But one can go further than this and say that S is not simply interested in whether an (adjectival) stimulus is punishing or rewarding, but also in how *much* so, in how *surely* so, in how *often*, in how *soon*, and in whether the stimulus portrays an event which is past, or now occurring, or imminent. If tenable, these considerations suggest that the effects of the qualifiers studied and discussed here reflect on the one hand an habitual, culturally ingrained tendency toward verbal regulation of symbolic reward and punishment, and reflect on the other hand the rapid action of a reliable internal monitor whose function is to screen and to moderate the arousal value of words according to certain rules.

Nor is there any a priori reason for assuming that the monitor operates only in relation to words received from an *external* message source (as in the present studies); the monitor must operate also in relation to words emitted in spontaneous speech. Implicit in this argument is the notion that, other things constant, some of the rules governing the arousal value of words used as stimuli govern also the arousal value of words used in speech. Furthermore, the analogy presented above, between the effects of verbal qualifiers on scaled evaluative ratings and the effects of various parameters of the rat S's speed of performance, suggests that it would be helpful to examine such rules of verbal behavior within the framework of S-R behavior theory. Adoption of that framework leads one, inter alia, to regard the adverbial and other qualifiers considered here as points along several stimulus continua in relation to which sharp discrimination has already been learned. One is moreover led to the view that both sign-specific and "gen-

[4] Preliminary pilot data collected prior to Studies I and II indicate that the past tense serves a diminutive function: e.g., *was beautiful* is rated less pleasant than *is beautiful*; *was angry* is less *un*pleasant than *is angry*. Further, the adverb *not* completely reverses the polarity of any adjective. Whereas *angry* is consistently rated as unpleasant, *not angry* is rated as pleasant; *not delightful* is rated unpleasant.

eral" anxiety drive level will turn out to be significant parameters determining the quantitative function of qualifiers in language messages both received and emitted. In this regard Osgood (1960) has of course had much to say in Sebeok's recent book.

These comments sketch a rough schema within which it should be profitable in future to approach a variety of language functions. It is first desirable, however, to generalize the obtained findings to qualifiers denoting dimensions other than intensity and probability, and to qualifiers belonging to nonadverbial form classes. Second, it is of considerable importance to explore the full psychological ramifications of the changes in meaning here considered, for the present studies treat the basic *psychological* problem but superficially. These ramifications evidently concern movement of (qualified) verbal stimuli in n-dimensional semantic space, changes in Uncertainty (entropy) of these verbal stimuli (and hence in their associative stimulus properties), and directly observed alterations in their arousal value. These problems seem eminently suitable for systematic experimental analysis.

Summary

These two inquiries are concerned with the effects of probabilistic adverbs (e.g., *possibly, definitely*) upon evaluative ratings of adjectives. In Study I, 14 adjectives were rated, along a Pleasant-Unpleasant scale, both in unqualified form and when qualified by each of 10 probabilistic adverbs. Data were scaled by the method of successive intervals. The scale values were then tested against a linear model originally proposed by Cliff to account for the effects of intensive adverbs upon adjectives. This model states that the scale value of an adverb-adjective phrase equals the product of the psychological scale value of the unqualified adjective and an empirical "multiplying value" for the adverb, plus a general constant, K. It was found that the effects of probabilistic adverbs are highly consistent. The correlation between empirical scale values and theoretical ones derived from the model was .987 ($df = 138$). It was shown that while the majority of variance is accounted for by adjectives rather than adverbs, nevertheless the high correlation cannot be considered artifactual and thus be attributed to chance effects of the adverbs.

In Study II, 7 adjectives from Study I were rated along the same Pleasant-Unpleasant scale both in unqualified form, and when qualified by: (1) each of 4 discriminable probabilistic adverbs from Study I; (2) each of 4 discriminable intensive adverbs from Cliff's study; (3) each of the 32 possible combinations of 1 probabilistic and 1 intensive adverb. Data were again scaled by the method of successive intervals. This study posed two questions. (1) Can the empirical effects of *double* adverbial qualification be predicted from the observed effects of the two constituent adverbs when used singly? (2) Does the Adverbial Order variable yield differences in the scale values (e.g., *definitely rather scared* vis-à-vis *rather definitely scared*)?

Five extensions to the basic model, designed to take account of double qualifications, were derived. The effects of double adverbial qualifications were excellently predicted using empirical data derived only from instances of single qualification. The two highest, linear correlations between empirical and theoretical scale values ($r = .991$ and .987) for the 224 instances of double qualification were obtained using, as the multiplying value for double adverbial qualifiers, the geometric mean of the multiplying values for the two individual adverbs. The effect of the Adverbial Order variable was negligible. While the majority of variance was again attributable to the adjectives, the superior predictability of the data could not be accounted for by appeal to chance effects of the adverbs. It was also established that an interaction occurs between the effects of the two classes of adverbs.

Psychological implications of the relative equivalence of intensive and probabilistic adverbs, of their interaction, and of the nonsignificant Adverbial Order variable are discussed.

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