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On the Nature of Relationships Involving the Observer and the Observed Phenomenon in Psychology and Physics

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A framework for psychology and physics is developed with the construct of *situation*—based on the indivisible and immediate relationship between an observed phenomenon and the observer of this phenomenon—as its foundation. Particular expressions of the objective view, the strength of which is reflected in the traditional assumption of a fundamental isolation between psychology and physics, are discussed. Contemporary dilemmas arising from the maintenance of this view are presented. These dilemmas are resolved by a thoroughly related structure in which situations are themselves related to one another, most importantly, in a simultaneous manner. It is proposed that empirical study in physics and psychology inherently involves theoretical circumstances that must be explicitly understood.

In the following paper a framework applicable to both physics and psychology is developed. The fundamental isolation traditionally assumed in considering these disciplines is reflective of the fundamental isolation with which the respective phenomena in each discipline have generally been considered. In the classical conception of physical phenomena, such phenomena are viewed as uninfluenced in their nature by the individual observing them. Many assumptions accompany this classical view, notably the assumptions that a particular phenomenon is singular in nature and yields but one truth regarding this nature. In their attempt to establish psychology as a discipline distinct from other sciences, psychologists have in general resisted attempts to reduce completely psychological phenomena to phenomena characteristic of the other sciences. Yet in their attempt to gain acceptance from established sciences, psychologists have adopted the major metaphysical and epistemological assumptions of other disciplines, notably classical physics.

The proposed framework for psychology and physics is based on *situation*. Situation is founded on the immediate and indivisible relationship between an observer of some phenomenon and this observed phenomenon. The

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above points are reviewed in this paper through discussion of particular issues in both physics and psychology. In physics, the development of quantum mechanics is explored; in psychology, the reflection of the classical laws of motion in psychotherapeutic theory and the concepts of mental health and illness are discussed. For each discipline, a model is outlined based on situation that resolves a fundamental dilemma. First, historical background regarding the development of quantum mechanics will be provided that will allow the dilemma in physics posed by Heisenberg's uncertainty principle to be clearly seen.

Physics

The Development of Quantum Mechanics

Physical phenomena traditionally considered in terms of waves (e.g., light) are found to act like particles in some circumstances, and physical phenomena traditionally considered in terms of particles (e.g., the electron) are found to act like waves in some circumstances. The foregoing is an essential understanding of quantum mechanics. In quantum mechanics, the mechanism for the transformation of a wave conception of some physical phenomenon (e.g., light or the electron) to a particle conception of this same phenomenon is through the concept of quantum. Quantum carries the sense of being a particle in that it is a discontinuous quantity, and it carries the sense of being a wave in that it is only a quantity of energy.

The understanding of quantum mechanics noted above arose out of experimental and theoretical work in physics in the last two decades of the nineteenth century and the first three decades of the twentieth century (Hanson, 1967). The work in these decades demonstrated, for example, that the traditional conception of light as electromagnetic waves was insufficient to explain the photoelectric effect. The photoelectric effect is concerned with the release of electrons from a metal surface when this surface is exposed to light. In investigating this effect, it was found that the kinetic energy of each of the emitted electrons did not increase when the intensity of the light of a particular frequency was increased. Rather, it was found that the kinetic energy of each of the emitted electrons was constant in these circumstances. A wave theory would presume a continuous nature for the light with the result that the intensity of the light would be expected to correlate positively with the kinetic energy of each of the emitted electrons. A particle theory of light, though, could explain this feature of the photoelectric effect. This particle theory views the intensity of light at a particular frequency as positively correlated to the number of discrete packets of energy impacting the metal surface. The feature of the photoelectric effect that appeared so peculiar from a wave standpoint can be explained within a particle framework if the following assumptions are made. First, the energy of each of the discrete packets of light (i.e., light quanta) is dependent on the frequency of the light. Second, the impact of a single one of these discrete packets of light is sufficient to release an electron from the metal surface with an amount of energy related to the energy of the light quantum that impacted it. It was Einstein who suggested this solution to the problem of the photoelectric effect, and subsequently, his position was experimentally verified (Einstein and Infeld, 1966; Hanson, 1967; Heisenberg, 1958).

From the side of matter, it was proposed by Bohr that an electron, traditionally considered a charged particle in orbit around a nucleus, has only certain possible orbits. Thus, the movement of an electron from one orbit to another involves only prescribed and discontinuous amounts of energy (i.e., particular quanta of energy). The manner of the discontinuous and prescribed possibilities for the motion of an electron in orbit could not be explained simply in terms of the classical laws of motion. De Broglie, though, could explain this phenomenon by ascribing wave properties, in the form of guide waves, to the electron. The idea of these wave properties of the electron was further developed by Schrödinger. Experimental evidence finally demonstrated the validity of de Broglie's idea when Davisson and Germer of the Bell Telephone Labs demonstrated that a beam of electrons reflected from a crystal produced a diffraction pattern, a basic characteristic of wave motion (Gamow, 1958).

Thus, physicists were developing a picture of physical reality that contradicted the classical distinction between particles and their characteristics on the one hand and waves and their characteristics on the other: the same physical phenomenon was exhibiting characteristics of both particles and waves depending on the circumstances in which the phenomenon occurred. It was in this dilemma that Heisenberg proposed his principle of uncertainty in which both particle and wave conceptions of physical phenomena were correct but limited in their application. The principle of uncertainty states that as the latitude becomes smaller regarding an observer's understanding of some physical phenomenon from either the wave conception or the particle conception, the latitude regarding the observer's understanding of this same physical phenomenon from the other conception becomes greater (Bohr, 1935; Hanson, 1967). For example, if an observer is concerned with locating the position of an electron in space, the latitude involved in a measurement of this position becomes smaller as the observer is willing to accept an increased latitude in his or her knowledge of the wavelength of the electron. On the other hand, if an observer is concerned with identifying the wavelength of the electron, the latitude in measuring this wavelength becomes smaller as the observer is willing to accept an increased latitude in his or her knowledge of the position of the electron.

Thus, Heisenberg could preserve a form of objective independence from the observer for both the particle and wave properties of physical phenomena through his development of the reciprocal limitation that each conception has on the other. These reciprocal limitations always involve a certain amount of uncertainty in the observer's knowledge of some physical phenomenon.

Though Heisenberg's principle of uncertainty has been greatly debated by physicists, there has to this point not been any better alternative to his resolution of this paradox of modern physics. Such an alternative follows.

Simultaneous Situations

Heisenberg's uncertainty principle, as well as the classical physics that the principle seeks to preserve, are both founded upon a fundamental assumption noted by Heisenberg (1958). In discussing the wave and particle conceptions of physical phenomena, he wrote:

> The two pictures [the wave and particle pictures] are of course mutually exclusive, because a certain thing cannot at the same time be a particle (i.e., substance confined to a very small volume) and a wave (i.e., a field spread out over a large space), but the two complement each other. (p. 49)

The manner in which wave and particle conceptions complement each other is given by the uncertainty principle.

Thus, though Heisenberg brought the influence of the observer into the understanding of physical phenomena, he stopped short of fully appreciating the indivisible and immediate relationship between the observer of some physical phenomenon and this observed physical phenomenon. In this conception, Heisenberg, like the classical physicists, did not conceive of a single physical phenomenon being simultaneously expressed in two distinct, nontransformable manners. A conception of a physical phenomenon as capable of being simultaneously expressed in two distinct, nontransformable manners leads to a full appreciation of the indivisible and immediate relationship between the observer and the observed physical phenomenon. Each distinct, nontransformable expression of the phenomenon is correlated with and immediately and indivisibly related to a distinct, nontransformable stance on the part of the observer. Thus, simultaneous situations regarding a physical phenomenon occur. This notion supersedes Bohr's idea of complementarity in that relations between expressions of a physical phenomenon and the approaches of the observer to this phenomenon are themselves fundamentally related to one another. This fundamental relation among relations unifies situations and expressions of a physical phenomenon in those situations.

Bohr (1935) used the term complementarity to refer to: (1) the fundamental relation in quantum mechanics between the physical phenomenon studied and the experimental arrangements used to study this phenomenon; and (2) the combination of the various relations to account for classical physical description. Each relation, though, was considered by Bohr to be fundamentally isolated from the other. Bohr (1935) wrote:

> In fact, the renunciation in each experimental arrangement of the one or the other of two aspects of the description of physical phenomena,—the combination of which characterizes the method of classical physics, and which therefore in this sense may be considered as *complementary* to one another,—depends essentially on the impossibility, in the field of quantum theory, of accurately controlling the reaction of the object on the measuring instruments, i.e., the transfer of momentum in case of position measurements, and the displacement in case of momentum measurements. (p. 699)

The fundamental relation among relations presently proposed implies that, contrary to Bohr's idea, each experimental arrangement does not result in the *renunciation* of one of two aspects of the description of physical phenomena. Rather, a concrete experimental arrangement may be viewed in such a manner that either of two aspects of the description of physical phenomena may be measured. Consider an example given by Bohr (1958) in which an experimental arrangement consists of a diaphragm with a slit rigidly fixed to a support. According to Bohr, the determination of the position of an electron is facilitated by this arrangement, but the accuracy in the determination of the momentum of the electron is reduced due to the rigid connection. In a reciprocal fashion, according to Bohr, an arrangement where the diaphragm is connected, but not in a rigid manner, to its support (e.g., by a theoretically completely flexible set of springs) facilitates the determination of momentum; the accuracy with which position may be determined is reduced due to the necessity of considering the diaphragm in this circumstance in terms of the uncertainty principle. In the proposed model, given a particular, concrete experimental arrangement, the facilitation in the determination of a particular attribute and the reduction in accuracy in the determination of another attribute depends on the basic nature of the *theoretical structure of the encompassing arrangement in which the concrete arrangement exists and the relation of this theoretical structure to the concrete arrangement*. There are four possibilities using Bohr's concrete experimental arrangement. If the basic nature of an encompassing theoretical support structure is one of rigid connection between this support and the concrete support, and the diaphragm is rigidly connected to its support, the determination of position is facilitated by the concrete arrangement. If the connection between the theoretical support and the concrete support is rigid, and the diaphragm is flexibly connected to its support, the determination of momentum is facilitated. If, on the contrary, the nature of the theoretical structure is one of a completely flexible connection between this structure and the concrete support, and the diaphragm is rigidly connected to its support, the concrete arrangement facilitates the determination of momentum. If the theoretical support and the concrete support are flexibly connected, and the diaphragm is flexibly connected to its support, the determination of position is facilitated. In this last case, the transfer of momentum from the electron to the diaphragm would be lost in the connection between the completely flexible diaphragm and the completely flexible concrete support.

Einstein, Podolsky, and Rosen (1935) demonstrated that quantum mechanics predicts the possibility of a correlation between two physical events such that there is no possibility of this correlation being mediated by any known physical phenomenon (including light). Physical events in this circumstance are termed space-like separated events. Bohr (1935) noted an "essential ambiguity" (p. 697) in their argument, this ambiguity reflected in their criterion of reality that a prediction can be made with certainty regarding the value of a physical quantity without in any way *disturbing* the system. In quantum mechanics, Bohr responded, the relation between the system studied and the experimental arrangement is fundamental, and the prediction of the value of a physical quantity is *influenced* by this relation. Einstein et al. (1935) did not clearly state how their criterion of reality is to be applied to this influence. Bohr's response, though, does not resolve the paradox posed by Einstein. In settling for the essential isolation of each complementary relation, he believed the occurrence of space-like separated events goes beyond the bounds of quantum mechanical explanation. In this historical context, the significance of the present proposal that a fundamental relation among situations exists (specifically, that there are simultaneous situations) may be seen. Each set of events noted by Einstein is a set of nontransformable expressions of physical phenomena, and their space-like character occurs *only* in the application of different experimental arrangements. The concept of space-like separated events implies the existence of simultaneous situations with the notion of immediacy as the structure in which events in each situation are related. In the notion of immediacy, there is the further implication that time and space are characterized by mutual inclusion as opposed to the traditionally held mutual exclusion among identical instants and points. In contrast to Heisenberg's and Bohr's limitation on understanding a physical phenomenon simultaneously as both particle and wave, the quantum in the proposed model is provided its natural basis as the simultaneous expressions of both formulations.

Psychology

The Classical Laws of Motion

The conceptual evolution of quantum mechanics in physics has been matched by a similar evolution in psychology. This evolution in psychology is presented here through its expression in the particular areas of psychotherapy and mental health and illness. Psychotherapy is based on the concept of change. Whatever the theoretical orientation (be it orthodox analytic, dynamic, client-centered, systems, or behavioral), psychotherapeutic change is directly reflective of the classical laws of motion developed by Newton (1687/1846) in the seventeenth century.

In the *Principia*, Newton (1687/1846) stated the three laws of motion as follows:

> (1) Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon.
>
> (2) The alteration of motion is ever proportional to the motive force impressed; and is made in the direction of the right line in which that force is impressed.
>
> (3) To every action there is always opposed an equal reaction: or the mutual actions of two bodies upon each other are always equal, and directed to contrary parts. (p. 83)

The first law is the law of inertia. In part, it states that a body remains at rest or moves at a constant velocity in the absence of some external force exerted upon this body. The second law gives the manner of relation of an external force exerted upon a body and the resultant change in its velocity (i.e., its acceleration). The second law may be stated as the equation: force = mass × acceleration. Force refers to an external force applied to a body, and mass and acceleration refer to characteristics of this body in motion. The third law states that the application of an external force upon an object is always met by an equal force exerted through this object in the opposite direction. This law may be stated: force = –force.

It may be seen that these three laws are all conceptually necessary for constituting the classical view of physical phenomena. The law of inertia is the necessary initial basis of stability and constancy from which to describe the change that occurs to the motion of a body when an external force is applied to it. The equation, force = mass × acceleration, describes this change in the motion of the body in terms of its mass and the external force applied to it. Finally, the third law provides the necessary structure to maintain the integrity of a system that is in change when the external force applied to a body occurs through contact with another body. The terms "force" and "equal and opposite force" of the third law may be manipulated through use of the second law to conclude that the total momentum of the system remains constant. The momentum of a body is its mass multiplied by its velocity (i.e., momentum = mass × velocity). The total momentum in the system is found by summing the momentum of each of the two bodies. It is found that the sum of the momenta of these bodies is always the same. This constancy in total momentum gives stability to the functioning of the system even while this system is in change.

The Classical Laws of Motion as Expressed in Psychotherapy

Newton's laws of motion may be seen to reflect fundamental aspects of psychotherapy regardless of theoretical orientation. The first of these fundamentals notes the basic stability and constancy of behavior in the absence of some external force of a psychological nature. That is, behavior is assumed not to have the capacity to change on its own. *Behavior can change only through the behaving individual or system being impacted by an external force of a psychological nature of which the presence and activity of the psychotherpist is one chief medium.* For example, in orthodox analytic theory as well as in dynamic theory in general, positive change in a patient's behavior occurs as a result of appropriate interpretation by the analyst or psychotherapist in the clinical situation (Freud, 1922/1978; Singer, 1970; Snyder, 1982). Schools of psychotherapy that seem to focus on the importance of the individual's own process in the development of personal change actually adhere to this first fundamental. For example, Rogers (1959) wrote that change from neurotic to healthful (i.e., congruent) behavior occurs when an individual is in a different environment than the one in which the neurotic behavior developed and was maintained. This environment must be characterized by unconditional positive regard directed towards this individual by significant others. Within a systems view, a system characterized by stability and constancy (i.e., by homeostasis) does not change on its own. Instead, it changes as the result of some external influence impacting it that affects the relations among members of the system. The result is that a new stable and constant pattern of functioning is established among members of the system (Watzlawick, Beavin, and Jackson, 1967). If a system incorporates some form of change as part of itself, it has in effect set up a system within a system with change in the interior, homeostatic system due to external force exerted upon it from the encompassing system. The existential view approaches the position that behavior can change on its own, but theorists from this view are often ambiguous as regards this position. Yalom (1980), for example, attempts to integrate an existential view with a dynamic view of behavior, while Sartre (1938/1966) discussed an original project of the patient in psychotherapy needing the assistance of a therapist to help make it explicit to the patient. Behavior therapy clearly relies on this first fundamental. The laws of learning themselves, upon which behavior therapy is based, follow this fundamental—as well as the two other fundamentals to be noted below. A change in behavior (i.e., a response) does not occur in the absence of some particular pattern of temporally contiguous environmental events (i.e., stimuli) (Bower and Hilgard, 1981).

The manner of change in the individual or system that is the clinical focus is described in the second fundamental. The second fundamental states that change from unhealthful to healthful behavior results from psychotherapeutic intervention and that the client manifests a certain amount of inertia, or resistance, to this intervention. Here, resistance does not refer to specifically analytic or dynamic resistance (though these forms are two theoretical expressions of the more general use). Rather, resistance denotes behavior, including that which is considered learned, that interferes with the work of therapy, or with the impact of the psychotherapist. As a reflection of Newton's second law, psychotherapeutic intervention represents an external psychological force. Change in behavior due to this intervention is reflective of acceleration by an object due to the application of external physical force, and resistance to change in behavior is reflective of the inertial resistance presented by the mass of this object to change in its motion.

In addition to the analytic and more general dynamic considerations of resistance (Fenichel, 1945; Freud, 1938/1978; Singer, 1970), the other schools of psychotherapy are also concerned with resistance. For example, in client-centered therapy resistance is seen in the need for self-regard of the neurotic client resulting in the continuation of the client's attempt to deny or distort experiences even though the therapist is presenting an environment designed to allow the client to engage in a reevaluation of his or her development of self (Rogers, 1959). In systems theory as applied to clinical work, a basic characteristic of a system (i.e., equifinality) is that it attempts to resist the influence of any unaccounted for external factor; the functioning of the system is determined primarily by the system itself as opposed to external factors (Watzlawick, Beavin, and Jackson, 1967). In learning theory, resistance is seen in that the strength of previous learning serves to retard the development of more adaptive behavior (Bower and Hilgard, 1981).

The third fundamental, reflective of Newton's third law, refers to the reciprocal impact that therapist and client (and two people in interaction in general) have on one another. Each theoretical system explicitly or implicitly acknowledges this reciprocal impact. This impact underscores the essential similarity in functioning of the people involved in interaction. Thus, it maintains the overall integrity and intelligibility of the psychotherapeutic situation and of interaction in general. Behavior therapy, for example, acknowledges that learning circumstances are constituted for the behavior therapist's own behavior in his or her work with clients. In the dynamic therapies, this third fundamental is noted in therapists' concern with countertransference (Singer, 1970). In a client-centered framework, this reciprocity is noted in Rogers' (1959) concern that the therapist be congruent and thus be susceptible to, and function according to, the same basic principles as his or her client. In a systems approach, the entrance of the therapist into the functioning of the system that the therapist is attempting to influence is fundamental.

In a similar manner to the laws of motion, the three fundamentals of psychotherapy are all necessary for a conceptually rigorous view of psychotherapeutic change. The first fundamental provides the base of stability and constancy of behavior in the absence of this behavior being impacted by an external psychological force. The first fundamental provides the base through which the second fundamental can function in the introduction of change, with the manner of this change and the variables involved having been cited. Finally, the third fundamental provides an overall conceptual integrity to psychotherapy. The therapist as well as the client are both seen to function according to the first two fundamentals of psychotherapy; the therapist's behavior does not change in the absence of an external psychological force (of which the client may be the medium). When the therapist is impacted by such a force, his or her behavior changes with a certain amount of resistance on the part of the therapist to this external force.

The Perspectival View of Behavior

In contrast to the reflection of classical mechanics in the established schools of psychotherapy, the perspectival view of behavior is based on the principle of relativity concerning psychological phenomena. The following two points comprise this principle:

(1) The perspective of a person is that of which this person is directly, or immediately, aware.

(2) The fundamental structure of the perspective of an individual is this person's direct, or immediate, awareness of himself or herself in the substantive world in which other people exist and with which this individual can communicate this awareness through the use of language.

The adoption of the objective view by a person as his or her perspective is this individual's mode of direct awareness of himself or herself in the world (Snyder, 1983).

In a perspectival view, the influence of external psychological force cannot be separated from the entire behavioral functioning of the individual. Behavior is not defined in terms of a stable and constant base from which causal external psychological forces can be distinguished. In the perspectival view, behavior is found in a situation. This situation has the same basic structure proposed above, however now, the phenomena of concern are psychological and not physical. Understanding and description of this situation supersedes the traditional notion of causality in that any proposed causal sequence regarding the studied phenomenon occurs as part of a fundamental structure based on the direct relation of the observer to the observed phenomenon.

A major dilemma for psychology has been the nature of mental health and illness. Traditional conceptions, relying heavily on the disease model (e.g., orthodox analysis), are based on the objective independence of the observed phenomenon. These conceptions proved limiting to the client's development, and many theorists (e.g., Rogers, 1951) believed them to be deleterious. In 1960, Szasz proposed that the concept of mental illness is a myth and that behavior deemed indicative of mental illness or health was the expression of values adopted by those making the decision. Thus, Szasz (1960) emphasized, as did Sullivan (1954) and Singer (1970), the relation of the stance of the observer to the observed behavior. In this emphasis, Szasz's beliefs reflected similar premises in quantum mechanics regarding physical phenomena. Szasz's position, though, is limiting regarding the client's behavior, because only one manner of relation exists at a time. The client remains either mentally ill *or* well (or exhibits behavior that fits within the psychotherapist's concepts of mental illness or health), reflecting in the same manner as Heisenberg and Bohr the maintenance of the objective independence of the observed phenomena. Further, just as quantum mechanics implies the consequence of space-like separated events, so Szasz's position implies the consequence of behavior simultaneously being both healthy *and* sick. One need only imagine, given a particular, concrete clinical arrangement, the instantaneous shift in the evaluation of a behavior as indicative of mental health or illness and the dependence of this shift on the particular theoretical stance maintained by the psychotherapist. For example, a client's behavior in a clinical session indicating the lack of adequate ego control in an orthodox analytic view might instantaneously come to be seen as indicating the achievement of congruence in a client-centered framework. The solution to the dilemma of the nature of mental health and illness lies within the construct of simultaneous situations with immediacy as the basic structure of relation in each situation. As for physics, immediacy implies that time and space (in this case, space in which phsychological phenomena occur) are mutually inclusive as opposed to the mutually exclusive manner in which they have been considered in psychology. In the proposed model, the complexity of behavior, and thus of the individual expressing it, is fully appreciated.

Conclusion

The radical separation in physics and psychology between the observed phenomenon and the observer of this phenomenon is finally bridged in a thoroughly related structure. Not only is each stance of the observer fundamentally related in an immediate manner to each expression of the observed phenomenon, but each such relation is fundamentally related to one another. Dilemmas implied by modern developments in psychology and physics are resolved by this structure, specifically by a structure involving simultaneous situations. In such situations, the same concrete arrangement may exist within different theoretical arrangements with the consequence that empirical study in physics and psychology requires an explicit understanding of theoretical circumstance.

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