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# Consciousness

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The experience of consciousness is analyzed. First, a pre-theoretical characterization of the term "consciousness" is attempted. Second, the phenomenology of human consciousness is described. Specifically, consciousness is defined in terms of several patterns all of which consist of the coupling of pairs of opposites. Resonance between such opposites may be the key characteristics of human consciousness. Third, the function of consciousness is considered. It is suggested that consciousness is functional in that it offers a medium in which cognition may be conducted in a manner akin to action in the real world. More general theoretical ramifications having to do with the representational view of mind are also discussed.

In all likelihood the most fundamental characteristic of human cognition is that it manifests consciousness. The defining and characteristic attributes of consciousness may not be well-defined, they may even be the subject of analysis and discussion themselves, yet the basic fact remains evident—human beings are conscious. While earlier students of mind have emphasized the significance of consciousness and have considered this phenomenon as one of the most important subjects of cognitive investigation (see, for example, Bergson, 1983; Humphrey, 1963; James, 1890), contemporary investigators have tended to ignore consciousness and some (notably Rey, 1983; Thagard, 1986) have dismissed consciousness as an epiphenomenon and its investigation as non-scientific. Such a judgment is, I find, rather curious. The very salience and uniqueness of consciousness make it a phenomenon that has to be considered and accounted for. *Prima facie,* these properties would also suggest that it is rather unlikely that consciousness is lacking any functional role. The fact that human beings are conscious whereas computers are not underlines the significance of the phenomenon even further. Any cognitive theory that cannot account for consciousness is therefore, even without further consideration, seriously lacking (see also Haugeland,

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1981).[1]

The following discussion is an attempt to probe the nature of consciousness. The discussion focuses on three questions: What is consciousness? What are its basic phenomenological characteristics? What might its function be? The consideration of these questions will also bear on more general issues concerning human cognition and its scientific investigation.

*What is Consciousness?*

Before one embarks on a theoretical account of consciousness, one should clarify what the term consciousness means. The clarification is pre-theoretical: it is an attempt to characterize a given experience, not to formulate a theoretical construct or a principled difference between conscious and non-conscious beings.

While, basically, "consciousness" denotes one's being aware of oneself, the term is associated with several experiences that are clearly distinct. The following discussion delineates three *types* of such experiences. The specification of the three types as distinct does not, however, mean that the common term "consciousness" is a misleading homophone and that one would be advised to replace it with three specific terms. As will be noted later, the three types of consciousness are interrelated: each of the types evolves into the others and together they comprise a cognitive structure exhibiting internal logic and coherence. Given that these types are the different manifestations of one common phenomenon, they may also be referred to as the different *aspects* of consciousness. And since, as will appear in the course of the discussion, they exhibit an internal order they may also be referred to as *levels*.

*Sensed being.* At the most basic level consciousness is what distinguishes between a living sentient organism and a dead one. A living organism is not stimulated by the environment in the manner an inanimate object is. Rather, the organism is situated in the environment, it constantly senses the environment and is in a state of responsiveness to it (see the perceptual state in Armstrong, 1981, and con$_3$ and con$_6$ in Natsoulas, 1978, 1981).[2] This difference between

[1]The appraisal that computers lack consciousness is taken here as a pre-theoretical observation marking the potential significance of the subject matter at hand. In itself, this appraisal is, of course, far from being self-evident; indeed, it raises a host of philosophical questions the consideration of which falls well beyond the scope of the present paper (for further discussion see Turing, 1950/1964; Dreyfus, 1979; Shanon, 1989a).

[2]It will be noted that Armstrong's characterization of consciousness is, in a fashion, most similar to that presented here. Armstrong, too, defines consciousness as a complex of three distinct states. While his characterization bears similarities to the present one, the two characterizations are different. On the one hand, Armstrong's second (perceptual) and third (introspective) states are similar to the present first and second states, respectively. On the other hand, his first state is constituted by the mere disposition to be conscious (which, by definition, distinguishes living creatures from inanimate objects) whereas what is regarded here as the third state does receive no specifical distinction in Armstrong's analysis (in all likelihood, it may be subsumed under his second state).

being subject to external stimulation and sensing the environment is two-fold. On the one hand, there is the involvement of an environment: unlike physical bodies which are in a mere physical world, organisms are embedded in an environment and they are in a dynamic interaction with it. On the other hand, the sensation is not merely of external states of affairs – things that are out there. The organism is alive and in touch with the external world, it senses its body functioning, it is affected by the environment and it interacts with it, it perceives, it feels. In its first, basic manifestation, then, consciousness is the sensed being in the world. The foregoing observations are not specific to the subject of consciousness, rather it bears on some very basic and general considerations of the study of behavior. Indeed, in light of similar observations, various theoreticians have argued that behaving organisms and cognitive agents cannot be defined without a joint definition of their environment. Likewise, the definition of the environment ties with the definition of the organism in question. This appraisal is central in both the frameworks of ecological psychology (Shaw and Turvey, 1980; Turvey and Shaw, 1979) and autopoiesis (Maturana, 1978; Maturana and Varela, 1980).

In the characterization of consciousness made above no "I" or "self" is specified, nor is any clear distinction between "me" and the world made. The quality associated with the first type of consciousness is one that comes about by the coupling of being and world. Both conceptually and psychologically this coupling is more basic than the constituents that, because of the manner they are being described in language (as in the previous sentence), may seem to be independently given. While at this first level of consciousness they are not so, there is already a difference between the being of organisms and mere thinghood of objects. Inasmuch as this difference is sensed, the organism is conscious.

The first type of consciousness is at the same time all pervasive and non-focal. In all likelihood, it is the only type of consciousness not specific to humans. How far down the phylogenetic scale this type of consciousness is encountered remains to be determined, but *prima facie,* it seems that the range of organisms that exhibit it is rather wide – this type of consciousness also serves as a requisite basis for the other types of consciousness.

*Mental awareness.* The second type of consciousness is, by contrast, characteristically human. It is also the one associated with the sense commonly intended when the term "consciousness" is employed in the cognitive psychological literature (cf., for instance, Mandler, 1975; Pope and Singer, 1978). I refer to one's being aware of one's inner mental life. Manifestly, people are at times aware of thoughts passing through their minds, they may be focally aware of the contents of their perception, and they may be focally aware of their executing an action. It is in this vein that Locke (1690/1964) defined "consciousness [as] the perception of what passes in a man's own mind" (p. 96). Generally, this type of awareness is associated with introspection, but there need not be exact convergence between the two. Typically, the awareness pertains to *contents,* not the *processes,*

of cognition. Whether other species share this faculty is dubious. At most, it might be attributed to some high primates (Griffin, 1978). (For further discussion, see the introspective state of consciousness cited in Armstrong, 1981; consciousness$_4$ in Natsoulas 1978, 1981; and Shanon, 1984.)

Unlike the first type of consciousness, the second is focal and differentiated. The awareness it involves is not the sensing of an all-encompassing quality or ambiance. Rather, it is the awareness of well-defined entities or states. These may consist of particular thoughts being entertained, of specific memories being recollected, or of idiosyncratic scenarios that one encounters in one's dreams.

*Reflection.* The last (and highest) type of consciousness to be noted consists of what may be referred to as reflection (in the sense of a function taking its own value as an argument). This, it is generally assumed, is the sole prerogative of human beings. Not only can humans be aware of their mentations, these mentations may themselves be the objects of mentation. Two principal kinds of reflection are noted. The first kind is meta-observation, in which the cognizer assumes the role of an observer and s/he reflects upon the content of her/his mental states, thoughts or processes associated with them. The second kind involves monitoring or control. Monitoring consists of one's checking or evaluating one's mentations, whereas control consists of conscious mentation that guides or governs thought. (For related discussion, see Johnson-Laird, 1983a and Natsoulas, 1981.)

*The Structure of Consciousness*

The three notions of consciousness noted are not unrelated. Indeed, the relationship between the three is manifold. First, there is a relation of *progression:* each higher level of consciousness is constructed upon the one that precedes it in the order of levels. Second, there is a relation of *analogy:* the third level is related to the second in a manner similar to that by which the second is related to the first. Third, there is a relation of *closure:* while the last type is the one most different from the first, it is in some sense also that closest to it. Fourth, given these three relationships, *coherence* is noted: albeit distinct, the three types comprise a unified, dynamic cognitive structure. Indeed, the three types may be regarded as focal, salient aspects of one phenomenological structure, one that may exhibit further, graded and less stable manifestations. By way of easy reference I will refer to the three types, aspects or levels as Con$_1$, Con$_2$ and Con$_3$ respectively.[3]

[3]The label "Con" is employed in order to distinguish the terms from "Consciousness" and "C" employed by Natsoulas (1978, 1983). As indicated in the discussion above, the present Con$_1$ and Con$_2$ are similar (but not necessarily identical) with concepts of consciousness noted by Natsoulas. Furthermore, Natsoulas is concerned with different concepts of consciousness; these concepts may be employed by different investigators in different theoretical contexts and there

*Progression.* The relationship of constructive progression has been explicitly noted in the course of the foregoing presentation. The mental entities constituting the experience associated with $Con_2$ come into being by the differentiation of the experience associated with $Con_1$. With this differentiation non-specific, ill-defined, non-focal ambience gives way to specific, well-defined, focal mental contents. A metaphor that comes to mind is of a viscous liquid that crystalizes into solid blobs. Such crystalization is encountered in the spontaneous emergence of order in dynamic systems subject to energy change. A concrete example is the appearance of a matrix of hexagonal patterns when rice is boiled.[4] The dependence of $Con_3$ on $Con_2$ is evident. By its very definition, reflection requires objects to which it applies. These are afforded by the mental entities constituting the second type of consciousness.

*Analogy.* While in the foregoing sketch of the progression between the types, the relationship between $Con_1$ and $Con_2$ and that between $Con_2$ and $Con_3$ are clearly different, there is an aspect in which the two relationships are similar. Specifically, both the progression from the first type of consciousness to the second and the progression from the second type to the third involve a process of differentiation in which the two facets of an experience become distinct. In the first progression the ambient sensation of the world differentiates into specific states of affairs of which one is conscious. Likewise, for the contents experienced in $Con_2$ of consciousness to become the objects of reflection experienced in $Con_3$, differentiation is needed. In $Con_2$ one is immersed in the contents of one's mentation; no distance is maintained between the thinker and his/her mentation. For this $Con_2$ to turn into $Con_3$, a distancing of the mentating self from the contents of mentation is required. Only thus do the well-defined contents of mentation become objects and reflection is made possible.

The foregoing characterization marks still another similarity between the types of consciousness. The immersion in the contents of mentation which is the essence of $Con_2$ is actually the mental analogue of one's being in the world constituting $Con_1$. It is as if the experience of sensed action without the experience of a distinct self has been transferred from the outside world to that inside. Indeed, a momentary reflection reveals a curious pattern. When taking place in the external world, the experience of immersion is usually characterized as a state of affairs in which one is not conscious. An example often given is that of automatic performances like driving in which the body acts as if on its own. By the present analysis, however, such a case does exhibit consciousness – that of $Con_1$. But note: this is fully analogous to what happens in the mentation of

need not be any relationship between them. By contrast, the types presented here are defined as the different facets of one unified, coherent system. Even if the extension of some of the present types partially or totally coincide with concepts or types noted elsewhere, the theoretical framework in which these are embedded makes the two distinct.

[4]For discussion of emergent structures in the physical world see Benard (1901), Katchalsky (1981) and Glansdorff and Prigogine (1964).

$Con_2$, one which is regarded in the literature as the paradigmatic case of consciousness. Just as when one speaks, speech proceeds on its own without prior planning, awareness of a self or concurrent reflection, so also in the case of inner mentation: thoughts proceed in one's mind as if on their own. As indicated above, one is aware of the contents of one's mentation, not of any of the processes that presumably lead to their generation or are responsible for their maintenance and progression. Not only is the characterization of the external case as unconscious phenomenologically inaccurate—specifically, it obscures the manifest difference between automatic human performance and the motion of physical bodies—it is also theoretically lacking for it misses the similarity between the external case and the internal one. By the present account, the two types of consciousness—$Con_1$ and $Con_2$—are rooted in the same basic pattern, that of $Con_1$.

The second type of consciousness, $Con_2$, involves not only a differentiation but also an internalization of the rudimentary experience of $Con_1$. Internalization is also the pattern that changes $Con_2$ into $Con_3$. $Con_2$ consists of the internalization of states that are noted, in a more basic form, in the interaction with the world outside, as it is manifested in $Con_1$. Similarly, reflection—the defining constituent of the third type of consciousness—is the consideration of the contents of one's mentation as objects (i.e., as analogues of the things one encounters in the external world) and the manipulation of these contents accordingly (i.e., a manipulation which is analogous to the manipulation of objects). In other words, $Con_3$ consists of an internalization of $Con_2$.

In summary, not only is it the case that $Con_2$ is analogous to $Con_1$, and $Con_3$ is analogous to $Con_2$—but it is the same principle of internalization that governs the two analogies. This similarity of analogies is one of the aspects of the relationship of coherence.

*Closure.* In addition to the three types of consciousness being related in their sequential order, $Con_3$ also relates to $Con_1$, so that the sequence turns onto itself and marks a closure. The relationship has already been noted in the consideration of the analogy of relationships. $Con_1$ consists of the experience of one's being in the world. The dominant flavor of $Con_2$ is that of content. That of $Con_3$ is, again, the experience of action, action in the world inside.

The pattern just noted is complementary to those noted in the previous section. While from one point of view there is an evolution from $Con_1$ through $Con_2$ to $Con_3$, an evolution can also be noted from $Con_1$ to $Con_2$, and likewise from $Con_1$ to $Con_3$. $Con_2$ relates to $Con_1$ by the differentiation of the contents of consciousness; $Con_3$ relates to $Con_1$ by the differentiation of the conscious self and by making it distinct form the objects of mentation. Together, the two differentiations result in the highest level of consciousness in which one is aware of oneself as contemplating well-defined mentations, with specific contents and forms. Together, these patterns mark a closure of the system of consciousness upon itself. $Con_3$ is the highest level in a sequence, but it also ties together with

$Con_1$. Self-awareness and meta-observation are not the inspections of states of affairs outside the realm of the agent who is doing the inspection. As noted, experientially, the awareness of one's self constituting $Con_3$ is similar to one's awareness of the world constituting $Con_1$. Furthermore, meta-observations of one's mentation ($Con_3$) are themselves objects of one's mentation ($Con_2$) [for further discussion, see Shanon, 1988b]. Given the closure of the system upon itself, any characterization of consciousness in terms of distinct, ordered levels will not do justice to this phenomenon (cf. Johnson-Laird, 1983a; Minsky, 1968). Consequently, the ordered sequence of consciousness defies any simple Euclidean characterization. Rather, a more appropriate geometrical modelling would be akin to a Moebius strip or to the ascending yet closed forms that serve as the basis for many of Escher's paintings (see also Hofstadter, 1979).

*Coherence.* With the marking of the relationships of progression, analogy and closure all ingredients for the relationship of coherence have been noted. Together, they indicate that albeit distinct the three types of consciousness are actually the manifestations of one unified cognitive pattern. The unity between the three will serve as the basis for the theoretical perspective that will be suggested at the end of this discussion.

By way of summary let us review the patterns of coherence we have noted.

1. $Con_1$ is related to $Con_2$ in a way analogous to that by which $Con_2$ is related to $Con_3$. In both cases a relationship of internalization is noted.

2. $Con_1$ is related to $Con_2$ in a way analogous to that by which $Con_1$ is related to $Con_3$. In both cases a relationship of differentiation is noted.

3. Together, the interaction between the relationship of internalization and differentiation is the generator of the progression defined by the three types of consciousness.

4. Lastly, the sequence closes upon itself, with $Con_3$ being similar to $Con_1$. In both, there is an engagement of one's being in action in a world.

Before turning to the second part of the discussion, let me comment on the possibility of still other superior types or levels of consciousness. Are there no other such types or levels? Phenomenologically, it appears that, indeed, there are. A fourth type of consciousness may consist in one's being aware of one's being engaged in reflection. This type of consciousness consists of taking reflection as the object of one's mentation and of distancing oneself from it so that it itself becomes the basis for further reflection. While this fourth type or level of consciousness definitely exists, here I will not consider it as a distinct, additional type. This is because structurally, it does not introduce any new ingredient not already noted. What this type does introduce is a recursion whereby the basic three-tier structure of consciousness is reapplied with the initial grounding point being not the world outside but the world within. With this all three types of consciousness are pushed one level up: the experience of inner mentation becomes the basic experience, it is differentiated into reflection, which in turn is subject to the distancing of the self from the objects of one's mentation so as to

produce the fourth type noted here.

Thus, consciousness is characterized here as a structure of three experiences which unite into one coherent complex. Standardly, this complex is grounded in that conscious experience which is most primitive, hence the three types of consciousness described in the two previous sections. It is, however, possible to ground the complex elsewhere. In this fashion, one may generate more types of consciousness behavior, but the basic function (in the mathematical sense of a structure taking arguments and generating values) does not change. For this reason, henceforth, the fourth level of consciousness will be ignored, and consciousness will be characterized in the three-layered manner detailed above. Lastly, one might also ask whether the tri-layered function may further be applied so as to generate still other levels of consciousness. While logically, there seems to be no reason why this could not be the case, phenomenologically the situation is not clear. Given that the examination of this question would lead to issues which are beyond the scope of this discussion, I will not examine it any further here.

*The Phenomenology of Consciousness*

The question "What is consciousness?" may, however, be taken up from another perspective—a structural-phenomenological one. Given the general characterization of consciousness suggested above, one may ask what the characteristics of consciousness are, as it is actually manifested in the psychology of human beings. In principle, consciousness could be realized in different fashions, and the shape human consciousness actually takes may be just one of a wide range of possible realizations. The definition of the particular phenomenological specifications of human consciousness is therefore a non-trivial question which is distinct from the question entertained in the first part of this discussion.

In the following phenomenological description reference is made in most cases to consciousness *in toto* without the specification of type. This perspective is taken in the light of the appraisal that consciousness is in effect a unitary phenomenon. Indeed, phenomenologically, adult human consciousness vacillates between the different types noted. In terms of $Con_1$ (normal) people—at least when awake—are always conscious; the awareness associated with $Con_2$ consists of a local crystalization of the undifferentiated $Con_1$ and occurs intermittently; the reflective experience of $Con_3$ constitutes a subset of the mental reality associated with $Con_2$. Thus, while the three types of consciousness are intertwined into a unified whole, the second type, $Con_2$, is central. Between the minimal, requisite $Con_1$ which is not specific to human beings and $Con_3$ which is the least frequent, the second is the paradigmatic type of human consciousness. Indeed, $Con_2$ may be regarded as one that encompasses the two other types: it is a Janus-like entity, with one face tied in $Con_1$ and the other tied in $Con_3$. Thus, consciousness may be regarded as a pattern of *resonance* analogous to that noted

in chemistry. As the analogy is, I find, constructive, a clarification of the chemical phenomenon is in place.

Resonance is encountered when a molecule of a given composition is associated with several chemical structures. While all the structures in question will be associated with the same chemical formula, they will differ in the distribution of electrons. The famous example is that of the benzene molecule in which three of the six hydrogen-hydrogen bonds are "double." The chemical data reveal that the molecule has more than one configuration. Specifically, the double bonds may be either at the bonds at the odd positions or at those at the even one, and the molecule resonates between the two. In fact, this is an abstraction. In effect, in itself neither of the two configurations is a real molecule: it is the dynamic hybrid resonance between the two which is the real state of affairs. That this is the case is indicated by the fact that the energy of the actual molecule is less than that of any of the contributing structures. In other words, the former is more stable than the latter (see Roberts and Caserio, 1967).

The resonance between alternate patterns is, to my mind, the fundamental property of human consciousness. Such an alternation is the common denominator of the following phenomenological characterization. This characterization defines consciousness in terms of a series of patterns all involving two opposite attributes.

*Subject and object.* A basic characteristic of consciousness is its pertaining to the realm of the subjective life of one specific individual subject. On the other hand, as noted, for example, by James (1890) and by Jaynes (1976), consciousness is always directed toward an object. Thus, consciousness couples two opposites: it is both subject-oriented and object-oriented.

The interplay between the two faces of subject and object is manifested in all three types of consciousness. In the first type subject and object are the two aspects of one undifferentiated experience. In the second type the contents of thought are well-defined, but the cognizer does not experience them as distinct mental objects. As for the subject, it too is not a distinct constituent of one's experience. Rather, the subject is an assumed background: the thoughts are experienced as the thoughts of the subject, but the subject is not being experienced as distinct constituents of one's mentation. In the third type one does in fact distance oneself from one's thoughts and regards them as objects, yet even here subject and object are phenomenologically intertwined. It is only with the fourth type of consciousness that the two become distinct.

*The bodily and the mental.* Clearly, consciousness is a mental phenomenon. While some authors (Teilhard de Chardin, 1959; Whitehead, 1929) have suggested that all physical entities exhibit consciousness, it is generally assumed that consciousness is confined to the domain of living organisms and a common tendency is to further confine it to a small subset of these organisms—human beings and perhaps some of the high apes. On the other hand, the body is indispensible for one to be conscious. As noted in the first part of the discussion, at the very least consciousness consists of one being in touch with the external

world, and this by virtue of one's having a body (see Merleau-Ponty, 1962).

While the experience of being in touch with one's body is a key ingredient of $Con_1$, the body is not experienced as such in either $Con_2$ or $Con_3$. Yet, since each of these types presupposes the one preceding it in the sequence, and given the involvement of the body in $Con_1$, it follows that as a unified whole consciousness brings together body and mind.

*Focalization and unboundedness.* Is consciousness bounded? This question may be read both in terms of time and of content. With respect to time the question is whether one is continuously conscious. With respect to content the question is whether consciousness is phenomenologically bounded and focalized. The two questions are interrelated and in both cases the answer is both in the affirmative *and* in the negative. On the one hand, with respect to neither time nor content can boundaries of consciousness be marked. On the other hand, while consciousness is continuous and fluid, it does involve focalization. As noted by both James (1890) and Jaynes (1976) consciousness always imposes a limitation: it focuses on parts or aspects of its objects and with this it crystalizes itself in a particular moment of time. Thus, while consciousness is in one respect an ever present all-enframing background to every behavior, in another respect it is single-tracked and serial. For an analysis of the notion of the background, see Searle (1983).

The three types of consciousness exhibit different tradeoffs between focalization and unboundedness. $Con_1$ is non-focal and it lacks any boundedness in time: at least when one is in what is standardly characterized as normal wakefulness, one is continuously conscious in the first sense. $Con_2$ and $Con_3$ involve increasing degrees of focalization as well as increased boundedness in time.

*Stability and change.* The three patterns of alternatives noted above present such a pattern. In resonating between these opposite alternatives, consciousness resonates between stability and change. On the one hand, consciousness consists of particular experiences associated as defined by any of the three types noted. On the other hand, consciousness continuously vacillates between its different types. Thus, conscious mentation of $Con_2$ and $Con_3$ may be regarded as the local creation of relatively solid configuration out of the undifferentiated ambience of $Con_1$. (The appearance of the fourth type of consciousness may likewise be regarded as such a crystallization.) Curiously, such a metaphor has been presented in a somewhat different context in literature. In his novel "Solaris" Lem (1978) presents a cosmological object which is actually a thinking object. This object is a viscous liquid which may crystalize into concrete bodies and scenarios, which embodies the objects of its thought. Fictional as this description is, it is, I find, a most appropriate characterization of human thinking.

Together, the four pairs of opposites noted suggest that consciousness is constituted by the meeting of the contradictories (for a discussion in line with this characterization, see Pollio, 1979). In other words, consciousness may be regarded as constituted by a duality between two poles. One pole is associated

with object-like qualities, it manifests stability, contentually it is relatively well-defined and temporally it is focalized. By contrast, the other pole lacks the object-like qualities, it is fluid, unbounded, ill-defined and exhibits continual flux. While the first pole has the effect of constructing an autonomous internal reality, the second marks the tie with the body and the external environment. Elsewhere I have referred to these two poles as the *representational* and the *presentational*, respectively (Shanon, 1982, 1988a).

Consciousness thus marks a duality between opposites, yet—as indicated throughout the foregoing discussion—it is a coherent, unified phenomenon. Indeed, it seems to me the key feature of the phenomenology of human consciousness is precisely this: the resonance between the representational and the presentational. This resonance is encountered both in on-going psychological activity and in cognitive development.

The foregoing patterns of resonance and duality suggest an analogy with patterns observed in the physical world. Whereas resonance is encountered in rather standard contexts of organic chemistry, the duality between contrary patterns pertains to non-classical quantum mechanics. That theory presents various patterns that defy the canons of common sense and traditional logic. For example, light turns out to exhibit the properties of both particles and waves. While cross-disciplinary analogies—especially those between physics and psychology—are fraught with problems and should be taken with caution, it seems to me that the analogy between patterns of consciousness and patterns encountered in physics is well worth pursuing; outlines for such an analogy are presented in Shanon (1989b) [see also, Bohm, 1980; Capra, 1983].

*The Function of Consciousness*

The functional characterization of consciousness is already ingrained in the foregoing structural-phenomenological characterization. In essence, consciousness is the ability of the human mind to render itself into a reality akin to that in which people actually live, the reality of the external world. Such a reality of being will be characterized here by two facets. The first and more basic one is *action*; the second, which is related to the first, is *medium*.

The characterization of action as basic is grounded in the appraisal that the fundamental capacity of organisms is to act in the world. A number of investigators have held this appraisal: Gibson and his followers in the school of ecological psychology (Gibson, 1966, 1979; Turvey and Shaw, 1979); Vygotsky and his followers in the Soviet school of activity theory (Vygotsky, 1986; Wertsch, 1981); Johnson-Laird in his theory of mental models (Johnson-Laird, 1983b); Winograd in his action-based view of artificial intelligence (Winograd and Flores, 1986); and students of social cognition (Harré, 1987). Yet, this appraisal entails a view of cognition which is diametrically opposed to that standardly held in contemporary cognitive science. Whereas the standard view regards cognitive activity in terms

of the manipulation of symbols, the alternative view regards it in terms of action akin to those employed in the execution of motor skills (see in particular Kolers and Roediger, 1984; Kolers and Smythe, 1984). If action as executed in the manipulation of objects is the basic human capability it is functionally advantageous for one to entertain mentation in an arena similar to that encountered in the external world. Such an arena is afforded by the phenomenon of consciousness.

Medium also bears on the critique of the standard representational view of mind. By it, cognition is conducted in the abstract. Specifically, mental representations—the locus of all cognitive activity—are defined formally but their medium is deemed to be irrelevant. Both conceptual considerations and empirical data hold against this appraisal (Kolers and Roediger, 1984; Kolers and Smythe, 1984; Shanon, 1987a). Specifically, it appears that human behavior is very much sensitive to the non-semantic particulars of the medium.

The two facets of action and medium are related. Medium is essential in the execution of action in the world. One cannot swim without water, produce a painting without canvas and paints, or play the piano without physically interacting with the keyboard (see Sudnow, 1980). If cognition is akin to action in the world, it too has to have a medium. Such a medium is afforded by the phenomenon of consciousness.

*Theoretical Considerations*

The foregoing discussion indicates that the issue of consciousness bears on some general considerations regarding cognition and cognitive theory. As noted, the grounding of cognition in action and the non-abstractness of its medium are not in line with the dominant view of mind in contemporary cognitive science, namely, representationalism. The critique of representationalism calls for extensive, multifaceted analysis, which is well beyond the scope of the present paper (cf. Dreyfus, 1979; Haugeland, 1978; Shanon, 1987b, 1988a; Winograd and Flores, 1986). Here, I would like only to mark two specific issues having to do with consciousness which bear on this critique: the relationship between consciousness and mental representations, and the question of the self.

Are mental representations necessary for one to be conscious? Should the postulation of representations be confined to the realm of the conscious? These questions may be taken both from a phenomenological point of view and from a more general theoretical one. Phenomenologically, a paradoxical state of affairs is once again revealed. On the one hand, except in its first, rudimentary level, consciousness involves the entertainment of mental entities. Indeed, reflection assumes the existence of objects to which it applies. These objects are mental, representational entities. Furthermore, being well-defined, the representational entities do not allow the fluidity and unboundedness of consciousness. Thus, again, resonance is suggested between two opposites: mental structures exhibiting representational properties and those which do

not.

Whereas, phenomenologically, representations are object-like mental entities, theoretically they are standardly defined as abstract symbolic structures constituting the covert substrate that underlies all cognitive activity. As such, mental representations exhibit fundamental shortcomings with respect to consciousness. These shortcomings may be appreciated even without any detailed analysis, by the comparison to computers. Representationalism sets itself to account for cognitive activity in terms employed in computer science. Given that computers lack consciousness it follows that representationalism fails, in principle, to account for this crucial aspect of human psychology.

Further, and more specifically, mental representations cannot account for the relationship between cognition and the body or for the interaction between the behaving organism and the world. These problems have been especially pointed out by Gibson (1966, 1979) and his followers in the school of ecological psychology (for a review see Michaels and Carello, 1981; see also Searle, 1980; Winograd and Flores, 1986; as well as Fodor, 1980). Given that the ties with the body are the basic constituents of consciousness, the failure of representationalism to account for them marks a fundamental inability of the model.

To the above one may respond by noting that in some sense consciousness can be accommodated within a representational model. Specifically, one may specify in the representational system a representation of the system itself. Such a representation may be referred to as "self," and the entire system would therefore be regarded as having a notion of its own identity and of being aware of itself (for specific proposals along these lines, see Johnson-Laird, 1983a; MacKay, 1951; Minsky, 1968). This notion of the self, however, is categorically different from that noted in human consciousness. It is extrinsic, and it lacks the tie with the medium. Indeed, it can account for neither the material link with one's body nor the interaction with the external environment. And then, it is just too simplistic. The self brings together subject and object and it is at one and the same time unified (in its identity) and dualistic (for it involves an aboutedness, or intentionality). Any computational boxing of the notion of the self would certainly miss precisely what is special about conscious self.

Let me conclude with a different problem associated with the notion of the "self." Commonly, it is said that human consciousness is characterized, or even constituted, by the experience of the self (see, for instance, Armstrong, 1981). I wonder whether such a characterization is indeed valid. Usually, when "I" is being thought of it is either a specific content that one entertains (e.g., just as one thinks something of John, one may think something of "I"), or else it is an implicit agent to whom one's thoughts are attributed. Very rarely does one experience oneself as a thinking self, distinct from the objects of one's thoughts (such an experience may, indeed, be the distinctive characteristic of the fourth level of consciousness). Consciousness, in other words, involves self-awareness, but this is distinct from an awareness of one's self.

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