

Prepared for
ASSOCIATION FOR BEHAVIOR ANALYSIS

25th ANNIVERSARY ANNUAL CONVENTION

CHICAGO, May 26-30, 1999

Symposium #33

The Objective Analysis of Subjective Behavior: William Stephenson's
Q-Methodology

DRAFT: NOT FOR GENERAL DISTRIBUTION

**An Empirical Probe of Subjective Probability Notions,
Guessing Behavior, and Personality Correlates**

Robert M. Lipgar

University of Chicago Medical Center

INTRODUCTION

B.F. Skinner's behaviorism has been understood by many to be anti theoretical and to assume that nothing occurs between stimulus and response, that the black box is empty, that what may occur there is of no interest, or that it is unknowable (Reese, 1986, p. 72). Skinner was not anti theoretical. Rather, what distinguishes "radical behaviorism" is a methodological choice — a preference for how best to gain the scientific understanding of behavior (Michael, 1985, pp. 110-114). For Skinnerians, a science of behavior requires the experimental analysis of relationships between independent and dependent variables in which dependent variables are primarily in terms of response rates and the independent variables are stimulus conditions in particular settings, circumstances, or contexts.

The analysis of behavior in the study reported today has much in common with Skinner's approach to scientific psychology. It differs, however, in that the dependent variable is not in terms of response rates and more specifically, is not in terms of changes in response rates in relation to different stimulus conditions. This study analyzed behavior samples in response to four different stimulus conditions in order to find similarities of response patterns across the four conditions. In this study, a small number of subjects' operant behavior was analyzed, not for the purpose of testing hypotheses about different effects of the stimuli, but rather for the purpose of discovering constancies in behavioral response patterns. In this sense, this study is aimed first at the scientific understanding of behavior rather than at its prediction and control.

In brief, this study confirmed previously reported findings concerning normal guessing patterns, identified three atypical response patterns, and found that all four can be systematically linked with other behaviors, suggesting that all may be regarded as effects of psychological dispositions or core organizational factors. Because systematic

associations have been objectively demonstrated to exist among subjective probability notions, guessing behavior, and personality variables, the psychological dispositions represented by the factors found with Q-methodology merit further empirical analysis.

THE STUDY PLAN

In studies of learning involving partial reinforcements, and in areas of psychological research such as decision-making, risk-taking, and test-taking, the subject's behavior is in part a response to uncertainty (Wright & Ayton, 1994). The present study was undertaken to add to the understanding of how people cope with uncertainty.

On the basis of empirical research reports by several investigators in different areas of psychology (Yacorzynski, 1941; Piaget, 1948; Lawlor, 1956; Gratch, 1959), and on the basis of theoretical considerations stemming primarily from Piaget (1948), Tolman (1963) and Brunswik (1939), there is reason to believe that different subjective probability notions exist, are influential in behavior, and can be classified. To test these beliefs, a sample of subjective probability notions was sought and a Q-sort consisting of patterns of H's and T's ("head" and "tail" guesses) was devised (Stephenson, 1953; Brown, 1980). A sample of people likely to produce different probability notions was then selected to interact with the sample of guessing patterns. Subjects' ratings of these H-T patterns were correlated and the correlational matrix factor analyzed. Four factors were obtained. The relation between actual guessing behavior and the factor-types was also examined, and two of the four factor-types were found to be congruent with subjects' actual sequences of guesses.

The second research question involved the relation of subjective probability notions to personality functioning in general, and orientational activities in uncertainty situations in particular. To explore this question, Thematic Apperception Test (TAT) and Rorschach data were obtained from the same subjects and analyzed in terms of the classes of subjective probability notions obtained by the factor analysis of the correlational matrix of Q-sorts. The four identified factor-types were found to be associated with different response patterns on these two other experimental tasks.

In sum, this investigation sought to:

- 1) confirm the finding that subjective probability estimates and systems of preferences for different kinds of response-sequences exist;
- 2) identify atypical subjective probability notions;
- 3) show how they can be classified;
- 4) explore the possibility that subjective probability notions reflect some core features of personality functioning; and
- 5) consider the relation between subjective probability preferences and actual guessing behavior.

PROCEDURES AND SUBJECTS

Four kinds of behavior were recorded for analysis: a) guessing behavior in a no-

feedback coin-tossing situation in which subjects were required to write down their guesses as a series of H's, "heads" and T's, "tails"; b) Q-sort ratings of items as "good" or "poor guesses" presented in the form of patterns of H's and T's (cf. Tables 1 & 2); c) thematic responses to structured but ambiguous stimuli (TAT); d) verbalizations of percepts in response to unstructured and ambiguous stimuli (Rorschach).

Thirty subjects representing three mental status levels (ten "normals", twelve psychotic patients, and eight non-psychotic patients) were selected for the study. Other psycho-social characteristics including religion, education level, occupation, major personality defenses, and prominent symptoms were approximately randomized.

FINDINGS

Subjective Probability Notions

A factor analysis of the correlational matrix yielded four factors. After a varimax rotation, the Q-sorts by subjects with the highest loadings in each of the four factors were used to obtain a composite rating (factor-array) of the items (patterns of H's and T's). Then, on the basis of inspection of items rated high and low, four types of subjective probability notions were identified as follows (cf. Table 3):

- I. Preference for many runs, short runs, approximately equal proportions of the two equally likely events, and some tendency to avoid sequences with obvious regularities (symmetry of patterning);
- II. Preference for one event with no other notable extremes in terms of number of runs, length of runs, or patterning;
- III. Unusual attention to patterning without a stable preference for such "popular" features as many runs, short runs, and an equal proportion of the two events;
- IV. An avoidance of patterning or symmetry without a stable preference for using the "popular" structural features.

Guessing Behavior

These four subjective probability (S.P.) types were next studied in relation to the coin-toss guessing behavior. Guessing patterns produced by the best representatives of each of the S.P. types were compared with their Q-sort preferences, and contrasted with guessing patterns produced by Ss without appreciable signs of the particular factor-effects under consideration.

Guessing behavior for both S.P. types I and II were consistent with the Q-sort ratings. The relation between Ss' actual guessing sequences and their Q-ratings of H-T patterns was less coherent for S.P. types III and IV. The patterns of sequential guesses in a non-feedback situation were distinguishable from each other, classifiable, and tended to be associated with each of the four factor-types.

Thematic Apperception Test (TAT)

TAT stories by subjects who best represented each of the factors were analyzed, and a typology of ways of organizing time was derived (Lipgar, 1969). Four clinical judges applied the criteria to stories written by representatives and non-representatives of the four factors. The ratings confirmed the objectivity of the derived Time-type descriptions and the hypothesis that these Time-types were associated with S.P. types in independent cases was supported. These associations were (cf. Table 4):

S.P. Type I was associated with orderly management of the time sequence in the thematic material, together with a personally involved participation in the flow of time, appropriate and realistic tensions about the use of time, and an integrated conception of the continuity of time.

S.P. Type II was involved with an avoidance of the future in the thematic material, a sense of frustration and disappointment with time, a sense of impotence in a power-struggle or contest of wills, and an attachment to, or lingering with the past.

S.P. Type III was found to be associated with thematic material in which there was an avoidance of the past together with an unrealistic or fanciful, fairytale hopefulness about the future. The future tended to be conceived of as a "place" to arrive at, or to be encompassed by, rather than as a continuation of the present to be planned for.

S.P. Type IV was associated with an emotional detachment from others and a "fabricated" involvement in the present, with a kind of intellectualized puzzlement not found in the other three types, respectively, and omnipotent conceits appear overtly or can be inferred.

Rorschach

To pursue further the personality traits associated with the subjective probability types, subjects' Rorschach data were studied. Differences in Rorschach response patterns according to S.P. types were determined in two ways: 1) rank order correlations between subjects ranked according to their loadings on each factor separately and subjects ranked separately according to their raw score on 19 Rorschach scoring categories showed distinctive kinds of significant correlations for each of the four S.P. types; and 2) an analysis of median values for factor groups in contrast with non-factor groups and also in contrast with a normative comparison group, showed interpretable, different patterns of trends, none of which contradicted each other or the significant correlations obtained by the first procedure.

Integrative and reality-appropriate critical abilities are manifest in the Q-sort behavior, guessing behavior, TAT, and Rorschach for subjects representative of S.P. Type I. In their relation to reality, these Ss can be considered *alert and responsive*; uncertainty

for these subjects presents a *problem* to be handled by application of some general rules of conduct derived from past experience.

Denial, suppressed emotionality and restricted productivity appear in conjunction with S.P. Type II. These Ss can be described as *disappointed* in reality. For them, uncertainty presents a *gamble* to be handled by reliance on luck.

S.P. Type III appears to include a *flighty* subtype together with a *rigidity* subtype, both of whom seem distractible and puzzled and react rapidly to new stimuli. These Ss relate to reality in a *wishful* way, and uncertainty is a pervasive part of a *puzzle* which if solved, would eradicate perplexity and uncertainty once and for all.

Looseness of perceptual and intellectual controls together with some deceit and/or conceit with regard to reality demands appear to be associated with S.P. Type IV. These Ss have a *distrustful* relation to reality, and uncertainty is viewed as the result of a *hoax* or a trick.

There is greater than chance association of Factor I with normals and non-psychotic patients, and of Factors III and IV with psychotic patients; Factor II tends to be associated with those normals in the sample who were under 14 years old and with some non-psychotic patients with depressive features.

CONCLUSIONS

One of the subjective probability notions (represented by Factor I) has the same structural characteristics reported in other studies for normal adult subjects. Ss holding this subjective probability notion guess in ways consistent with their view or quasi-theory about the structure of sequences of random events, that is, their behavior is congruent with their preference for sequences with short runs, many runs, equal proportions of "heads" and "tails," and ones without obvious pattern regularities.

Three additional subjective probability notions have been identified, and may be considered atypical. Although the guessing behavior produced by Ss holding these atypical S.P. notions can be distinguished from each other, only one of the three appears to be logically consistent with the S.P. notion held as represented by Factor II. For the two other S.P. types, represented by Factors III and IV, the association between behavior and belief is not coherent and not easily made clear in operational terms.

It appears, therefore, that one can speak meaningfully of only two subjective probability types, S.P. Types I and II. Representatives of Factors III and IV, reference to above as S.P. Types III and IV, are probably better conceptualized as "reaction types." As "reactions types," however, they can be identified by means of tasks requiring Ss to employ probabilistic notions. These data do not permit conclusions to be drawn about the full extent of variations in types of subjective probability notions, nor about the frequency in the general population of the ones identified.

Treatment of time and attitudes toward time, as manifested on TAT stories, can be classified as four Time-types derived from grouping Ss according to S.P. types. The Time-types can be independently identified and are associated with the psychological effects of the S.P. types.

Representatives of different subjective probability notions have been found to be different from each other on the Rorschach. These differences were in terms of rank order correlations of scores on variates in Beck's (1961) scoring system and of factor loadings and in terms of contrast in profiles of median values for the scoring categories.

These links among different kinds of behavior in response to different conditions of uncertainty provide some evidence that the organization of subjective probability notions and guessing behavior is connected to aspects of personality organization, specifically to the treatment of time, and to perceptual control, as reflected in the Rorschach. Hence, the central hypothesis for the study was supported: subjective probability notions are found to reflect some core features of personality functioning. These analyses suggest an organizational core common to both domains. This organizational core may be described in terms of variations in combinations and saturations of four dispositions toward reality — reality seen as *a problem, a gamble, a puzzle, or a hoax*.

This use of Q-methodology illustrates how interrelations among behavioral, perceptual, cognitive, and personality variables can be scientifically explored with a small number of subjects. Investigations of this kind can provide objective, systematic empirical bases upon which to build and refine theoretical understandings of psychological functions governing human behavior. Essentially, this study sheds light on how people deal with uncertainty, an aspect of existential reality that requires us to choose and act without full knowledge of consequences, and shows that identification of factor-types can be a useful way to organize further scientific inquiry into the relationship of subjective probability behaviors and personality.

REFERENCES

- Beck, S., Beck, A., Levitt, E. E. & Molish, H. B. (1961). Rorschach's test. New York: Grune & Stratton.
- Brown, S. R. (1980). Political subjectivity: Applications of Q-methodology in political science. New Haven: Yale University Press.
- Brunswick, E. J. (1939). Probability as a determiner of rat behavior, Journal of Experimental Psychology, 25, 419-431.
- Gratch, G. (1959) The development of the experience of non-independence of random events in children, Child Development, 30, 217-227.
- Lawlor, W. (1956). Subjective probability in sequential uncertainty situations. Unpublished doctoral dissertation, University of Chicago.
- Lipgar, R. M. (1965). Subjective probability notions, guessing behavior, and their personality correlates. Unpublished doctoral dissertation, University of Chicago.

Lipgar, R. M. (1969). The treatment of time in the TAT, Journal of Projective Techniques, 33, 219-229.

Michael, J. L. (1985). Behavior analysis: a radical perspective, in Hammonds, B. L. (Ed.) Psychology and Learning. Washington, D.C.: American Psychological Association.

Piaget, J. (1948). The moral judgment of the child. Glencoe: Free Press.

Reese, E. (1986). Learning about teaching from teaching about learning: presenting behavioral analysis in an introductory survey course, in Makosky, V. P. (Ed.) The G. Stanley Hall Lecture Series. Washington, D.C.: American Psychological Association.

Stephenson, W. (1953). The study of behavior. Chicago: University of Chicago Press.

Tolman, E. C. & Brunswick, E. (1935). The organism and the causal texture of the environment, Psychological Review, 42, 43-76.

Wright, G. & Ayton, P. (1994). Subjective probability. New York: John Wiley & Sons.

Yacorznski, G. K. (1941) Perceptual principles involved in the disintegration of a configuration formed in predicting the occurrence of patterns selected by chance. Journal of Experimental Psychology, 29, 401-406.

SUGGESTED READINGS

Brichacek, V. (1970). Use of subjective probability in decision making, Acta Psychologica, 34 (2-3), 241-253.

Cooke, R. M. (1991) Experts in uncertainty: Opinion and subjective probability in science. New York: Oxford Press.

French, A. P. & Steward, M. S. (1975). Adaptation and affect: Toward a synthesis of Piagetian and psychoanalytic psychologies, Perspectives in Biology & Medicine, 18 (4), Sum 1975, 464-474.

Gigerenzer, G. (1994). Why the distinction between single-event probability and frequencies is important for psychology (and vice versa), Chapt. 2 in Wright G. & Ayton, P. (Eds.) Subjective probability. New York: John Wiley & Sons.

Phillips, L. D. (1970). The "true probability" problem, Acta Psychologica, 34 (23-) 254-264.

Warren, R., Zgourides, G. & Jons, A. (1989). Cognitive bias and irrational belief as predictors of avoidance, Behaviour Research & Therapy, 27 (2), 181-188.

Address correspondence to: Robert M. Lipgar, Suite 1375, 980 N. Michigan Ave., Chicago, IL 60611
Telephone: (312) 266-1170
e-mail: rlipgar@ yoda.bsd.uchicago.edu

TABLE 1.

Q-sort Item: Example (1 of 72)

T T H T H H H T H H T T T H T H

Distribution of Items in Q-sort

<i>Rating Scale</i>	-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
No. of Items	1	2	4	9	12	16	12	9	4	2	1

Instructions to the Subjects for Rating the Q-items

“Place the items that look like *“good guesses,”* that look like the penny would come up that way, over here [examiner points to the right of the stack of item-cards now on the table in front of the subject] and the ones that you don’t believe are very good or likely, over here [examiner points to the left] and the ones that seem just so-so, or the ones you aren’t quite decided about, put in the middle. So you will have three piles to start with.”

[After the subject had read through and sorted the 72 item-cards into three piles, the examiner instructed the subject to continue to review and sort the cards into smaller piles until the above distribution had been decided upon by the subject.]

TABLE 2.
Structure of the Subjective Probability Q-sort

		<u>PROPORTION of HEADS & TAILS</u>		<u>Number of Q-Items</u>			
		8:8		24			
		10:6		24			
		12:4		24			
<u>NUMBER of RUNS</u>		<u>No. of Q-Items</u>	<u>No. of Q-Items Proportion H and T</u>			<u>No of Q-Items Length of Longest Runs</u>	
			<u>8:8</u>	<u>10:6</u>	<u>12:4</u>	<u>3</u>	<u>5</u>
low {	6	17	11	3	3	12	9
	7	19	1	9	9	12	7
typical {	8	19	8	4	7	3	16
	9	17	4	8	5	15	2
<u>LENGTH of LONGEST RUN</u>		<u>No. of Q-Items</u>	<u>Proportion H and T</u>			<u>Symmetry & Non-Symmetry</u>	
			<u>8:8</u>	<u>10:6</u>	<u>12:4</u>		
3		36	12	12	12	18	18
5		36	12	12	12	18	18
<u>SYMMETRY vs. NON-SYMMETRY</u>		<u>No. of Q-Items</u>	<u>No. of Runs</u>				
			<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	
Symmetry		36	7	11	11	7	

Non-symmetry 36 10 8 8 10

TABLE 3.
Top Ranking Items for Four
Subjective Probability Factors

Factor I

<u>Rank</u>	<u>Item No</u>	<u>Structure of Item</u>	<u>Item</u>
1	22	8:8, 8:9, 3, NS	TTHHTHHHTTHTTTH H
2	24	8:8, 8:9, 3, NS	TTHHHTTHTHTTTHHH T
3	48	8:8, 8:9, 3, S	THTTHHTTTHHTTTHH H

Factor II

1	54	12:4, 6-7, 3, NS	TTTHTTTHTTTTHHTTT
2	51	12:4, 6-7, 3, NS	TTTHTTTTTTHHTTTTH

Factor III

1	31	8:8, 8:9, 5, S	HTTTTTHTHTHHHHH T
2	7	8:8, 8:9, 5, S	HTHHHHTTHTTTHT T

Factor IV

1	22	8:8, 8:9, 3, NS	TTHHTHHHTTHTTTH H
2	9	8:8, 8-9, 5, NS	TTHTTHTHHHHHTTT H

TABLE 4.
Treatment of Time in TAT Stories by the High Loaders in the Subjective Probability Factors

Factor I Subjects show a personal involvement in a continuity of events clearly placed in three time dimensions. By implication, time is filled and spent.

Subject # 3 (.84)

The parents of the boy have — want him to take music lessons. They bought him a violin. I would think that he is at home waiting for his tutor or instructor. He doesn't want to play the violin. He looks like he is trying to figure what it is all about, why he should. He will be able to play the violin and he may be very good at it but I don't think that would be his career. But I think in later years he may develop a genuine appreciation for good music. (*Note: continuity of past, present and future events and references to feelings and motivations.*)

Factor II Ss' stories express themes of resistance and contrariness, involving contests of opposing wills. The future is avoided, and the past events or states are heavily invested and of current concern.

Subject # 13 (.64)

This is a boy. He has a violin and his music sheet is on the table, but it seems like he might be a little disinterested in his lesson, in doing his violin, and he's more or less trying to decide whether he wants to play it or just what he wants to do. . . . (*Examiner: What happened before?*) Seems like he probably has this instrument and he didn't get along with his teacher and was put in this room by himself and he has to think it over. . . . (*Examiner: How will it turn out?*) Seems like he didn't want to go along with his instructor so he was put in this room to decide what he should do. . . . (*Examiner: What will he do?*) I think he should be able to have his own feelings. He should be able to tell his parents and to try something else. (*Note: future not included.*)

Factor III: Ss' stories tell of people who are perplexed and overwhelmed by present time events or states from which there is flight to a highly invested, make-believe future.

Subject # 16 (.69)

The first thing I thought of was a kid having to take violin lessons. Now that I look at it, he looks like he's daydreaming ahead. He seems like he's serious minded. . . . (*Examiner: What is he dreaming about?*) Someday that he's gonna be a great violinist. That he can play it good later. . . . (*Examiner: What happens*

next?) I imagine that he would be a good violin player. I sort of imagine him with a tuxedo on, playing. (Note: no preceding events and a “jump” into the future.)

Factor IV In these stories, the central figure is aloof, markedly emotionally detached from others, and the events seem to be have an “as-if”, make-believe quality or fabricated, like omnipotent conceits.

Subject # 18 (.52)

Child seems to be in deep study or thinking, concentrating about his music. . . . (Examiner: Tell a story with a beginning, middle, and an end.) The guy is just, he seems to be very interested and serious about his music, maybe he's grown tired of it and getting sleepy - - but I think he's concentrating on violin and music. . . . (Examiner: How will it end?) Well, he will get up and go to bed and go to sleep and study the next day and feel better when he's studying. I don't guess it would ever end — if interest, he just keeps practicing until he gets better and improve till he's so old he couldn't play the violin anymore until death or something interfered till he couldn't play no more. (Note: no past events, little continuity of events, and external forces interfere with self-efforts.)