THE QUANTUMIZATION OF PSYCHOLOGICAL EVENTS

William Stephenson
University of Missouri-Columbia

ABSTRACT: There is a growing interest in application of quantum theory to psychology. The opportunity is taken to report the basic postulates involved, from a Q-methodological standpoint. Q is a new use of statistical method, away from statistics for large numbers of cases, to representing, instead, states of feeling for a single case. There is now a subjective science, based on self reflection, and depending only upon everyday cultural communication. The fundamental postulates are outlined. Psychology had to develop its own modus operandi for these developments, leading to formal statements of the quantumization of psychological events in a series of papers, "William James, Niels Bohr, and Complementarity."

Introduction

That quantum theory could apply to psychology was one of Niels Bohr's firmest beliefs (Bohr, 1950). Cyril Burt, in his *The Factors of the Mind* (1940),

---

Author's address: 2111 Rock Quarry Road, Columbia, MO 65201.

Operant Subjectivity, Oct 1988/Jan 1989, *12*(1/2)

was first to observe that quantum mechanics and factor analysis were close twins, fashioned upon the same mathematical formulations, presumably to serve the same fundamental purposes, to fathom nature in physics and psychology alike. The present author introduced a new statistic, a new "probabilistic" called Q-technique, in 1935, which corresponded to that upon which quantum theory is based (that of Max Born, 1927), and continued thereafter to bring quantum theory to bear upon psychology, not as speculation and analogy, but by force of experiment and determination of phenomena particular to psychology. Since 1935 a science for all things subjective has been fashioned, along quantum-theoretical lines. It required solving problems peculiar to psychology--that "consciousness" is a *non-ens*; that *abduction* is a logic for indeterminism; that factor theory had to be changed from a methodology for measuring the capacity of individuals (R) to measuring the *states of feeling* (Q) of "single cases"; that factors could be *operant*; and that theories of *concourse*, as well as of *communication* (as distinct from *information*) had to be developed. In the process a solution was found for Newton's aborted *Fifth Rule* (Stephenson, 1979a), which is for inductive methodology what Newton's other *Four Rules* are for deductive methodology. The author's *The Study of Behavior: Q-technique and Its Methodology* (1953) laid down guidelines for these developments, but it was not until the 1970s that the pieces were in place for accepting quantum theory as the *modus operandi* for a real science of subjectivity. The new science is put into operational form in a series of current papers (Stephenson, 1982, 1983, 1986a, 1986b, 1987, 1988a, 1988b).

In this, the concern was with much more than Bohr's Copenhagen interpretation of quantum phenomena: it meant bringing modern philosophy of science to bear upon psychology, which continues to this day very largely in the classical mode of Newtonian methodology. But it also meant that one could now lay claim to priority for *macroscopic* phenomena as subject to quantum theory (in agreement with suggestions to that effect by Bohr in his time, and by a leading physicist today (Ilya Prigogine)). In this connection it is abundantly clear that any

interpretation of quantum phenomena as depending primarily and crucially upon an *act of observation* (i.e., by intrusion of human conscious activity) is unacceptable. Instead, it is only when *measurements* are made that quantum phenomena appear.

In this connection physicist Fred Alan Wolf, in "The Quantum Physics of Consciousness: Towards a New Psychology" (1985) and in *Star Wave* (1984), makes *consciousness*, and *acts of observation*, the foundations for his proposed application of quantum mechanics to a "new" psychology. He assumes, also, that his is the first attempt to "bring psychology into the light shed by the discoveries of quantum mechanics" (Wolf, 1984: vii).

Since there is a growing interest in quantum theory applications to psychology and philosophy, it is possible to place on record the basic postulates involved. It should be said that I am by training both nuclear physicist and experimental psychologist, assistant to Cyril Burt and Charles Spearman in the formative years of quantum theory in psychology, and that my involvement has been long in the making, for more than 50 years, for justifiable reasons.

Beginnings

The beginnings are in *factor theory*, created by Charles Spearman (1904), which, as Cyril Burt (1940) found, has the same statistical foundations as quantum theory in physics. The present author changed this factor methodology in psychometrics from its classical mode to the modern quantum theoretical mode, by introducing *Q-technique* (Stephenson, 1935, 1936; Burt & Stephenson, 1939), which developed into Q-methodology (Stephenson, 1953). *It was a new use of statistical method, away from statistics of elements that could be made accountable and averaged, to representing probability states of feeling.*

The significance of this step has always been thoroughly misrepresented by my critics, from Burt in 1939 and 1940, to every factor theorist since. In physics it was very different. Max Born performed the same change in physics, upon which quantum theory made its beginnings, and although he faced difficulties in having his ideas accepted, they were

scarcely as onerous as those that have faced Q-technique for 50 years.

Consider Born's insights into the physical principles of quantum mechanics: and I quote from Abraham Pais's authoritative *Inward Bound: Of Matter and Forces in the Physical World* (1986):

> On August 10 [1926] he [Max Born] read a paper before the meeting of the British Association at Oxford in which he clearly distinguished between the "new" and the "old" probabilistics in physics: "The classical theory introduces the microscopic coordinates which determine the individual processes only to eliminate them because of ignorance by averaging over their values; whereas the new theory gets the same results without introducing them at all.... We free forces of their classical duty of determining directly the motion of particles and allow them instead to determine the probability of states. Whereas before it was our purpose to make these two definitions of force equivalent, this problem has now no longer, strictly speaking, any sense." (Pais, 1986: 258)

What confronted Max Born in 1926 faced the present author independently 10 years later, when he wrote a letter to *Nature* (Stephenson, 1935) and developed the new probabilistic in the first volume of *Psychometrika* (Stephenson, 1936).

Classical psychometrics (and factor theory supporting it) had introduced individual processes, as mental tests (of intelligence, personality, etc.) which could be averaged over their values, for example to determine whether boys were superior to girls in this-or-that capability. The emphasis was on large scale sampling, standardization, norms, reliability, etc. Spearman's (and Burt's) factor theory went one step further by determining the capabilities of individual persons in factor terms. It was still classical psychometry, of standardization and norms, in terms of large populations of individuals.

Q-technique changed this, by calling for all measurement to be the same for everyone, as a "forced-distribution." This was achieved, as follows:

	Unpleasure					*Neutral*			*Pleasure*		
Score	-5	-4	-3	-2	-1	0	1	2	3	4	5
Frequency	2	3	5	6	7	7	7	6	5	3	2

(n=53)

Forced-Choice Distribution

Different distributions are used, of course, to serve different needs, but in every particular study, whatever the problem, a "forced-choice" distribution is used, each in quasinormal form, in accordance with a rough use of the "law of error." The mean score on every Q-sort was therefore *zero* (m=0).

This frees the measurement from involvement in capabilities, in norms, in standardization in terms of large samples (the "old" probabilistics). They were not introduced at all. Instead the Q-sort scoring gives descriptions of *probability of states* (the "new" probabilistics), of what *one* particular person, for one particular psychological event (PE) feels as *pleasure-unpleasure* about it.

"Whereas before it was our purpose to make these two definitions equivalent" (Born wrote) was also the purpose of classical factor analysis. Cyril Burt, to the end of his life, believed he had proved this, that Q and R (the individual difference methodology based on large samples of persons) were merely two sides of the same coin (Burt, 1940, 1972). To think so is nonsense; or, as Born put it, "this problem has no longer, strictly speaking, any sense."

What Born had achieved was to give substance to what Einstein had described as a "ghost field" which determines the *probability* for a light-quantum (Pais, 1986: 259). Pais continues:

> Born may not have realized at once the profundity of his contribution.... Much later he reminisced as follows about 1926: "We were so accustomed to making statistical considerations,

> and to shift it one layer deeper seemed to us not very important."

Born indeed may not have realized the profundity of his contribution, but when in 1935 the present author came (by a very different route) to this same conclusion, there was no doubt in his mind about the fundamental nature of the change: his letter to *Nature* in 1935 bears testimony to his excitement. The shift to one layer deeper occurs in Q-methodology when the individual performs several different Q-sorts to describe different aspects of an event: it is these that introduce the "ghost field" of quantum subjectivity.

What corresponds in Q to the "ghost field" in physics is the set of *probability of states* for a "single case," for a set of Q-sorts about a psychological event, performed by the "single case" with respect to that event, with postulates we can proceed to place on record.

Basic Postulates

Niels Bohr believed that there were only two sciences, physics and psychology (Bohr, 1950). We agree. They differ in one fundamental respect, namely, the acceptance of *self-reference* in psychological science. Quantum theory applies to both alike, and has precedence in psychology, not physics (Stephenson, 1983).

The basic postulates in physics are described by Abraham Pais in *Inward Bound: Of Matter and Forces in the Physical World* (1986). Niels Bohr, we are told, "plunged" into quantum theory with two fundamental postulates:

> *First*: an atom has a lowest state of energy (he called it a permanent state, physics now calls it ground state) which, by assumption, does not radiate. (Pais, 1986: 199)

This, according to Pais, is "one of the most audacious hypotheses ever introduced into physics" (p. 199).

> *Second*: higher "stationary states" of an atom will turn into lower ones, such that the energy difference E is emitted in the form of a light-quantum with frequency f given by E=hf (where h is Planck's constant). (Pais, 1986: 199).

This was recognized as important because it offered an explanation for the first time of the spectra of simple atoms.

There are two corresponding postulates in Q-methodology, where the concern is with complex *psychological events* (PE) such as those in which Freud's case "Dora" participated during her analysis (and of course before, in her life experiences), as described in *The Study of Behavior: Q-technique and Its Methodology* (Stephenson, 1953: 97-100, 250-254).

For psychology, the postulates are as follows:

> *First*: any psychological event (PE) can be transformed to "quantumstuff" by a concourse of self-referential statements belonging to the PE.
>
> *Second*: operant factor structure for a PE is subject to Bohr's principle of complementarity, providing *psychological quanta*, the fundamental phenomena in subjective nature.

The first postulate is as audacious as Niels Bohr's. By "quantumstuff" (a term introduced by Herbert, 1985) is meant a collection of self-referential statements belonging to the PE which, as a set, is *meaningless* (corresponding to an atom's lowest state of energy). The second postulate provides for the quantumization of what we call "consciousness" (but which is really merely "communicability"), and has its roots in the "new" probabilistics of Max Born.

A *concourse* is a collection of self-referable statements spoken by the participants in the psychological event (PE). In the example given in the paper "III--Schrodinger's Cat" of the series "William James, Niels Bohr and Complementarity" (Stephenson, 1987) it was a distraught widow who had escaped from her house on fire and who cried "Save my dog!" when the dog was clearly already dead.

The statements were of the kind "Oh! What a terrible thing to have happened!", "What would my poor husband have said!", "Save my dog!"...and so on, hundreds of such in practice, and innumerable in principle (Stephenson, 1978).

This concept of a concourse broaches the "Duplex World" of Heisenberg, who distinguished between "potentials" and "actualities" (Herbert, 1985: 26 gives the story). Concourses, like Heisenberg's "potentials," are tendencies for action, yet such that nothing actually happens. Every concourse is a hotbed of self-referential potentials.

Concourse Theory

My "Concourse Theory of Communication" appeared in *Communication* in 1978, but was written in 1974. It has important features. Like physicist Prigogine (1980) in recent years, I was particularly struck by the complexity of nature:

> We call a crow black, but it is a concatenation of flopping wings, sombre greys, bright sheens, and noisy cawings, in innumerable functions and formations. We call a handshake a greeting; but a hundred gestures, remarks, and acts of recognition mark the occasion. (Stephenson, 1978: 22)

The theory of concourses began with such an observation, that the words we use as *object-terms* (crow, handshake) hide complex behaviors. Similarly for the distraught widow, her self reflections on the fire that destroyed her home had wide ramifications, enveloping hundreds of self-referable statements--apart altogether from the facts of the incident.

There were basic postulates for concourse theory:

> *First*: subjective communication is grounded in statistical quantities of self-referable "statements" about a psychological event.
>
> *Second*: it is assumed, for theoretical purposes, that each "statement" is equally probable a priori, and equipotential a priori.

Third: the concourse is meaningless.

"Statements" are best represented by verbal communication, but there can be concourses of objects, pictures, etc., subject to the above postulates.

Quantumization

In the above context, nothing happens until a measurement is made. This is achieved by Q-technique. When the distraught widow performs Q-sorts to describe various feelings belonging to the psychological event, these, duly factored, provide operant factor structure, inherent in the situation, and the factors are quantumized--they obey Niels Bohr's principle of complementarity (Stephenson, 1986b).

What, exactly, is involved in this result? Why quantum theory? Anyone who glances at the mathematics of quantum physics, such as one finds in Eisberg and Resnick's *Quantum Physics: Of Atoms, Molecules, Solids, Nucleii, and Particles* (1985) would have reason to wonder how psychology could enter into it. The truth is that all quantum experiments are straightforward, about which Herbert, in *Quantum Reality* (1985) has the following to say:

> Today's state-of-the-quantum-art is such that we cannot directly experience quantum reality. All human experiences--or at least all physics experiments--are ordinary, not quantum in appearance. (Herbert, 1985: 57)

He added:

> Quantum reality doesn't show up *directly* in the quantum facts: it comes indirectly out of the quantum theory, which perfectly mirrors these facts. (p. 57)

And then says:

> The simplest conceivable quantum experiment consists of a source of quantumstuff, a quantumstuff detector, plus something to put in between that alters quantumstuff in a systematic way. (p. 58)

What was achieved in the experiment with the widow fits completely into this reality. Her experience is "ordinary," even if terrifying. She is quite unaware of the quantum factorization that is enclosed in her Q-sorting. The quantum reality doesn't show up directly in Q-sorting--no one had ever guessed before that quantum theory would be involved in Q-factor form.

Subsequently, something is introduced by the widow (though she is unaware of it) that alters the quantumstuff systematically, to provide the operant (i.e., natural) factors, in quantum theoretical form; that is, displaying factors in complementarity. If there are three factors A, B, and C, then AB, AC, and BC are subject to complementarity. Nor had anyone guessed that this refers to the reality of her experience.

The concourse has served as a source of quantumstuff. The Q-sorting has been a quantumstuff detector. No one had thought before that the forced-statistical distribution in Q-technique corresponded to Max Born's "new" probabilistics, representing the probability of states, not of individual processes that could be averaged over their values.

The Modus Operandi

But why was quantum theory used?

It began by defining a behavioral segment (Stephenson, 1953), which was represented by J.R. Kantor as a *psychological event* (PE) in the following formulation:

$$PE = C(k,sf,rf,hi,st,md)$$

from Kantor's *Interbehavioral Psychology: A Sample of Scientific Construction* (Kantor, 1959: 16).

Thus, for the widow, lighting the candle that she accidentally knocked over, setting her bed aflame, could be the stimulus function (sf) that set the event on its course. "Save my dog!" could be the desperate response function (rf). Tying up the dog to stop it from getting into bed beside her no doubt had history behind it (hi)...and so on for each function in turn. C symbolizes that the event is interactional, and k that it is unique. Each of the functions can

be represented by one or more Q-sorts, performed by the participant (the widow in our example).

It is a fairly simple matter to describe a chain of causes and consequences in the above manner, and perhaps to represent these by stochastic theory (Markov chains). But the widow was slightly "tipsy." And where does the event really begin? She thought of her deceased husband, wondering what he would have said. The situation is far more complicated than it seems at first sight.

Moreover, though Kantor says it is a *psychological event*, it is so only from a psychologist's standpoint, as he or she is an *onlooker*. It is a very different situation when the *participant* in the event performs Q-sorts, to describe his or her feelings about the event, afterwards. The widow is now in a unique psychological situation, recalling the event, still distraught and disturbed, but able to describe how she felt about this-or-that of the event.

Even these descriptions are ordinary. "What did you feel as you watched the house aflame?" "Describe your feelings as you knocked over the candle." "What was on your mind as you cried 'Save my dog!'"...and so on, for 20 more.

Everything, from beginning to end (except for the use of Q-technique) is in the everyday common language use of the widow. She understands every instruction, every element in the concourse, every Q-sort she performs.

The implications of this are indeed stupendous: there is now possible a science for *common things*, for everyday common communicability, quite separate from that of science since Copernicus and Newton where the concern has been with *uncommon* things, with the "secrets of nature," typified by quarks and antiquarks, electrons, "dark holes," and all else of the nuclear age. *That is, a science based entirely on the self reflection, self reference, of anyone, that requires no norms or standardizations, no reckoning vis-a-vis individual differences, and that evolves from quantumization of everyday psychological experience.*

Fundamentally, of course, the individual belongs to a culture--as our widow belonged to Western culture, subculture Caucasian or the like. The concern, however, is with ostensible learning within a culture,

and *not* with formal learning of substantive knowledge (such as learning arithmetic). The quantum-theoretical approach to everyday life gives substance to Harold A. Innis's *The Bias of Communication* (1951), with which Marshall McLuhan began his adventures into the communicability of the "electronic age" (McLuhan, 1960).

Kantor's PE formulation is for a concrete situation, unique, the functions in interaction, as interbehavior. It is halfway to a quantum-theoretical formulation, and indeed Zimmerman (1982) has called attention to the "harmony" in viewpoint between Kantor's interbehaviorism and quantum-mechanics treatment of causality, probability, and the uncertainty principle, as well as with the inseparability of object and measuring instrument.

Note that the functions sf, rf, hi, md, and st are with respect to what we assume about the real world in which we live--that something began it (sf), and it resulted in such-and-such (rf), under this-and-that conditions (hi, md, st). The Q-sorts performed by the widow cover the same assumptions. But the factors bear no causal relation to these assumptions; they are indeterminate factors of Q-technique.

The Independent Development of Q

In *The Study of Behavior* (Stephenson, 1953), chapter 1 is a "Prolegomena to Q," and on page 28 there is the following reference to quantum theory:

> ...those who have read Sir C. Burt's *The Factors of the Mind* will remember that large sections of it concern logical and methodological issues. These in part seem to be completely up-do-date, with quantum theory and relativity thrown in for our delectation. But more of the argument in this monumental work leans heavily upon nineteenth century thinking. Frequently, the methodological matters to which Burt appeals are unacceptable to present-day thought about them.

I was saying that physics was taking good care of itself by way of quantum theory, and that psychology would have to do the same for itself by factor

theory, which Burt and I knew full well were parallel statistical theories at a fundamental level. It was not enough to speculate with an analogy. Psychology would have to provide its own *modus operandi* for a fully developing general science. One had to determine along the way that indeed two distinct sciences were at issue, as Niels Bohr indicated--one physics, the other psychology. But how did they differ, as fundamental?

The purpose of my *The Study of Behavior: Q-technique and Its Methodology* (1953) was precisely this, to lay down ground rules for a science of subjectivity, science from the standpoint of the subject's own "mind."

In this context I provided, in 1961, my "Scientific Creed" (Stephenson, 1961), stating explicitly that indeterminateness was central to subjective science, and that Newtonian deductivism was no longer acceptable. The creed introduced Charles S. Peirce's abductory inference, up to then ignored because leading philosophers couldn't agree about it. Abduction, indeterminateness, and Q-methodology fitted like glove onto hand. Niels Bohr knew what to expect (wave or particle) but couldn't predict which: a measurement was crucial. And this is the recurrent theme in my "Creed." I write, for example:

> A virtue can therefore be made of the centroid method's indeterminateness *by rotating deliberately so as to bring unexpected but not unsuspected results to light, that is to make discoveries.* (Stephenson, 1961: 10)

And:

> One expected something of the kind, but couldn't predict what precisely.... an explanation can be given only after the facts are observed. (p. 10)

And:

> The emphasis, on scientific work is on operations to provide the facts--such as Q-sorts leading to factors--in which case explanations

> are discoveries and not merely conclusions to deductive inference. (p. 10)

And:

> *The fundamental data are the operations by persons, not operational definitions of self-descriptives.* (p. 14)

Other developments followed, including the paper on the operant nature of factors (Q) (Stephenson, 1970), the solution for Newton's Fifth Rule (Stephenson, 1979a), and communication theory (Stephenson, 1978). Many doctorate students were involved in these advances, from Joye Patterson's *Attitudes About Science: A Dissection* (1967) to Robert W. Kraay's *Symbols in Paradox* (1977). The former exposed C.P. Snow's two-cultures thesis to experimental regard and found it wanting. Kraay's was the first use of Newton's Fifth Rule (other than by myself) to a problem in theology (as the science of religion).

There was the "Burt Affair" in 1978, when Burt was accused of falsifying data on the inheritability of intelligence. Like Spearman, I had taken a very different position about inheritability from that of Burt, and was in no way involved with Burt about this matter. There was a mischievous notion that I was involved indirectly in seeking Burt's downfall because of our controversy, to which I replied as follows:

> Burt, like Spearman, and like the assistant they both inspired, was at the frontier of a research area that embroiled us, and those around us, in exciting possibilities, far outside the pragmatics of psychology and into interesting, scientific procedures concerning the higher mental processes. If we forget the excitement, we forget Burt's humanness and devotion to a profound purpose. (Stephenson, 1979b: 123)

If Burt had malfunctioned, I said, it must have been because he was ill. Without Burt, and Spearman, their assistant could have achieved nothing.

How Quantum Theory Entered Psychology

It is now easy to say that by ignoring all extant knowledge in psychology, we may ask (for the first time) how can psychological experience be made subject to quantum theory? Do the various incidents in the widow's experience resonate, as in David Bohm's theory of physics (1980)? Can each be represented as a wave function, as in Schrodinger's theory of cause and time? Or, with physicist Ilya Prigogine, in *From Being to Becoming: Time and Complexity in the Physical Sciences* (1980), can we have, if not a subjectivistic view of science, one that nevertheless accepts *knowing* as characteristic of life? *Knowing*, that is, as everyday reality, as for the widow who knows about everything she is asked to perform? If Nobel Prize winner Prigogine can accept as much for the physical sciences, is it too much to expect a science of psychology to do the same?

In effect, this is the approach of physicist Fred Alan Wolf in his *Star Wave* (1984), whose Preface captures the spirit of our own adventures for 50 years to use quantum theory to investigate the mind itself. Unhappily, Wolf believed that his is the "first attempt to bring psychology into the light shed by the discoveries of quantum physics" (Wolf, 1984: vii).

Unhappily, too, Wolf continues the mystification of quantumization with such conclusions as "that the future is more important than the past in deciding the present"; that "the future already exists while the past is continually being re-created"; that "evolution is a consequence of the future and not of the past." This is astrology *ignotum per ignotius*--the unknown explained by the still more unknown. Quantum theory as Niels Bohr understood it has no such implications.

However, Wolf correctly observes that *time* is largely an illusion (like the "consciousness" he accepts), and that *creativity* is somehow tied to quantum theory. But that is to a "specious present," an *event* known to psychology since James Ward wrote of it in 1881, and that sees its substantiality in Niels Bohr's version of quantumization, as requiring *measurement*, i.e., instrumentation, as the *modus operandi*. The subject is dealt with in "William James,

Niels Bohr, and Complementarity: IV--The Significance of Time" (Stephenson, 1988a).

One was saved from Wolf's misadventure into the future by researches that had to solve current problems before one could make a quantum analogy into a quantum reality. In 1930 there were few who were prepared to call consciousness a fiction, and when they did (as with the behaviorist Watson) they fell into another trap, that of determinism and positivism. It was Karl Pearson's thesis, we remember, that *instrumentation* is the *sine qua non* of science; but his was for reasons of objectivism and determinism, not of quantum theory and indeterminism. Charles Spearman, Cyril Burt, L.L. Thurstone and psychometrics to this day followed the Pearsonian way, and it was against this that Q had to make its own way, for what seemed intractable problems of logic, of the substantiality or not of *consciousness*, of theory of *communication* as distinct from that of *information*, of the *operant* nature of Q factors and *concourse* theory.

Quantum theory had been "on my mind" since 1938, but by 1980 there were excellent books on the subject, in particular one could value Alastair I.M. Rae's *Quantum Mechanics* (1980). On page 210 of the second edition (1986) there is a summary of what he believed to be at issue. The indeterministic nature of the theory was emphasized:

> By this we mean that there are some physical measurements whose outcome is not uniquely determined by the state of the system beforehand.

Nothing more succinct can be written about psychological measurements using Q-technique in the framework of J.R. Kantor's formulation for a psychological event (PE), upon which Q-methodology is fashioned.

The mechanism at issue is referred to by Rae as a "reduction," that is...

> when a measurement is made of some property of a quantum mechanical system, the wave function changes from what it was before the measurement was carried out to become an ei-

> genfunction of the operator representing the measurement. (Rae, 1986: 211-212)

Nothing again more succinct could be written about what happens when the distraught widow performs a set of Q-sorts to bear upon different reflections about her experience--they change from the "forced distribution probability" for pleasure-unpleasure, to a "ghost field" of quantumization, an eigenfunction of the operator (the widow herself) representing the measurements.

There follows from Rae the following:

> A problem arises when we ask at what point in time this reduction takes place, and what exactly is meant by a measurement in quantum mechanics. (Rae, 1986: 212)

This, however, did not require the presence of a personal human observer: an alternative interpretation was that...

> ...the wave function is reduced, and the measurement performed, when the fact is registered on some counter or other recording equipment. (Rae, 1986: 212)

Nothing against could better demonstrate the truth of this than my example of Virginia Woolf's *Orlando* (1928) (Stephenson, 1982b). The novel was autobiographical, with literary license. Orlando experiences many events during his/her lifetime, from being a youthful courtier at the court of Queen Elizabeth I three centuries ago, to being a married woman (she had changed sex along the way) on Oxford Street in London on October 11, 1928. Any event could be represented by a Q-sort. Two possibilities existed for Virginia Woolf. She could have done the Q-sorts when the events occurred, at the Court of Queen Elizabeth I, in Turkey when he became a gipsy woman, in London at the time of Queen Charlotte, again when Queen Victoria reigned, and again in Oxford Street, London, October 11, 1928. Each would be a record, *on paper*. Or, again, she could have performed all of the Q-sorts on October

11, 1928. Again they would be for Q-sort data, *on paper*.

The "reduction" takes place when these *records* are factored (Q). They are factored on a computer. And the factors are quantumized, in complementarity, as Niels Bohr held for physics. The factors are also *decision structures* (Lasswell, 1964) pointing to the future. But the future is also indeterminate, and only good luck may fashion an apparent determinate outcome.

The Outcome

So ends the beginning. By the 1970s the psychological pieces were in place for acceptance of quantum theory as the foundation of psychological science, as subjective science. "Cyril Burt, Quantum Theory, and Q" (Stephenson, 1981) gives credit to Burt, and concludes as follows:

> It was only late in the 1970s that I could satisfy myself about the pragmatics of quantum theory in subjective science.... it required the putting together of communication theory, concourse theory, the operantcy of factors, and Newton's Fifth Rule, to make tangible what had previously been mainly an exciting analogy between physics and psychology, for matter and mind. (Stephenson, 1981: 132)

An article by Donald Zimmerman entitled "Quantum Theory and Interbehavioral Psychology" (1979) opened the door for my next contributions, in support of this thesis. Zimmerman wrote as follows:

> The quantum mechanics treatment of causality and probability, the status of the uncertainty principle, and the inseparability of object and measuring instrument,...are harmonious with J.R. Kantor's ideas on interbehavior early in this century. Insights from interbehavioral psychology, moreover, throw light upon unresolved issues in quantum theory related to the role of the observer in measurement. (Zimmerman, 1982: 235)

All of this was fully "on line": I had identified with Kantor's interbehaviorism since 1933, as *The Study of Behavior* tesifies abundantly. Zimmerman attended particularly to questions concerning the concept of "universes" in psychology and opened the door for me to develop the quantum mechanics treatment of causality, probabilities, etc.

I began with "Q-methodology, Interbehavioral Psychology, and Quantum Theory" (Stephenson, 1982a), drawing attention to the quantum-mechanical features of Q-technique, and giving the reminder that *quantum theory applies to states of matter, not to individual observables in the states* (p. 237). Attention was given, particularly, to the change in causal explanations, as in the following statement:

> Cause and effect explanations...are replaced in Q by the unpredictable, quantumized effects of factor theory, where the outcome is self-reference. Operant factors in Q, unknown to anyone beforehand, are nevertheless recognized as self-referent when the factors are shown to the Q-sorter. (Stephenson, 1982a: 244).

This was not a matter of getting facts first, and then seeking explanations for them. Nor was it a return to Baconian inductivism, of proceedings from observations and experiments to the formation of theories. Instead, something of nature emerged, as self references, in complex functional relation to the behavioral segments at issue (Stephenson, 1982a: 245). Operant factor structure was indicative of inherent, natural form of the mind (so-called):

> There is form in subjectivity, therefore, in relation to feeling and self-reference, comparable fundamentally to the fermion and boson of nuclear theory (Handler Report, 1972), also to form in biology (the horns of antelopes, the convolutions of sea shells, the shapes of leaves, as in D'Arcy Thompson's *Growth and Form*, 1946). (Stephenson, 1982a: 246)

In the article references are made to the quantum-theoretical aspects of factor theory. The purpose

was to introduce matters in relation to *concourse theory* (p. 238), *consciring* (p. 240), and to the fundamental premise that quantum theory applied to the Kantor formulation for a *psychological event* (PE) only when his classical functions were replaced by Q-sorts.

Then followed the series of papers which develop my own treatment of Niels Bohr's quantum theory, beginning with "William James, Niels Bohr, and Complementarity: I--Concepts" (Stephenson, 1986a), and "William James, Niels Bohr, and Complementarity: II--Pragmatics of a Thought" (Stephenson, 1986b). William James was first to recognize that transitory thought and its substantive representation (as print, written matter, speech, etc.) were in a complementarity relationship. I was able to add that every transitory thought itself is subject to complementarity ("Pragmatics of a Thought").

(It has to be remembered that "thought," like "consciousness," is a *non-ens*--all is communicability, but it remains convenient to keep William James, and James Ward, in their own contexts.)

There followed Part III of the series, "Schrodinger's Cat" (Stephenson, 1987) in which the mystification of the cat was resolved as substantive thought, to which quantum theory doesn't apply at all. Replaced by the problem's transitory counterpart, the problem is at once solvable in Q-methodological terms.

Then Part IV, "The Significance of Time" (Stephenson, 1988a), in which it appears that time's significance is its insignificance. The "new" physics of David Bohm and Ilya Prigogine concentrated on *time* in order to try to find a determinate cause for the indeterminacy of quantum theory--a life-long wish expressed by Einstein. It doesn't "work" to explain quantumization.

Then Part V, "Phenomenology of Subjectivity" (Stephenson, 1988b) in which Husserl's phenomenology is shown to have rich correspondances to Q-methodology and quantum theory.

These papers must be allowed to speak for themselves. Meanwhile there has indeed been fashioned a basis for a science for all psychological events, for all that is subjective. One is disposed to say that,

with inspiration from Charles Spearman and Cyril Burt, *veni, vidi, vici.*

References

Bohm, D. (1980) *Wholeness and the implicate order.* London: Routledge & Kegan Paul.

Bohr, N. (1950) On the notions of causality and complementarity. *Science, 111,* 51-54.

Born, M. (1927) Report of British Association for Advancement of Science. *Nature, 119,* 354.

Burt, C. (1940) *The factors of the mind.* London: University of London Press.

Burt, C. (1972) The reciprocity principle. In S.R. Brown & D.J. Brenner (Eds.), *Science, psychology, and communication: Essays honoring William Stephenson* (pp. 39-56). New York: Teachers College Press.

Burt, C. & W. Stephenson (1939) Alternative views on correlations between persons. *Psychometrika, 4,* 269-281.

Eisberg, R. & R. Resnick (1985) *Quantum physics of atoms, molecules, solids, nuclei, and particles.* New York: John Wiley.

Herbert, N. (1985) *Quantum reality: Beyond the new physics.* Garden City, NY: Anchor Press /Doubleday.

Innis, H.A. (1951) *The bias of communication.* Toronto: University of Toronto Press.

Kantor, J.R. (1959) *Interbehavioral psychology: A sample of scientific system construction.* Bloomington, IN: Principia Press.

Kraay, R.W. (1977) Symbols in paradox: A theory of communication based on the writing of Mircea Eliade. (Dissertation, University of Iowa, 1977). *Dissertation Abstracts International, 38,* 1720A. (University Microfilms No. 77-21146)

Lasswell, H.D. (1964) *The future of political science.* New York: Atherton Press.

McLuhan, M. (1960) *Explorations in communication* (with C.S. Carpenter). Boston: Beacon Press.

Pais, A. (1986) *Inward bound: Of matter and forces in the physical world.* Oxford: Clarendon Press.

Patterson, J. (1967) Attitudes about science: A dissection. (Dissertation, University of Missouri,

1966). *Dissertation Abstracts, 27,* 2492A. (University Microfilms No. 67-926)
Prigogine, I. (1980) *From being to becoming: Time and complexity in the physical sciences.* New York: W.H. Freeman.
Rae, A.I.M. (1986) *Quantum mechanics* (2nd ed.). Bristol: Adam Hilger.
Spearman, C.E. (1904) General intelligence objectively determined and measured. *American Journal of Psychology, 15,* 201-293.
Stephenson, W. (1935) Technique of factor analysis. *Nature, 136,* 297.
Stephenson, W. (1936) The foundations of psychometry: Four factor systems. *Psychometrika, 1,* 195-209.
Stephenson, W. (1953) *The study of behavior: Q-technique and its methodology.* Chicago: University of Chicago Press.
Stephenson, W. (1961) Scientific creed--1961. *Psychological Record, 11,* 1-25.
Stephenson, W. (1970) Factors as operant subjectivity. In C.E. Lunneborg (Ed.), *Current problems and techniques in multivariate psychology: Proceedings of a conference honoring Professor Paul Horst* (pp. 33-48). Seattle: University of Washington. (Reprinted: *Operant Subjectivity, 1,* 3-16)
Stephenson, W. (1978) Concourse theory of communication. *Communication, 3,* 21-40.
Stephenson, W. (1979a) Comment: Q-methodology and Newton's Fifth Rule. *American Psychologist, 34,* 354-357.
Stephenson, W. (1979b) Observations on Sir Cyril Burt and "The Burt Affair." *Operant Subjectivity, 2,* 110-123.
Stephenson, W. (1981) Cyril Burt, quantum theory, and Q: Historical note. *Operant Subjectivity, 4,* 120-134.
Stephenson, W. (1982a) Q-methodology, interbehavioral psychology, and quantum theory. *Psychological Record, 32,* 235-248.
Stephenson, W. (1982b) Newton's Fifth Rule and Q methodology: Application to self psychology. *Operant Subjectivity, 5,* 37-57.
Stephenson, W. (1983) Quantum theory and Q-methodology: Fictionalistic and probabilistic theories conjoined. *Psychological Record, 33,* 213-230.

Stephenson, W. (1986a) William James, Niels Bohr, and complementarity: I--Concepts. *Psychological Record, 36,* 519-527.

Stephenson, W. (1986b) William James, Niels Bohr, and complementarity: II--Pragmatics of a thought. *Psychological Record, 36,* 529-543.

Stephenson, W. (1987) William James, Niels Bohr, and complementarity: III--Schrodinger's cat. *Psychological Record, 37,* 523-544.

Stephenson, W. (1988a) William James, Niels Bohr, and complementarity: IV--The significance of time. *Psychological Record, 38,* 19-35.

Stephenson, W. (1988b) William James, Niels Bohr, and complementarity: V--Phenomenology of subjectivity. *Psychological Record, 38,* in press.

Wolf, F.A. (1984) *Star wave: Mind, consciousness, and quantum physics.* New York: Macmillan.

Wolf, F.A. (1985) The quantum physics of consciousness: Towards a new psychology. *Integrative Psychiatry, 3,* 236-242.

Woolf, V. (1928) *Orlando: A biography.* London: Penguin Books.

Zimmerman, D.W. (1979) Quantum theory and interbehavioral psychology. *Psychological Record, 29,* 473-485.

Zimmerman, D.W. (1982) The universe--an unscientific concept. *Psychological Record, 32,* 337-348.