CROSS-TECHNIQUE VALIDATION OF ATTITUDE MEASURES

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Abstract. The joint use of R and Q technique factor analysis can be a potent tool for validation of tests and for theory elaboration. The paper presents a method for jointly using the two techniques. A study of the concerns of counseling students is used as an heuristic demonstration of the procedure. Subjects in the study were all the students enrolled in a graduate training program in a large university in the southwestern United States.

The 1930s were years during which psychometricians struggled to understand and evaluate a host of relatively new analytic techniques. Among these was a technique conceptualized at about the same time by Stephenson (1935) and Thomson (1935), which was the basis for what is now commonly referred to as Q technique factor analysis. The years which immediately followed conceptualization of the technique saw a lengthy interchange of views about the nature and relative merits of Q as against R technique analysis.

More recently, notwithstanding debate regarding the merits of factor analysis itself, some consensus

Operant Subjectivity, 1983(Jan), *6*(2), 37-50.

has begun to emerge regarding the characteristics of Q technique. Numerous investigators have demonstrated that Q methodology can provide a useful tool for examining phenomena as diverse as psychotherapeutic styles, sociological development, creativity evaluation, perceived desirability of teaching behaviors, and evaluator "types." Kerlinger (1973) has argued that the technique has a close affinity to theory, holds substantial promise for examining effects of independent variables on complex dependent variables, and has heuristic and exploratory power. Levitov (1980) presents an exemplary study which demonstrates the close affinity between theory and Q technique. However, Kerlinger (1973) also notes another advantage of the technique: "Although seldom [so] used, Q can be a strong aid in scale construction. The high items of factor arrays should make good scale items" (p. 595).

Nevertheless, some applications of the methodology do generate problems. For example, significance testing of the residual person-by-person correlation matrix after extraction of factors would require a difficult to defend assumption that there had been random sampling of items from a defined population of variables. Some statisticians would also argue that the technique is not amenable to use with large samples of persons. Indeed, the upper limit on participation in a Q study is generally taken to be $(N/2)-1$, where N is the number of sorted items. However, as Stephenson (personal communication) has suggested, this requirement derives from "large sample doctrine." Many social scientists believe that empiricism derives its generalizability from random sampling of people from identified populations. However, some Q researchers argue that empiricism can also derive generalizability from a particular form of grounding research in scientific laws. For example, Stephenson (1982) argues that "the 'single case' methodology of Q is widely misunderstood, as though one were generalizing from a statistic $n = 1$, whereas by the introduction of *laws* into Q-sorts, n is more infinite than single."

Whichever position one accepts, it is clear that

both R and Q techniques have greatly facilitated the knowledge acquisition efforts of contemporary social scientists. The purpose of this paper is to explore the benefits of the conjoint use of the two techniques. Specifically, a generalization of Q methodology in the underexplored area of validity applications is discussed, and a heuristic application of the procedure is presented.

FUNCTION OF THE PROCEDURE

Scientists have increasingly come to focus upon explanation as the business of science. Scientists are about "the process of showing that the finding follows as a logical conclusion, as a deduction, from one or more general [theoretical] propositions under specified conditions" (Homans, 1967: 23). This renewed emphasis has stimulated increased concern about the construct validity of the measures that researchers employ.

Construct validity requires more than an examination of a test taken at face value in terms of "representativeness" of items or "sensibility" of construction methods; a demonstration of functional relationship between a test and some event is also insufficient to establish construct validity. Construct validity requires evidence that a test yields findings which lawfully flow as inescapable postulates from accepted theory.

Nunnally (1967: 87) suggests that the process of establishing construct validity involves:

(1) specifying the domain of observables;
(2) determining to what extent all, or some, of those observables correlate with each other or are affected alike by experimental treatment; and,
(3) determining whether or not some or all measures of such variables act as though they measure the construct.

Nunnally laments the fact that scientists frequently move directly to the third step of the process and

try to find relationships between their measures and measures of other constructs. The passing attention devoted to Nunnally's step two is sometimes limited to an R-technique factor analysis of items to determine if anticipated factors emerge, and whether or not items correlate as expected with factors. Consequently, construct validity has sometimes been labelled "factorial validity."

The fundamental criterion implicit within this approach is that a test item is valid only to the degree that the item clarifies the dimensions underlying the items as a group. Unfortunately, such a criterion ignores the irresistable but inappropriate impulse of some researchers to generalize information about persons' scores on item dimensions to statements about types of persons. In the context of these impulses, and because a different view would be more productive for some theory development, it can be argued that a more suitable item evaluation criterion in some cases would be: better items should clarify the dimensions underlying *both* respondents as a group and test items as a group.

In short, it is suggested that R and Q techniques might productively be used together in exploring the validity of tests. This idea is not new. Kerlinger and Kaya (1959: 27) long ago argued that "Q methodology evidently can, in some cases, be used in place of, or rather, prior to, the usual type of factor analysis (so-called R methodology) and the usual type of item analysis as a potent logical validity tool." As Kerlinger (1972: 994) later argued, "the theoretical expectations of duality of attitude structure and comparative lack of bipolarity have now been found using both R and Q methodologies. Research findings are always strengthened when yielded by different approaches, methodologies, and measurement instruments." Thompson and Miller (1981) also report a joint application of both R and Q technique analyses. The study which follows exemplifies a procedure which may facilitate even more optimal concurrent use of the two techniques.

THEORETICAL FRAMEWORK

The importance of developmental models in education and sociology has been well established by theoreticians such as Piaget and Kohlberg. Work by Fuller (1969, 1970), and a generalization of that work by Hall and others (George, 1977; Hall & Loucks, 1977) suggests that stage models focusing on the concerns of teachers may also have important implications. Put briefly, Fuller argues that teacher trainees usually face and resolve an ordered sequence of concerns, including concerns about self, concerns about task, and concerns about impacting pupils. Hall and Loucks (1977) have extended this model and argued that individuals progress through a similar hierarchy of concerns when confronted with innovations.

Whatever the merits of these two concerns models, both rest upon phenomenological observations rather than explicit premises. For example, Fuller (1970) extrapolated her theory as follows: "Data have come from individual and group counseling typescripts, records of depth interviews at graduation, from teachers' written statements and from videotapes of classroom teaching. A dependable pattern on concerns arises" (p. 10). However, others have attempted to formulate a rudimentary theoretical base for concerns phenomena.

Thompson, Frankiewicz, and Ward (1978) have argued that concerns phenomena occur as an aspect of career obligations. It is suggested that the professions thrust people into a broad spectrum of intense interactions. Most jobs require some degree of personal interaction, but the professions generally involve more and deeper interactions with people. Teachers must interact somewhat personally with students, or at least sustain an image of such interaction; the encounter inherent in these relationships may compel examination of aspects of self that others can afford to ignore. The professions typically require special skills of practitioners; the expertise that lawyers must possess probably impels most practitioners to review occasionally task proficiency. Finally, the professions usually provide services that have seri-

ous impacts on their clients; the physician's knowledge that behavior can cost or save the life of a patient hopefully generates some form of self-examination not extant in nonprofessional occupations.

Of course, one aspect of a profession may be used to mask the presence of another. For example, a counselor might avoid personal encounter by dealing with clients in cold, clinical fashion, as if clients were merely collections of intriguing difficulties. But most professionals to some extent probably feel the influence of all the discussed dynamics.

In order to test some of these propositions, Thompson, Frankiewicz, and Ward (1978) developed an instrument to explore concerns-related dynamics in the counseling profession. The referents of the concerns were: (1) clarifying the roles counselors play, (2) understanding counseling theories, (3) being firm with clients, (4) being liked by clients, (5) being respected as professionals, (6) developing empathic listening skills, and (7) facilitating the growth of clients. Seven items were generated to mark each of the seven postulated dimensions of concerns. Needless to say, the items would be useless unless they measure the constructs they are purported to measure. Thus a validity study was in order.

METHOD

All students ($N = 109$) enrolled in graduate counselor education at a large southwestern university were the subjects in the study. Each student completed two forms of the 49 item instrument. Form R required subjects to indicate, on a one (very concerned) to four (very unconcerned) Likert scale, how concerned they were about the issue presented in each item. Form Q required that the same 49 items be Q sorted into 9 groups representing concerns levels ranging from least to most concerned. All subjects were required to sort the items into a quasi-normal distribution. The subjects completed the two forms on separate occasions. As an added protection of the possible independence of the forms, form R and Q items were sequenced and numbered in different random orders.

Data from the form R instrument were analyzed using a principal components procedure. All components (hereafter called factors) with eigenvalues greater than one (Guttman, 1954) were extracted from the item-by-item correlation matrix. The pattern matrix was then rotated to the varimax criterion. Finally, least square regression estimates of factor scores were calculated.

The initial step in analyzing the Q sort data involved randomly selecting 105 subjects from the population of 109 subjects, and randomly assigning each of the 105 selected subjects into one of five equally sized cohorts ($n = 21$). Thus, each cohort was sized to accomodate a Q technique factor analysis ([49/2] - 1 = 23.5; 21 < 23.5). For each cohort a person-by-person correlation matrix was calculated and a principal components analysis followed by varimax rotation was again performed. Based on Guttman's criterion, three factors were extracted in analyzing two cohorts, four factors were extracted in analyzing one cohort, and five factors were extracted in analyzing two cohorts. Then least squares estimates of factor scores were also calculated.

Next, the standardized Q factor scores were collapsed back into the metric of the number of groups into which the statements were originally sorted, i.e., one through nine. This was done by consulting the z-test distribution, since the 49 scores were originally distributed by each subject into a quasi-normal distribution (e.g., -.25 to .25 = 5; .25 to .75 = 6). Taus between the 20 (3 + 5 + 3 + 4 + 5) sets of revised factor scores were then calculated. Taus were calculated rather than rhos because tau is a direct measure of extent of agreement among ranks. As Glass and Stanley (1970: 178) argue, "computational ease and historical precedent constitute the weak case that can be made for use of rho." The resultant matrix is presented in Table 1.

Next, an effort was made to aggregate the factors across the cohorts. If the items had been randomly selected from a defined population of items, statistical significance testing might have been appropriate, and taus greater than approximately .3 would

Table 1. TAU MATRIX

	Cohort/Factor																				
	ONE			TWO					THREE			FOUR				FIVE					
	I	II	III	I	II	III	IV	V	I	II	III	I	II	III	IV	I	II	III	IV	V
I	--	04	03	59	18	-10	18	30	65	10	27	46	-05	43	08	23	06	63	17	08
II		--	04	20	33	59	16	02	12	59	28	48	44	-20	30	42	53	00	18	14
III			--	-08	11	-18	20	14	-06	-07	40	-06	16	28	-18	08	04	22	-39	06
I	59			--	08	-01	-08	-01	49	15	24	49	-07	28	14	15	05	53	24	26
II					--	10	-06	04	-08	35	39	30	18	-13	18	47	30	15	-25	-05
III		59				--	02	-05	00	50	-07	19	38	-31	41	12	51	-22	33	19
IV							--	02	25	-07	29	24	23	19	-34	36	-07	08	07	-06
V								--	31	31	-16	00	-01	23	33	-11	35	34	-02	-27
I	65			49					--	11	07	33	03	42	12	17	08	41	32	13
II		59	40			50				--	00	37	32	-10	54	16	75	11	14	-06
III											--	36	27	14	-21	53	02	29	-23	21
I	46	48		49								--	06	-04	10	43	23	32	26	07
II		44											--	02	01	24	40	-11	-04	28
III	42								42					--	-13	-12	00	59	-10	09
IV						41				54					--	-14	49	12	15	04
I		42			47						53	43				--	09	06	-06	02
II		53				51				75			40		49		--	10	04	01
III	63			53					41					59				--	-03	03
IV																			--	00
																				--

NOTE: Decimals omitted. Entries below diagonal meet "meaningfulness" criterion.

have been considered statistically significant ($p < .001$). However, the items were not randomly sampled and might even be considered the population of interest, so statistical significance testing was inappropriate. More importantly, significance testing provides only a lower bound criterion for aggregating factors; if 100 items had been sorted, factors might be considered for aggregation even if they shared only a trivial percentage of variance.

A more appropriate technique would be to employ a dual decision rule for aggregation of factors across cohorts. First, a "meaningfulness" criterion might be employed whereby factors would be considered for aggregation only if the factor score sets shared a "substantial" proportion of variance. Second, an associative property might be required; factors A, B, and C would be considered for aggregation only if $\tau_{A \times B}$, $\tau_{B \times C}$, and $\tau_{A \times C}$ *all* met the meaningfulness criterion. Based on application of the two criteria to the Table 1 results, two aggregates of the factors were constructed. The first aggregate consisted of cohort one, factor I; cohort two, factor I; cohort three, factor I; and cohort five, factor III. The second aggregate consisted of cohort one, factor II; cohort two, factor III; cohort three, factor II; and cohort five, factor II.

An individual was considered a member of an aggregate if the individual shared at least 25% of variance with an aggregated factor, as indicated by the squared structure coefficients from the Q technique results. Thus defined, aggregate I consisted of 35 subjects, and aggregate II consisted of 26 subjects. Finally, a discriminant analysis was performed to determine if a linear combination of R technique factor scores could be constructed to differentiate the two aggregates beyond a chance level. Before discriminant functions can be interpreted, it is necessary to ascertain whether the dependent variable groups do indeed differ on the predictor variables. This is a multivariate test of the equality of group centroids and is conventionally measured by Wilk's lambda. Lambda was calculated to be .446. This value is statistically significant ($p < .05$). The

discriminant function associated with this value was:

Z = -.058 × R factor I (client growth)
-.838 × R factor II (role clarification)
-.086 × R factor III (being firm)
.665 × R factor IV (being liked)
.646 × R factor V (being respected)
-.063 × R factor VI (empathic listening)
-.694 × R factor VII (understanding theories)

As expected, the information generated across the two modes was related. Specifically, the results indicate that information regarding membership in an aggregate explains roughly 54.2% of the variance (41.7% if adjusted for shrinkage) of the R technique factor scores (Thompson, in press). The results from the two modes of analysis should not be perfectly related, however, since the modes generate different information and cannot be considered equivalent (Stephenson, 1981: 131-132).

DISCUSSION

As anticipated, application of Guttman's criterion in the R technique analysis resulted in extraction of seven factors. The factors measured the postulated dimensions, and were uncorrelated. The items predominantly correlated with the factors they were hypothesized to measure. Only three items had communalities less than .5. Communalities provide a lower bound estimate of reliability; reliability is a necessary but not sufficient requisite for validity. This is where most investigators would stop, and would consider Nunnally's second step completed.

However, in this case it is possible to identify the dimensions which underlie the respondents. Each of the 20 factors of persons is also interpretable. Analysis of these factors might yield information such as how many subjects are *relatively* concerned about being liked and much less concerned about helping clients grow. It is also possible to identify items which are not helpful in defining the dimensions of the subjects.

An item might also be considered poor if it failed to help differentiate a Q factor; one indication of this would be Q technique factor scores across factors for an item all being approximately zero. The Q sorted items generally performed well in terms of this criterion. Even the less useful form-Q items had reasonable form-R chracteristics (i.e., acceptably high communality).

The discriminant analysis provided an index of how stable the items are across the two response modes. Examination of the Q technique factor scores indicates the concerns foci of the two aggregates of subjects. Aggregate I subjects are concerned, roughly in descending order, about (1) facilitating client growth, (2) mastering counseling theories, (3) developing empathic listening skills, (4) role clarification, (5) being firm with clients, (6) being respected as professionals, and (7) being liked by clients. Aggregate II subjects are concerned about (1) facilitating client growth, (2) developing empathic listening skills, (3) being firm with clients, (4) being respected as professionals, (5) being liked by clients, (6) mastering counseling theories, and (7) role clarification. Based on these analyses one would expect the two aggregates to be differentiated primarily by the R concerns factors: role clarification, theoretical knowledge, being liked, and being respected. The discriminant function coefficients confirm this expectation, and suggest that the items are valid across solutions.

In short, there is consistent evidence that the items have the anticipated characteristics. However, the claim that Q technique is also helpful theoretically has yet to be established. Two applications may illustrate this utility. First, Q technique provides a backdrop against which the R technique factors can be interpreted. For example, in interpreting the R factor which accounts for the largest proportion of variance (i.e., facilitating client growth), it is probably important to remember that most subjects do not differ substantially in terms of self-reported rank-order concern for this impact. Second, knowledge of the counselor trainee types,

though useful in and of itself, can lead to theory elaboration. Examination of the concerns in the two aggregates might lead to a suspicion that the aggregates reflect a developmental sequence. Aggregate I subjects seem to have concerns reflecting an earlier status in a possible sequence of growth; these subjects seem process oriented while the aggregate II subjects seem more impact oriented.

SUMMARY

The previous discussion suggests that the conjoint use of R and Q techniques can offer some important benefits. Joint use of the techniques provides information useful for evaluating item performance; best items will generally perform well across both response formats. This is not to say that best items will always perform "well" across both techniques; the two techniques are quite different both mathematically and philosophically. R technique derives its generalizability from large sample doctrine while Q technique derives its generalizability from grounding in theory. Q emphasizes self-reference or subjectivity as the truth to be investigated, while R emphasizes "objective" non-referenced description of reality as the truth to be investigated.

An extension of conventional Q technique has been offered. The analysis of several cohorts amounts to repeated replication, and means that results are more interpretable, since information from several analyses can be considered, and more generalizable, since the technique considers the invariance (Thompson, 1981) of the identified "types" of people. The generalizability of the aggregates is also protected by the use of a conservative decision rule for determining membership in the aggregates. Joint use of the techniques can also facilitate theory elaboration.

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COMMENT BY WILLIAM STEPHENSON

It has never been an objective, nor was it possible, to be restrictive about the uses to which Q technique may be put, and the study by Thompson, Frankiewicz and Ward is welcomed to *Operant Subjectivity* in that connection. It is particularly warming to find statistical expertness in use to a good purpose. The article affords an opportunity, however, to raise a question: Why is *validation* not a problem in Q methodology?

First, we should say that the Q approach to the problem of *concern* by teacher trainees, by pupils undergoing counseling, or by individuals receiving at-

tention (whether legal, medical, or any other), would be very different from that employed by Thompson and his colleagues. *Concern* raises questions, not merely of "being firm," "being liked," "respected," "developing listening skills," etc., but also of anxiety, solicitude, prudence, hope, and other feelings: It is a highly subjective matter, and Q would deal with it concretely, by way of "single case" exploration. The object would be to discover what characterizes *concern* in general, from "single case" studies.

This may well seem a very tall order, and one would study three or four "single cases" for verification, but not for validation.

To take an example (which is not facetious, but quite serious), what about one's own *concern* vis-a-vis the paper by Thompson, Frankiewicz and Ward? Any reference of *concern*, concretely, will serve Q's purpose.

First, concourse theory takes over. A concourse is put together of self-referrable statements with respect to the communicability of the situation, with such statements as the following:

...it is warming to have statistical skills at command.
...the real problem is to grasp what "non-essential" means.
...Q fits squarely with the mathematical formulation of quantum theory in physics; shouldn't that make everyone take notice?
...there is no real need to be concerned about validation.
...the scientist has to "idealize" experience, thus going away from immediate experience.
...the search has to be for natural subjective phenomena.
...we deal with logically complex structures, "events," not attitudes.
...there is an assumption that what is being verified is an inherent structure, measurable by scales.
...the claim that Q technique is also helpful theoretically has yet to be established.

...joint use of R and Q methodologies can facilitate theory construction.

...and so on.

From the concourse, a Q sample is taken. There would follow a set of Q sorts performed by me, each "at the call of theory," making use of research and scholarly inquiries in the field, some of which is now expressed as *lawful*, e.g.:

(1) Perform a Q sort to represent your present *concern* about the TFW paper.

This involves Taylor's law (1953) that Q sorts tend to be consistent over long periods of time.

Next (2) What is your *feeling* about the TFW article?

This is essentially the stimulus function (sf) of Kantor's (1959) interbehavioral system, as it is for the present study.

Then (3) What, *ideally*, should your concern be?

This invokes Rogers' law, of *self* and *ideal* as congruent in adjusted situations, i.e., ego-ideal is at issue.

Now (4) One of my mentors, Sir Godfrey Thomson, had his views about Q: What would he have considered my position to be?

This involves Shibutani's law of "significant other."

Again (5) What do you *take for granted*?

There is evidence (e.g., in Katona, 1964) that what one takes for granted has a determining effect upon one's feeling: It is yet to be called Katona's law, but it is worth keeping in mind.

Or again (6) How do you feel that "authority" has

a bearing here?

And (7) How a feeling for "novelty"?

Both (6) and (7) stem from work in journalism, that these attributes are characteristic of professional work (e.g., O'Brien, 1967).

Or (8) What has been your experience with the success, or not, of others adopting Q?

This stems from Ezra Stotland's *The Psychology of Hope* (1969), which adopts a subjective stance.

If one were actively researching *concerns*, the literature would be searched to provide the conditions for Q sorts, as was done above for professionalism (O'Brien) and for hope (Stotland). Even Kierkegaard's *The Concept of Dread* would not escape notice. The object would be to become informed about everything written about *concern*: One day it may be interesting to write on the *concept of concern*. Methodologically, however, one is feeding into Q's hopper previous scholarliness and research, from which concourse is garnered, and lawfulness espoused.

One need not say much more: Each condition for Q sort is in the form of an hypothesis, capable neither of proof or disproof. Though they are deductions from "theory," no conditions are testable. Our version of Newton's *Fifth Rule* has changed this, in that *new* hypotheses issue from factor analysis, as operant structures and these are hypotheses with inherent truth-value. This is very obvious when the Q sorter confronts his/her factors and recognizes some as him/her, others as his/hers only (the latter often a matter of testable knowledge).

What is important is that any "single case" study points to important self reference, inherently at issue in matters of *concern*, as a theoretical basis for subsequent research. The question of validation never seriously arises, unless one questions the breadth of the concourse, or the interpretations given to the factors as "me" or "mine", etc. One could well study four or five "cases," each as richly con-

cerned as possible, for amplification and verification. It is only when normative conditions are involved, as in the TFW study, that validity becomes an essential issue, for the sake of generalization as to fact. Each "single case" study, instead, is for a unique situation, interbehavioral, from which new hypotheses form, like flowers in a garden. The experiment cannot be repeated, any more than the same flower can grow again in any garden.

Why, then, should anyone wish to use Q in this, its essential form? Would this approach help teacher training, pupils, and consumers of professional services? Or would it be of use only to psychologists?

The *concern* is with a methodology for a science of subjectivity, and not merely with a technique. When Ezra Stotland began his study on *The Psychology of Hope* he realized that "hope" is subjective: He wanted to be scientific, and therefore (as he argued) objective, with reference to "hard-nosed" researches about the "perceived probability of attaining goals" and the like and use of the hypothetico-deductive methodology. In defending his central concept, "hope," he argued that because "hope" cannot be measured objectively, it is still viable as a scientific construct: One day, he added, we may be able to measure consciousness (Stotland, 1969: 5). It happens, in Q, that consciousness is a pseudo-issue, a "non-essential" categorization. What is "essential" is communicability (consciring); and a study of *hope*, as of *concern*, in this context will indicate how little the objective approach really touches self reference. This we can be absolutely certain about, because objective methodology necessarily cuts out self reference. In this context, therefore, if one really wishes to be scientific, the way ahead is ours!

One indeed should notice its credentials. Q has two distinct prongs. One is the *theory of communicability* which is of astonishing scope. The other is its inductive methodology, fashioned first as criticism of the hypothetico-deductive methodology (as being more logic than empiricism), and culminating in Newton's *Fifth Rule*, but also paralleling the induc-

tivism of modern nuclear physics (Stephenson, 1982). Which is to say that, as a purist, for purely scientific reasons, one *has* to pursue the uniqueness of events, in terms of theory. In this way there can be sanction for practical uses such as giving advice on "being firm," "respected," and the like.

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Factors, everyone knows, have to be interpreted. The word "interpretation," however, has down the ages had two very different meanings. One is ARS INTELLIGENTIA, as understanding and synthesis ab initio; the other is ARS EXPLICANDI, as explanation and analysis. Modern science, very largely, pursues the latter, of analysis into constituent elements, and psychology and psychoanalysis followed suite. Q methodology, and the subjective science it pursues, look instead for understandings, as syntheses, from the ground upwards into meanings. (William Stephenson)