JOURNAL OF VERBAL LEARNING AND VERBAL BEHAVIOR 11, 141–147 (1972)

Verbs as Implicit Quantifiers[1]

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Two studies are reported investigating the hypothesis that in simple sentences of the form "Subjects verb objects," the verb provides implicit information concerning the proportion of the object class which is "verbed." In the first study, respondents were asked to supply object quantifiers for a systematic collection of unquantified sentences. As anticipated, it was found that object quantifiers were primarily determined by two semantic dimensions of the verb (rather than the object) of the sentence: a "manifest–subjective" dimension and a "positive–negative" dimension. In the second study, cued recall of quantifiers was examined in sentences varying in verb type and level of explicit quantifiers. As predicted, frequency of correct recall was an interactive function of level of quantifier and type of verb in the sentence, and errors were distorted in the direction of the level of quantifier "appropriate" to the verb.

A series of studies reported by Gilson and Abelson (1965) and Abelson and Kanouse (1966) suggests the hypothesis that in simple, unmodified sentences of the form "Subject(s) verb objects," quantitative transfer of meaning occurs between the verb and the object, such that the verb provides implicit information concerning the proportion of the object class to which it applies. For example, the unmodified sentence "John buys vegetables" appears to mean "John buys *a few* or *some* vegetables," while the sentence "John likes vegetables" appears to mean "John likes *most* or *all* vegetables." The results of these studies suggest that such verb differences in implicit quantification may be quite general. The notion that the verb plays a major role in implicit quantification of a sentence object is rather intriguing, since it is, after all, the object which is quantified and not the verb.

Two complementary studies are reported here. In the first of these, respondents were presented with a large set of sentences including a variety of verbs and objects, and were asked to judge the implicit object quantifiers implied in the sentence. If verbs do serve to quantity their objects, then the judged quantifiers should differ systematically as a function of the verb. On the basis of results from previous studies two semantic dimensions of verbs were selected for systematic examination: (*a*) a subjective–manifest dimension, distinguishing verbs which express sentiments or subjective orientations (e.g., like, love, understand) from those which express objective actions or manifest relationships (e.g., have, buy, produce), and (*b*) a positive–negative dimension, distinguishing verbs which describe a positive orientation or action (e.g., buy, love) from those which describe a negative one (e.g., destroy, hate). These dimensions are described more fully elsewhere (Kanouse, 1971). The results of the Abelson and Kanouse studies (1966) suggest that subjective verbs are understood as applying to a larger proportion of the object class than manifest verbs, and that negative verbs are understood as applying to a larger proportion of the object class than positive verbs. The first study was designed to examine this hypothesis.

[1] This paper is based on results reported in a doctoral dissertation completed at Yale University. The author expresses his deep appreciation to Robert P. Abelson for his invaluable help throughout the project. Thanks are also due to Robert G. Crowder, Wendell R. Garner, Charles A. Kiesler, and Richard E. Nisbett for their valuable advice and assistance.

TABLE 1

EXPERIMENT I: DESIGN

Block	Manifest positive	Manifest negative	Subjective positive	Subjective negative
Verbs				
1	Use	Harm	Trust	Ignore
2	Buy	Destroy	Appreciate	Despise
3	Recommend	Ruin	Like	Distrust
4	Make	Attack	Enjoy	Hate
5	Steal	Abuse	Love	Fear
6	Produce	Disturb	Understand	Oppose
7	Have	Discard	Want	Disapprove of
8	Seek	Abandon	Value	Abhor
9	Collect	Damage	Admire	Dislike
10	Find	Deface	Approve of	Resent
Objects				
1	Table	Basket	Rock	Shoe
2	Picture	Wheel	Board	Door
3	Glass	Bag	Cup	Ring
4	Hat	Party	Stick	Watch
5	Crown	Clock	Game	Ball
6	Song	Bill	Box	Bell
7	Gift	Nest	Chair	Gate
8	Suit	Sign	Window	Word
9	Story	Coat	Cake	Rule
10	Pen	Book	Bed	Dress

The second study was designed to test the importance of implicit quantification by the verb in the actual processing of sentences. Within a recall situation, the notion of implicit quantification suggests the following hypothesis: the ease with which quantifiers are recalled in sentences varying in verb and quantifier should reflect the naturalness of the verb–quantifier combination. If the verb appears with an explicit object quantifier at the appropriate level, recall should be easier than if the quantifier is too "large" or too "small." In addition, the naturalness of the verb quantifier combination should affect the direction in which errors are distorted. Incorrect responses should tend to express the level of quantification appropriate to the verb.

EXPERIMENT I

Method

A questionnaire was constructed which contained 160 unmodified sentences together with an "implicit quantifier scale." The sentences were generated by systematically combining a set of 40 verbs and 40 objects, as described below.

From a list of common transitive verbs compiled from a Thesaurus, 10 verbs were chosen from each of four categories: manifest positive, manifest negative, subjective positive, and subjective negative. Noun objects were selected from the list of 1000 most common English words in the original Thorndike count (Thorndike & Lorge, 1944). Objects were selected for their compatibility with the four types of verbs and their capacity for enumerative quantification.

The 40 objects and 40 verbs were combined to create 160 sentence items by the device of creating 10 blocks of sentence elements. Each block contained four randomly chosen objects and one randomly selected verb from each class. Within each block, verbs and objects were factorially combined to produce 16 predicate combinations Finally, sentence subjects were randomly assigned from a list of 80 haphazardly chosen male first names. The design is schematized in Table 1, which shows the verbs and objects comprising each block.

The 160 items were presented in a questionnaire together with an implicit quantifier scale, consisting of the response alternatives "all," "most," "many,"

"some," "a few," and "one or two " Two forms of the questionnaire were used. In one, the instructions emphasized that *S*'s task was to select the quantifier which seemed closest to expressing the number of objects implied in the unmodified sentence. Thus, if *S* felt that the sentence "Jimmy bends paper clips" implies that "Jimmy bends *a few* paper clips," he so indicated by checking the appropriate quantifier on the scale. In the second form, *S*'s task was to select the *smallest* quantifier which would justify the unquantified sentence. Thus the *S*s receiving one form were asked to judge probable quantifiers, those receiving the other form were asked to judge minimum quantifiers for each of the 160 sentences The instructions emphasized that the respondent should give quick, intuitive answers, considering each sentence separately on its own merits

The *S*s were 16 Yale undergraduates who volunteered to receive participation credit for a course in introductory psychology or payment of $1.50 Eight *S*s were randomly assigned to each questionnaire form. To prevent systematic order effects, page order was randomized separately for each *S*.

Results

To check on the interval properties of the implicit quantifier scale, the *S*s' categorical judgments to the 160 sentences were subjected to Thurstone's method of successive interval scaling (Green, 1954). The results indicated that an assumption of equal intervals could be made without noticeable loss of sensitivity. Thus, for purposes of quantitative analysis, the successive integers 1 through 6 were assigned to the quantifiers "one or two . . . all."

TABLE 2

MEAN MINIMUM QUANTIFIERS

Manifest positive		Manifest negative		Subjective positive		Subjective negative	
Verbs							
Collect	3 34	Attack	3.81	Love	4.53	Hate	4.66
Recommend	3 19	Destroy	3 75	Trust	4 38	Oppose	4 47
Produce	2.97	Abandon	3.50	Approve of	4.28	Abhor	4.41
Seek	2 81	Harm	3.31	Value	4.28	Despise	4.38
Make	2.69	Deface	3.25	Like	4.03	Ignore	4.38
Buy	2 62	Ruin	3.25	Understand	3 97	Fear	4.31
Use	2.53	Disturb	3 22	Enjoy	3.69	Disapprove of	4 22
Steal	2 45	Damage	2.97	Admire	3 66	Dislike	4 19
Find	2 22	Abuse	2 85	Appreciate	3 66	Distrust	4.06
Have	2 03	Discard	2.85	Want	2 34	Resent	3 69
Mean	2 68	Mean	3 28	Mean	3.88	Mean	4 28
Objects							
Table	3 50	Basket	3.66	Rock	3 88	Shoe	3.56
Picture	3 56	Wheel	3 44	Board	3.66	Door	3.75
Glass	3 50	Bag	3.69	Cup	3.56	Ring	3 78
Hat	3 91	Party	3 88	Stick	3.34	Watch	3.75
Crown	3 44	Clock	3 19	Game	3.94	Ball	3 56
Song	3 56	Bill	3.59	Box	3 84	Bell	3 62
Gift	2.94	Nest	3 19	Chair	3.07	Gate	2.28
Suit	3 66	Sign	3 62	Window	3.59	Word	4.12
Story	3 59	Coat	3 12	Cake	3.47	Rule	4.03
Pen	3.56	Book	3 44	Bed	3.25	Dress	3 19

The mean minimum quantifier judgments for each verb and object are presented in Table 2. The nearer the number to the maximum of 6.00, the closer to the "all" end of the scale.

Inspection of the means in the top half of the table reveals the anticipated pattern of re-

sults for the four verb classes. Subjective verbs are judged to have higher minimum quantifiers than manifest verbs, and negative verbs are assigned larger quantifiers than positive verbs. The magnitude of these effects is approximately one scale point for the manifest–subjective dimensions and half a scale point for the positive–negative dimension. Examination of the array of means for objects shows that, consistent with the notion that the implicit quantifier is primarily determined by the verb, there is considerably less variation among objects than among verbs.

An analysis of variance reveals highly significant differences between manifest and subjective verbs, $F(1, 7) = 39.50$, $p < .01$, and between positive and negative verbs, $F(1, 7) = 12.74$, $p < .01$. Indeed, the manifest–subjective dimension accounts for 45.7% of the total between-sentence variance, and the positive–negative dimension subsumes an additional 9.4%.

Although the *a priori* verb categorization accounted for more than two thirds of the between-verb variance, there were also significant differences among verbs within the four categories, $F(27, 189) = 2.82$, $p < .01$. These appeared to be due primarily to the three verbs "collect," "recommend," and "want." "Collect" is similar to other verbs of acquisition and ownership in its category (have, buy, find) except that it connotes *cumulative* acquisition; thus, its somewhat higher quantifier seems reasonable. "Recommend," on the other hand, was considered taxonomically puzzling at the outset of the study. Like other manifest positive verbs it denotes an observable action, but at the same time it strongly connotes a positive subjective orientation. Moreover, it is possible to engage in the action of recommending without any observable relationship to the object. The same taxonomical ambiguity, of course, applies to any verb denoting verbal expression of a subjective orientation. In view of this analysis, it is interesting to note that "recommend" falls at a point roughly intermediate between manifest–positive and subjective–positive verbs.

Among positive subjective verbs, "want" emerges as clearly different from its fellows. Despite the fact that "want" is clearly a subjective orientation rather than a manifest action, it seems likely that within the framework of this study "want" was construed to mean "want to have." Thus, its quantifier may have been keyed to the implicit infinitive object "to have," thereby taking on the constraints of the manifest "having" relationship.

The effect of objects within blocks, though small, was statistically significant, $F(30, 120) = 1.80$, $p < .01$. Detailed analysis revealed that this effect was concentrated within three of the 10 blocks. "Game" and "rule," both somewhat less concrete than other objects in the study, received substantially higher quantifiers, while "gate" was rated markedly lower. In general, however, the objects exerted little effect on the implicit quantifier ratings, and there were no significant interactions between verbs and objects.

Table 3 displays the pattern of mean quantifier judgments for the probable quantifier form of the questionnaire. In general, the same pattern of results was obtained for probable quantifiers as for minimum quantifiers, with the exception that the data were somewhat weaker statistically. This relative weakness appears to be due to a general restriction of the variance. More than half the responses fell into the categories "many" and "most." As in the case of minimum quantifiers, there was a significant difference between manifest and subjective verbs, $F(1, 7) = 19.96$, $p < .01$. The difference between positive and negative verbs, though in the anticipated direction, did not reach significance ($.10 < p < .15$). Once again, there were significant differences among verbs within class; however, objects within blocks did not differ significantly.

In general, the results of the study lend strong support to the notion that implicit object quantifiers are primarily influenced by the sentence verb. The differences between

TABLE 3

MEAN PROBABLE QUANTIFIERS

Manifest positive		Manifest negative		Subjective positive		Subjective negative	
Verbs							
Recommend	4.09	Destroy	3.88	Love	5 09	Despise	5.00
Produce	3.53	Harm	3.81	Value	4.97	Abhor	4 94
Buy	3.50	Discard	3 75	Trust	4 59	Distrust	4 84
Collect	3 50	Abuse	3 72	Understand	4 59	Hate	4 84
Seek	3.44	Disturb	3.72	Approve of	4.50	Fear	4.62
Make	3 38	Ruin	3.72	Appreciate	4.47	Resent	4.53
Find	3.31	Deface	3.66	Like	4 37	Ignore	4 38
Have	3.16	Abandon	3.59	Admire	4.22	Dislike	4.31
Use	3 16	Attack	3 53	Enjoy	4.19	Disapprove of	4.28
Steal	3 12	Damage	3.34	Want	3.34	Oppose	4 09
Mean	3 42	Mean	3.67	Mean	4 43	Mean	4.58
Objects							
Table	3 88	Basket	3 91	Rock	4.00	Shoe	4 16
Picture	4 06	Wheel	4 19	Board	4 25	Door	4 34
Glass	4 47	Bag	4.44	Cup	4 31	Ring	3 78
Hat	4 03	Party	4 09	Stick	3.69	Watch	4.12
Crown	4.25	Clock	3 88	Game	4.28	Ball	4.16
Song	3 88	Bill	3 84	Box	4 12	Bell	4 09
Gift	3 91	Nest	3 97	Chair	3 38	Gate	3.28
Suit	4.19	Sign	4 37	Window	4.31	Word	4.09
Story	3.94	Coat	3 78	Cake	3.66	Rule	4 00
Pen	3 75	Book	4.25	Bed	4.19	Dress	3 81

manifest and subjective verbs are particularly striking. On the minimum quantifier form of the questionnaire only two of 20 manifest verbs display mean quantifiers above 3.60, while among subjective verbs, only "want" falls below this value. Now we can turn to the question to which Experiment II was addressed; namely, the importance of implicit quantification in the actual processing of sentences.

EXPERIMENT II

Method

A set of 16 sentence frames was constructed which factorially combined four verb categories with four quantifiers—"all," "most," "some," and "one or two." Four verbs represented each of the four verb types:

Manifest positive: buy, use, have, make
Subjective positive: love, admire, understand, enjoy
Manifest negative: destroy, harm, fight, abuse
Subjective negative: hate, fear, avoid, ignore

Each of these 16 verbs appeared in one sentence frame The design was completely factorial with respect to the two variables of theoretical interest, namely, verb type and quantifier, but was fractional with respect to individual verbs. To provide information on all 64 verb-quantifier combinations, it was necessary to construct four such orthogonal sets of 16 sentences, with each *S* tested on one of these sets.

Four feminine names were employed as sentence subjects, and 16 common words (e.g., cars, cookies, umbrellas) were used as objects These appeared in systematic combinations with other sentence elements.

The *S*s were 20 Yale undergraduates who received course credit for their participation Each of the four sets of sentences was administered to five *S*s in individual sessions. During an initial exposure trial the sentences, which were printed on index cards were manually presented to *S* in random order for a duration of 5 sec per card. The *S* was asked to examine the sentences closely and remember them as well as he could. On subsequent trials, *E* read *S* the first two words of each sentence (i.e., the subject and verb), and *S* responded by writing the entire sentence on an answer sheet After he had answered, *S* was again shown the correct sentence. This procedure was repeated for a

total of seven test trials, with a different random order of presentation on each trial.

Results

Preliminary analysis of the data revealed that, although there was a general learning effect, there were no changes in the pattern of sentence differences over trials, hence the data for all seven trials were combined for the analysis presented below.

It was expected that the frequency of correct recall of quantifiers would be an interactive function of verb type and level of quantifier. More specifically, recall of "small" quantifiers should be greatest in sentences with positive verbs, manifest verbs, or both, while recall of "large" quantifiers should be greatest in sentences with negative verbs, subjective verbs, or both.

Table 4 summarizes the data directly bearing on this hypothesis. The mean number of correct responses (out of a possible seven) is given for each verb and quantifier. It is apparent that in general the pattern of results supports the hypothesis. From the row of difference scores, it is apparent that for the quantifiers "one or two" and "some," recall was appreciably higher for positive verbs, while for "most" and "all," the reverse was true. When this effect was tested by a contrast which assigns opposing linear weights to positive and negative verbs, the result was significant at the .05 level, $F(1, 44) = 4.33$. The same pattern of results obtained for the manifest-subjective dimension, with the exception that quantifiers in sentences with subjective verbs were more readily recalled only when the quantifier was "all." Again, the predicted Linear × Verb Class interaction was significant, $F(1, 144) = 4.20$, $p < .05$.

The second major expectation was that errors should tend to reflect intrusion of the "natural" quantifier into the response; that is, incorrect responses should most often reflect the quantifier appropriate to the sentence verb. Table 5 displays, in percentages, the distribution of errors among quantifiers for each verb type. These percentages are based on errors aggregated over trials, sentences, and *S*s. The pattern of percentages provides strong support for the hypothesis. Thus, for example, manifest positive verbs elicited less than half the number of errors involving "most" and "all" that subjective negative verbs did (34.2% vs 71.0%).

Since these are aggregate data, individual *S*s contribute more than once to cell totals. Hence the usual statistical techniques cannot be applied without violating independence assumptions. In order to test these effects for

TABLE 4

MEAN NUMBER OF CORRECT RESPONSES BY VERB TYPE AND QUANTIFIER

Verb type	Quantifier			
	One or two	Some	Most	All
Manifest positive	5.55	4.60	3.55	4 00
Subjective positive	4.35	3.60	3.95	4.00
Manifest negative	4.40	3.45	4 30	3 90
Subjective negative	4.40	3.95	3.30	4 90
Positive	4.95	4.10	3.75	4.00
Negative	4.40	3 70	3.80	4.40
Difference (P − N)	+.55	+ 40	− 05	−.40
Manifest	4.97	4.02	3 92	3.95
Subjective	4 38	3 77	3.62	4.45
Difference (M − S)	+ 59	+ 25	+.30	−.50

TABLE 5

DISTRIBUTION OF PERCENTAGE ERRORS AMONG QUANTIFIERS FOR EACH VERB TYPE

Verb type	Quantifier			
	One or two	Some	Most	All
Manifest positive	26.6	39 2	12.1	22.1
Subjective positive	14.3	26.2	33 8	25.8
Manifest negative	14.1	29.1	28.2	28.6
Subjective negative	12.3	16.7	33.3	37.7

statistical reliability, an "average quantifier level" was calculated for all errors made by each S on each sentence. This was done by assigning the successive integers 1 to 4 to the quantifiers, with 4 indicating "all."

An analysis of variance performed on these scores established the significance of the effects noted in Table 5. Errors for positive verbs involved significantly smaller quantifiers than those for negative verbs, $F(1, 48) = 8.79$, $p < .01$, and errors for manifest verbs involved smaller quantifiers than errors for subjective verbs, $F(1, 48) = 11.34$, $p < .01$.

DISCUSSION

The results of both studies reported here provide strong empirical support for the hypothesis. The proportion of an object class to which a verb is taken to apply appears to depend primarily on the verb rather than the object. This finding may seem surprising in view of the fact that it is the object which is directly quantified rather than the verb. However, at a general level the phenomenon of quantitative transfer of meaning from verb to object bears some similarity to the phenomenon of adverbial multiplication of adjectives (Cliff, 1959; Howe, 1962; Lilly, 1968) and that of selectional semantic rules for noun–verb combinations (Hamilton & Deese, 1971).

The generalization that objects exert little influence on implicit quantifiers must be tempered by the fact that at least two classes of objects which might be expected to exhibit different quantification properties were deliberately excluded from study; namely, singular and mass nouns. Singular nouns, such as "New York," are unquantifiable, while mass nouns (such as "sugar") grammatically require a different set of quantifiers from ordinarily plural nouns (e g., "much," "a small amount of," etc.). However, these nouns were excluded because they are grammatically distinct, whereas the phenomenon reported here appears to be a semantic one.

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(Received September 2, 1971)