"Q-ANALYSIS": CAVEAT EMPTOR

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Abstract R.H. Atkin's Q-analysis is described in terms of a study of nurses' countertransferences toward patients, and the outcome of a Q-analysis is compared with Stephenson's Q methodology. The conclusion is reached that Q-analysis is a variant of R methodology inasmuch as it is logico-categorical and oriented toward discovering inherent structure among objective features of the external world, hence is distinct from Q methodology which is designed to provide a science for subjectivity.

Modern methods of information retrieval are simplifying the task of tracking down studies employing Q technique and its methodology, as routinely transmitted in "Q Bibliographic Update." Publications such as *Social Science Citation Index*, *Dissertation Abstracts International*, *Psychological Abstracts*, *Education Index*, and others are among the pertinent titles consulted, augmented by computer searches. However, the letter "Q" is currently apt to bring the conscientious bibliophile into contact with more than just the Q methodological literature with which readers of this newsletter are familiar.

Specific reference is to a growing body of litera-

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ture concerning a mathematical method consistently referred to as "Q-analysis" which is associated with the work of University of Essex (England) mathematician Ronald H. Atkin (1974, 1978, 1981, 1982) and increasingly employed in geography (e.g., Gatrell, 1981; Gould, 1980, 1981, 1982; Johnson, 1981; Johnson & Wanmali, 1981), but in other areas as well, such as communication (Johnson, 1978).

Q-ANALYSIS APPLIED: A STUDY OF COUNTERTRANSFERENCES

A recent paper by psychologists Whyte, Constantopoulos, and Bevans (1982) provides an example of much of what is involved in Q-analysis *a la Atkin.*[1] The focus is on the countertransferences involved in 11 nurses' reactions to 10 patients, utilizing a checklist of 30 words (e.g., helpful, angry, disappointed) to which the nurses gave yes-no answers reflecting the presence or absence of the feelings. Shown in Table 1 is the shared-face matrix (as it is called) for all 11 nurses for a single patient, which is similar in function to the correlation matrix in Q method (*a la Stephenson*): The diagonal entries are the $N-1$ words checked yes by each nurse, and the off-diagonal numbers are the $N-1$ words which each nurse pair checked yes in common. (The authors also report the original data matrix as well as the complement to Table 1, i.e., the 30×30 shared-face matrix showing the relations among the items, analogous to the $n \times n$ trait correlation matrix in R methodology.) Table 2 is the components table for the nurses, with the Q-value indicating the $N-1$ words checked yes by the nurses, those nurses bracketed together sharing the same or similar groups of words. Nurse 3, for example, checked the most yeses ($N=15$), hence attains the highest Q-value ($Q=15-1=14$). $N=12$ words ($Q=11$) were checked by nurses 3, 5, and 11, but the words checked were not wholly overlapping,

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1. Reprint requests can be made to Dr. C.R. Whyte, Consultant Psychotherapist, Westcotes Hospital, Westcoates Drive, Leicester LE3 0QW, England.

Table 1
SHARED-FACE MATRIX

1	2	3	4	5	6	7	8	9	10	11	Nurses
(8)	4	6	5	7	6	3	6	7	5	7	1
	(6)	5	5	6	5	3	5	5	5	5	2
		(14)	6	7	7	4	7	7	7	7	3
			(8)	7	6	3	6	7	5	8	4
				(11)	8	3	9	9	7	10	5
					(9)	3	8	8	6	8	6
						(4)	4	3	4	3	7
							(10)	8	8	9	8
								(9)	6	9	9
									(8)	7	10
										(11)	11

Table 2
COMPONENTS TABLE

Q-value	Components
14	(3)
13	(3)
12	(3)
11	(3)(5)(11)
10	(3)(5 11)(8)
9	(3)(5 8 9 11)(6)
8	(3)(4 5 6 8 9 10 11)(1)
7	(1 3 4 5 6 8 9 10 11)
6	(1 2 3 4 5 6 7 8 9 10 11)
5	(1 2 3 4 5 6 7 8 9 10 11)
4	(all)

hence the three are bracketed separately. Where Q = 9, nurses 5, 8, 9, and 11 are bracketed together (into what is called a chain of connectivity) indicating that the reaction of any one of them shared 10 feelings with at least one of the other nurses within the

same bracket, an operational manifestation of the family resemblance concept advanced by Wittgenstein (1958). $N = 5$ words ($Q = 4$) were shared by each nurse with at least one other. Nurse 3 therefore stood out as most eccentric,[2] attributed to the fact (when the raw data matrix is examined) that she checked an unusually large number of negative reactions such as angry, anxious, sad, and frustrated.

Through the use of both shared-face and components tables, and from both the nurse × nurse and item × item standpoints, the authors identified four different kinds of responses: *Role responses*, feelings that most nurses reported having toward most patients; *diagnostic responses*, feelings induced in most nurses by particular patients; *character responses*, a distinguishing response by one nurse to most patients; and *conflict responses*, feelings toward one patient which were atypical of the reporting nurse. The patient the reactions to whom gave rise to Tables 1 and 2, for example, was diagnosed senile dementia (progressively severe mental ineffectiveness) and in need of nursing care, and the nurses' responses to her consisted of terms such as motherly, affectionate, and happy, a countertransference induced in all the nurses by this particular patient (diagnostic response). By the same token, nurse 3 (above) tended to respond in an angry and anxious way to most of the patients, whereas nurse 9 was always happy (character responses). All the nurses reported feeling sympathetic, helpful, and interested in relation to all the patients (role response). These are among the

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2. Eccentricity is a measure of the isolation of each nurse's reaction from the others, and is calculated from the formula $E = (Q - q) / (q + 1)$, where Q is the highest Q-value at which a nurse's reaction enters the component table, and q is the highest value at which her reaction is bracketed with another. (Whyte et al. do not provide the formula; see Atkin, 1974: 33-34.) In the case of nurse 3, $Q = 14$, $q = 7$, and $E = (14 - 7) / 8 = 0.88$, which is the highest E (most eccentric) of the nurses in the group. Low communality (h^2) is the equivalent measure in Q factor analysis.

"major findings" which the authors report.

A question arises, however, as to how major the findings really are. In the first place, the response categories (role, diagnostic, character, and conflict) are only logical distinctions whose existence or not is merely verified by the data. That a nurse may react in a characteristic fashion to most patients but atypically to some, for example, is a categorical distinction, as is the possibility that some patients may induce the same general set of feelings from all nurses whereas others may induce atypical feelings because of their specific illness: A senile patient induces motherliness, a pathological murderer caution. These will be recognized as the kinds of general propositions which are given Fisherian representation in Q methodology (Stephenson), as exemplified in Table 3. Hence (ac) is Whyte et al.'s

Table 3
STRUCTURE OF NURSE RESPONSES

Effects	Levels	
Origin of feelings	(a) nurse projected	(b) patient induced
Reactions	(c) typical	(d) atypical

character response, (ad) their conflict response, and (bc) and (bd) their role and diagnostic responses, respectively. These, then, are not operant categories which emerge naturalistically from the data, but apriori logical categories whose frequency of occurrence (or absence) is merely determined by counting nurse responses which fit the definition.

The nurses in Whyte's study merely checked yes to existent feelings; the raw data matrix is therefore binary in nature, and Q analysis (Atkin) uses only the yes responses while ignoring the no responses.[3]

3. As Atkin (1975) once said in response to a review of his book, "I believe that the data of science,

Dichotomized data of this kind is relatively primitive compared to Q sort data, which uses the entire array, negative as well as positive, but they can still be correlated (ϕ) and factor analyzed. The Q-factor results for the same patient as in Tables 1 and 2 are shown in Table 4 where we see that eccentric nurse 3 (*supra*) is not alone in her eccentricities but shares them with nurse 7 in particular, and to some degree as well with those nurses with mixed loadings.

Table 4
OPERANT FACTORS

Nurses	Rotated A	B
1	(67)	33
2	(52)	(57)
3	21	(57)
4	(72)	33
5	(89)	23
6	(77)	37
7	26	(77)
8	(72)	(50)
9	(91)	29
10	(50)	(75)
11	(92)	18

Significant loadings in parentheses.

The dichotomized raw data are crude, as mentioned, and so the factor scores contain many ties, but even so two interesting and distinct pictures emerge (normalized scores to the right of each item for factors A and B, respectively):

helpful	1.33	2.09	receptive	1.33	-0.01
sympathetic	1.33	2.09	motherly	1.33	-0.01
tired	-0.80	2.09	interested	1.33	-0.01
enthusiastic	1.33	-0.69	strong	0.59	-0.69

Both factors regard themselves as helpful and sympathetic, as nurses are trained to be as a matter of role, but factor B is tired whereas A feels enthusiastic and strong which suggests a difference in energy level, and this is perhaps the key. It would be worth knowing whether the nurses on B were older or

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and therefore of all rational analysis, is in fact based on the recognition of set-membership, with its binary yes/no observation" (p. 4). This would appear to rule out Atkin's Q-analysis as a method for the study of subjectivity, since subjectivities seem always to admit of degrees.

had worked a double shift at the time of the study. Whatever the reason, those on A have the resources to be receptive, motherly, and interested, which are more matters of attitude than behavioral role performance. Factor B is not up to this level of investment.

Given the factor scores above, we can ask whether the sympathy and helpfulness a nurse displays as a matter of role requirement is the same when she feels tired (factor B) as when she feels enthusiastic (A)? Stephenson (1953) has said that "running 100 yards is one thing in a race, another when a lion is behind, and still another in a dream" (p. 24n), and so it is with helpfulness. Indeed, we can inquire into the tiredness itself: Is factor B physically tired, or perhaps tired of hearing the senile patient's complaints? The word "tired" can mean many things in singular situations.

This issue is raised since in applications of Atkin's Q-analysis there seems to be an implicit assumption (in practice if not in theory) that one is dealing with unambiguous and context-free "things," even in the realm of human feelings: For Whyte et al., tired = tired and helpful = helpful, and if two nurses check these feelings they are, by definition, q-connected despite the fact that they may have meant quite different things. In short, Atkin's Q-analysis is in the nondynamic and context-free mode of R methodology to which Q methodology stands in stark contrast.

MOVING THE UNIVERSITY BAR

Q-analysis is also non-self-referential as can be shown in terms of Atkin's (1974: 17-21, chap. 7) fictitious problem of whether to move a university's bar from its present position A to a proposed position B. Atkin analyzes the situation in terms of the university's decisionmaking structure, or "political backcloth" (X1 = minor-works finance committee, X3 = landscape committee, X10 = senate, etc.), in terms of university functions with which the committees deal (Y1 = capital expenditure, Y7 = security, Y11 = public rela-

tions, etc.), and in terms of the political actors (P1, P2,...) with memberships on the various committees. Shared-face and components tables can be constructed for all of these and the various q-connections determined, but all is in the objective mode, i.e., is concerned with the structure inherent among objective characteristics. So, too, in Atkin's consideration of the two locations for the bar: Position A is $50m^2$ in floor area, beneath a common room, 500m from the parking lot, etc.; whereas B is $75m^2$, would have to be converted from two seminar rooms, is 600m from the parking lot, etc. All are objective characteristics of the external world.

These are not unimportant considerations to be sure--no one ever said R methodology was unimportant --but the subjectivity at issue is also important and would also have to be contended with, and in this connection we can only imagine what people might say if it were proposed that the bar be moved:

- It certainly would be handy to be able to take a study break without having to walk three blocks to the student center.
- Why not have two bars, one at each location? There are not enough places for rest and relaxation as it is.
- I kind of like the bar where it is. There's lots of tradition there.
- I don't care where they have it as long as they keep the townies out.
- They should save the money that the move would cost and put it into the student scholarship fund.

And so on *ad infinitum*. Q methodology would demonstrate the structure of the subjectivity involved, and these structures would likely be as important to the outcome as any q-connectivities demonstrated by Atkin's Q-analysis.

EPILOG

I first encountered Q-analysis in Peter Gould's paper,

"Q-analysis, or a Language of Structure" (1980), which prompted me to examine Atkin's work. It seemed highly unlikely that two Britishers, Atkin and Stephenson, could invent sophisticated mathematical methods to reveal structure in human affairs and that both would be referred to by the letter Q, yet there be no common roots, but nowhere does Atkin cite Stephenson. Twice I wrote to Professor Atkin stating my incredulity--"It seems odd that two quantitative approaches, both oriented toward the study of structure, and both invented by Britishers could have been labeled 'Q' by accident" (letter to Atkin, November 16, 1981)--and inquiring whether there was some common heritage. There was no response.

Gould was likewise queried, and in a letter dated November 19, 1981, he asserted that "q-analysis, the 'language of structure' written by Ron Atkin, has nothing to do with q-methodology--the q-mode factor analysis advanced by Stephenson." He then continued with the following telling remarks:

> Having taught many varieties of multivariate methods over the past twenty years--including the P, Q, R, S, and T varieties of factor analysis--I must say I can no longer stand up in front of students and teach them with the same sense of intellectual honesty I once had. The "language of structure" of Atkin throws a devastating light on all of these, essentially linear, methods, and I think I would simply point to that very first step in any factor analysis ("straining" the data matrix through a linear filter to get the correlation matrix) as a serious indictment.

Gould is of course unaware that the Q in his string of PQRST techniques, including "q-mode factor analysis," are creatures of Burt and Cattell and have nothing whatever to do with Stephenson's innovation.[4]

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4. Peter is not the only Gould to have erred in this way. Harvard biologist Steven Jay Gould, in his *The Mismeasure of Man* (1981), also was unaware that Q has a methodological foundation independent of the

As Stephenson said, in a letter dated November 30, 1981 (after having seen Gould's comments):

> Gould, and Atkin, learned too late that Cattellian PQRSTs are quite inappropriate for social-structure problems--no one with a proper understanding of what correlation methods demand would have gone ahead, as it seems Gould has done, to apply the methods to geography, ecology and the like. The PQRSTs are not even very suitable for anything! Being categorical. But note also that everything in Atkin is categorical, i.e., in the deductive mode. One would almost think that no one had ever used a microscope, telescope, or other instrumental device to further the course of science!

Consider Gould's "indictment" that factor analysis involves the prior "straining" of the data matrix through the linear filter of correlation. In a purely statistical sense this is of course true, just as telephone systems compress words into electrical impulses, but the impulses are decoded at the other end and are rendered true to life, and the process is so unobtrusive that the two communicating parties are unaware of it. And the same is true in Q methodology: The communicability is compressed into correlation coefficients and factor loadings, but these compressions are unscrambled at the other end and allowed to reemerge and flower in the complexities of the factor score matrix which largely reproduces the complexities that went into it. However applicable Gould's comments may be to the PQRST complex to which he referred, therefore, they are certainly inapplicable to the Q methodology with which we are concerned.

It would be shortsighted to discard Atkin's Q-analysis in the same cavalier way in which Gould throws the baby out with the bathwater by lumping Stephenson with Cattell's PQRST system and dispensing with the entire package as if it were cut from the

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PQRST complex. His realization of this fact is chronicled in *Operant Subjectivity*, 1982, *5*, 77-78.

same cloth. Atkin is an accomplished mathematician whose *Mathematical Structure in Human Affairs* (1974), as Stephenson said in his letter (*supra*), "does for *information*...what our Q does for *communicability*"; moreover, there is much more sophistication in Atkin than in the brief study by Whyte and his associates. In addition, there is much wisdom in Gould's papers as well. Both Atkin and Gould are interested in unveiling inherent structure, and in this respect there is no difference between Stephenson's Q methodology and Atkin's Q-analysis (or R methodology generally, to which Atkin's innovation is q-connected). Where the two are incommensurate is in their subject matters--the structure of objective characteristics in Q-analysis, and the structure of subjectivity in Q methodology. And just as Q methodologists would have to adopt Q-analysis or some variant of it were they interested in examining objective features of the external world, so will Q-analysts such as Atkin and Gould have to abandon Q-analysis and adopt Q methodology should they ever wish to examine subjectivity.

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In the next issue...

A response to the above essay by Professor Peter Gould, Department of Geography, Pennsylvania State University.
