From: Oshins, E. (1991). About models and muddles, part I: Why Brown's *Laws of form* and Pribram's "hologram hypothesis" are NOT relevant to quantum physics and quantum psychology. In Manthey, M. (ed.), *Alternatives in physics and biology*. London: Alternative Natural Philosophy Association.

Appendix IV: Schwinger Quantization for Incompatible Discriminations

Operationally, quantum physics has shown that there is an empirical difference in coding between (Oshins 1984a, 1989a,b, 1990; Schwinger, 1970, esp. pp. 27-28): (1) forming a class (ensemble) of possible states (subensembles) which are discriminated according to some specific attribute (eg. subensembles having either predicate-A or incompatible/complementary predicate-B) and (2) forming a class (ensemble) of possible states (subensembles) which are not empirically distinguishable according to such a predicate – ie., there is no empirical procedure that discriminates between the alternative, possibly incompatible/complementary predicates). This is true even if no member of the class is distinguished or separated out, as long as, operationally, one could be.

Schwinger (Ibid.) introduces the following "measurement symbol" notation for a "selective measurement": $M(b')$. This represents a projection operator that accepts systems possessing the value b of the property B and rejects all others. As a projector $M(b')$ satisfies the properties: $M^{\dagger}(b')\, M(b') = M(b')\, M^{\dagger}(b') = M(b')$ and $M^{\dagger}(b') = M(b')$, ie. they are normal, idempotent and Hermetian. In addition, he introduces the following "measurement symbol" for a "non-selecting measurement" that does not even discriminate between the b′ alternatives:

$$\text{Non-discriminating Measurement: } I = \sum_{b'} M(b')$$

Here we have no operationally meaningful way of saying that a measurement had even taken place. Thus the non-discriminating measurement acts as if no measurement had even taken place. Within the Hilbert space, one would apply Dirac's principle of linear superposition of states and take their span which corresponds to the projection operator of the entire space, ie. the identity operator $\mathbb{I}$. On the other hand, for an alternative that could in principle be discriminated, even though one is not selected, Schwinger introduces a different measurement symbol:

$$\text{Discriminating, but Non-selecting Measurement: } M_b = \sum_{b'} e^{i\varphi_{b'}} M(b')$$

The random phases $\varphi_{b'}$ separate the previously coherent sectors into superselected sectors. It is easy to show that the elementary selective measurement symbols (projectors) obtain from the non-selective measurement symbols by replacing all but one of the phases by positively infinite, imaginary numbers, thereby rejecting all but one of the subensembles.

The road to quantization is easy: As Schwinger shows (1970) the for compatible projection operators $M_{b'}$ and $M_{b''}$ the product of the projectors yields a delta function $\delta(b',b'')$ times a projector. Without getting to caught up in the formalism, for

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noncompatible measurement symbols dealing with *complementary* attributes one obtains a Dirac bracket $\langle b'|c''\rangle$. One can then show Schwinger's "Action Principle" that the variation of a bracket connecting two space-like surfaces σ_1 and σ_2 is proportional to the expectation value of the variation of the Action (or integrated Lagrangian density) between these two space-like surfaces:

$$\delta \langle \sigma_1 | \sigma_2 \rangle = \langle \sigma_1 | \, \delta \left\{ \frac{2\pi i}{h} \int_{\sigma_2}^{\sigma_1} (dx) \, L[\chi(x)] \right\} | \sigma_2 \rangle$$

Oshins (1989a,b) has suggested a possible psychological example which might carry this same type of representational alternatives. Consider the difference between saying a person (= a "male or female", if distinguished) came into the room and saying that a "male" or a "female" came into the room (distinguishing gender as opposed to a different, competing context). Of course, the existence of complementary, competing construct attributes is an empirical issue. Other possible complementary alternatives might involve a meta-choice between, say, the good/bad-attribute-dichotomy and the love/hate-attribute-dichotomy. See also, Bohr (1987/1954, p. 81) regarding "justice and charity" and Heisenberg (1958, p. 179) regarding "enjoying music and analyzing its structure." The existence of two operational ways to code "nonselecting measurements" became a foundation for Oshins' "quantum psychology" approach (Op.Cit.).