CONSCIOUSNESS, EXPERIENCE, AND A PERSON'S WORLD

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ABSTRACT

An approach to conceptualizing, analyzing, and formally representing the phenomenon of consciousness is developed. The basis of the approach is the State of Affairs System. The State of Affairs System formulation provides a conceptual and technical basis for formal, rigorous, but non–reductionist descriptions of the real world, including a person acting in the world. With this formulation, consciousness can be formulated as $C = <I, W, P>$, where I is the individual whose consciousness this is, W is the world the person is conscious of, and P is the position in that world that the person is conscious as. Experience and feelings are shown to be aspects of the relationship between a person and their world, specifically of the unique position a person occupies in their world. A Consciousness Change Formula is presented, which specifies in terms of actions and worlds the principles that govern consciousness change. The formulation is used to address (1) how consciousness arises, (2) the physical basis for consciousness, (3) the rigorous but non–reductionist scientific study of consciousness, and (4) the possibility of computer–based consciousness.

This paper takes an entirely different approach to consciousness. It begins in a different place, uses different techniques, and arrives at different answers. The end result is a foundation for a science of consciousness that is precise, systematic, and formal, but is entirely non-reductionistic.

The paper has two primary goals. The first is to provide an articulation of the concept of consciousness, using the concepts of a world and a person's place in the world, based on the formulation of real world concepts by P. G. Ossorio, the State of Affairs System (Ossorio, 1978), and to show that the phenomena of experience and feelings are aspects of the relationship between a person and the world. The second is to use the formulation to address the questions of how consciousness arises, the physical basis of consciousness, logical and non-reductionist foundations for the scientific study of consciousness, and the possibility of computer-based consciousness.

The paper thus presents a conceptual basis for research in a science of consciousness that is different from what has previously been available. This basis is formal, systematic, and comprehensive, but in no way based on any reductionist methods or assumptions.

There are two separate tasks involved in presenting this approach: (1) Presenting the concepts, their logical connections, and how they form a logical foundation for the study of consciousness; and (2) showing how the foundational concepts are elements of a formal system. In Section 1 we present Ossorio's formal system for real-world concepts, and use them to give formal meaning to the terms "world" and "a person's world." We discuss how the formalization makes practical a different approach to formal models of the world. In Section 2 we formulate consciousness as a phenomenon due to the logical relationships between a person and their world, and in Sections 3 and 4 we show how experience and feelings are logical outcomes of the unique relationship of a person to their world. Section 5 addresses the questions of how consciousness arises, the physical basis of consciousness, the non-reductionist scientific study of consciousness, and necessary conditions for computer-based consciousness.

Most of the formalism in this paper is in Section 1. Readers with little interest in formalism, or those who would like to see the treatment of consciousness, experience, and feelings before examining a formalization of the concept of real world, may wish to go directly to Section 2. The formalization is not superfluous, however; it is what makes the approach rigorous and systematic.

THE CONCEPT OF A WORLD

The different place that this treatment of consciousness begins with is the concept of a world. The primary way of proceeding from that beginning is to articulate the concept of the world and a person's place in it, and certain aspects of the relationship between a person and the world.

We do not have in mind, however, the concept of world most commonly used by a physicist or other physical scientists, namely the physical world, that world defined by all the configurations of fundamental objects (more commonly termed particles) describable in principle by a set of physical relationships.

Failure to distinguish between the physical world and the more general concept of a world is so common that it is easy to overlook the fact that the concepts are not identical. We begin with the recognition that there is a distinct concept of "real world." (This is not the issue of reductionism, even in disguise. It is simply an acknowledgment of the fact that there are two different concepts, of real world and physical world. Whether the real world can or cannot be reduced to the physical world is the question of reductionism, and is not addressed here.)

The concept of world we are using is that the real world is the all–inclusive whole that encompasses all of the objects, processes, events, relationships, and states of affairs that we can observe or do, and all of their parts, sub–parts, etc., both material and non–material. It includes pencils, atoms, computers, windows, coffee cups, and flying airplanes, but also includes friends and friendship, love and loved ones, anger, joy, fear, and satisfaction. It includes the objects, processes, events, and states of affairs we now know of, those we could come to know of, and those that could come to be the case. As such, it is analogous to the concept of the physical universe as all possible configurations of particles in 4–dimensional space–time. However, the analogy is a limited one, for this conceptualization is not limited to those objects, processes, and relationships definable in terms of physical dimensions such as mass, extension in physical space and time, etc.

To use this conceptualization, especially if we are to have a formulation that can serve as a rigorous foundation for addressing fundamental questions of consciousness, we need a technically rigorous elaboration of it. We need, for example, to say precisely what is meant by object, process, event, and state of affairs, how they are related, what it takes to specify an object, process, and so on.

In the following sub–section, we elaborate the fundamental concepts of object, process, event, state of affairs, and relationship. These concepts are defined in terms of the relationships they have to each other, not in terms of other concepts. In this sense, the concepts are formal, and they and their relationships comprise a formal system of concepts, just as the concepts of point, line, and plane and their relationships comprise the formal system of plane geometry, or force, mass, time, and velocity comprise a formal set of concepts in Newtonian physics. We will not, therefore, "define" any of the basic concepts, in the sense of presenting them in terms of other, more fundamental, things.

This lack of definition may seem a bit peculiar and uncomfortable, just as plane geometry often seems peculiar and uncomfortable at first, especially as accustomed as we are to the injunction, "Define your terms." The injunction is so common that the important exception to the rule is typically neglected: fundamental concepts cannot be defined, other than in terms of each other. Just as point, line, and plane

are defined in terms of each other in the discipline of plane geometry, and there is no question such as "but what is a line, *really*," object, process, event, state of affairs, and relationship are logically fundamental concepts that taken together comprise the fundamental concepts with which we articulate the concept of world. Following Ossorio's usage, we refer to these as "reality concepts."

This does not constitute any claim that these concepts are the only ones possible, or that it could not be discovered that one or more of these concepts could be defined in terms of one of the others or another system of concepts. We wish only to articulate these concepts and their relationships without having to assume that they can be reduced to some other concepts.

The system of reality concepts is presented *via* a list of relationships between them. The analogy to plane geometry may be carried a bit further. Geometry is the formalization of something we are all already familiar with. It is a formalization of the subject matter because it is a set of descriptions, in terms of the formally defined concepts of point, line, and plane, and the derivation of logically implied facts from those concepts. In the same way, what we are presenting here is a formal system that corresponds to the real world we all know, live in, use elements of, do things in, and generally are extensively familiar with. We are not describing something new, or giving a theoretical construct; we are articulating the concept of the real world.

The analysis and conceptualization that follow are due to Ossorio (1978), and follows the form and style of Shideler (1988).

Objects, Processes, Events, and States of Affairs

People observe objects, processes, events, and states of affairs. Each of these is a different kind of thing that may be found in, and observed in, the world. Further, any description of the world of any kind, including scientific theories and any other sort of description, are descriptions in terms of these four kinds of things.

As Ossorio (1978) discusses extensively, there is considerable ambiguity in describing any actual piece of the world. "The same thing" can be described as a situation (state of affairs), an object with certain attributes ("the world at war"), the outcome of a process (as is usually done in scientific explanations), and so forth. This re–descriptive possibility is an inseparable aspect of our notions of objects, processes, events, and states of affairs, in the sense that any set of concepts without such possibilities would not be usable for giving the descriptions that we in fact give. The rules that present the basic relationships between objects, processes, events, and states of affairs are called "transition rules" because they are logical rules for how one thing can be re-described in terms of others, and the two descriptions still be descriptions of "the same thing." Thus, for example, we have

Transition Rule 1. A state of affairs is a totality of related objects, processes, events, and states of affairs.

Thus, for example, "The cat is on the mat" names a state of affairs with two objects, the cat and the mat, related by "on."

The result of applying this, or any, of the transition rules is some number of objects, processes, events, or states of affairs. This and all the rules therefore can be applied recursively.

Anticipating for a moment the next section, in which we address the question of how to describe the world or parts of it, this rule is a reminder that states of affairs in general have constituent objects, processes, event, and states of affairs, in various relationships, and thus to describe a state of affairs we will need to specify these constituents and their relationships.

Transition Rule 2. An object, process, event, or state of affairs is a state of affairs that is a constituent of some other state of affairs.

This rule captures a critical fact about worlds as contrasted with sets of objects: the concept of the world includes the concept of composition, that elements of the world "come as" part of some larger thing (which may be a larger object, process, event, or state of affairs). At minimum, any object, process, event, or state of affairs is a constituent of the single, all–inclusive thing, the world (see Limiting Case I, below), sometimes called "the universe" in ordinary discourse, although this is more commonly used synonymously with "the physical universe."

Transition Rule 3. An object is a state of affairs having other related objects as constituents.

This rule is the formal statement of the logical fact that objects divide into sub–objects. Applying the rule recursively produces descriptions in terms of sub–objects, sub–sub–objects, etc., in the familiar way. With a few repetitions a describer moves from everyday objects to molecules to atoms to sub–atomic particles, in the way that is familiar to anyone who has gone through high–school science and is perhaps most clearly articulated in the early chapters of *The Feynman Lectures in Physics* (Feynman, 1963). However, there is an important caveat to be given here. There is no *a priori* ontological superiority of one level of description over any other here, and this is not the usual account of "levels of description" in which, explicitly or implicitly, the atomic or sub–atomic level of description is considered the "real thing" or more fundamental than the others.

Transition Rule 4. A process is a successive change from one state of affairs to another, having at least one intermediate state of affairs.

Transition Rule 5. A process is a state of affairs having other, related, processes as immediate constituents.

Transition Rule 6. An event is a direct change from one state of affairs to another, i.e., a change with no intermediate states of affairs.

Transition Rule 7. An event is a state of affairs having two constituent states of affairs. (The two states of affairs are customarily called "before" and "after.")

A word of explanation about events and processes is called for, since one commonly encounters something that would ordinarily be described as a direct change revealed as the last of a sequence of intermediate states of affairs. A lightning flash, a light bulb going on, a clap of thunder, or the now–famous freeze–frame photographs of a bullet going through a light bulb are all examples. In fact, this is so common that the idea of some changes happening directly, with no intermediate stages, is one of the hallmarks of quantum theory: the quantum transition. This rule articulates the more exotic cases, but equally (or more) important, it codifies the everyday cases such as the beginning of the Boston Marathon, the ending of the lecture, etc.

The Transition Rules provide the "raw material" for giving any description. They do not in any way state which things "really are" or "really are not" events or processes. They codify the logic embodied in statements such as "Closer examination reveals that event E is really the result of process P," which is to say that Event E can be re–described as Process P, for at least one intermediate state of affairs has been identified. The lightning flash, the light bulb going on, the clap of thunder, and the bullet going through the light bulb are all examples. Conversely, to describe a transition from one state to another as a "quantum" event" is to say, "There is no process P such that Event E can be re–described as Process P."

Several of the above rules include the term "related." Rule 3, for example, refers to "other, related, objects." This means that the particular state of affairs, objects, etc., is characterized by having one or more particular relationships. The next two rules capture the logical connection between relationships and states of affairs and make explicit the other part of the connection: they note that having a particular relationship constitutes a state of affairs.

Transition Rule 8. That a given state of affairs, object, process, or event has a given relationship R to another state of affairs, object, process, or event, is a state of affairs.

Transition Rule 9. That a given object, process, event, or state of affairs is of a given kind is a state of affairs.

Due to this close connection between states of affairs and relationships, and following ordinary usage, we will occasionally in the following refer to "objects, processes, events, states of affairs, and relationships," when it seems useful to emphasize the relationship aspect. By Rule 8, whenever we identify a relationship, we are identifying a State of Affairs (the one that includes this relationship), so by referring to relationships we are not indicating a fifth kind of thing to be found in the world.

Finally, two rules codify the connection between events and other things:

Transition Rule 10. That an object or process begins is an event and that it ends is a different event.

Transition Rule 10a. That an object or process occurs (begins and ends) is a state of affairs having three constituent states of affairs (customarily called "before," "during," and "after.")

The set of rules taken together is referred to as the *State of Affairs System* (SAS). It should be noted that, as in (Ossorio, 1978), we are not claiming that these rules are minimal, i.e., that some could not be replaced with a smaller, equivalent, set. Nor are we claiming they are complete, in the sense that the need for another rule could not be discovered. It is simply that this set appears to capture the concepts of object, process, event, and state of affairs and their interrelationships.

As we noted above, these rules are recursive, both in composition and decomposition. The natural question is then the usual one of where to stop the recursion. There are five limiting cases, two of which are of particularly relevant to our purpose:

LC–I: The state of affairs which includes all other states of affairs (and thus all objects, processes, events, and states of affairs and all their constituents at any level of detail).

LC–II: A type of object that has no constituents and thus is a "basic building block."

LC–I is the limiting case which is most important for the development in this paper, for it, together with the State of Affairs System, amounts to a formal articulation of the world as the transitive closure of all of the objects, processes, events, and states of affairs we see around us, where the "operations" that introduce new states of affairs, objects, processes, and events are the Transition Rules. It should be noted that this conceptualization of the world is open–ended and allows for any kind of re–description that may be discovered to apply. This is as it must be if we are trying to articulate the actual concept of what it means to be a world, rather than a limited subset.

The SAS thus defines a set of concepts for describing the world, LC–I. A description of a world using these concepts is a set of specifications of objects, processes, events, and states of affairs. However, nothing in the SAS requires that any object, process, etc., be a particular part, a particular kind of part, have particular parts, or have any special "connections," i.e., relationships, with other parts. The rules that define the system are entirely permissive, in this sense. Any re-description, including any relationship with any other objects, processes, etc., is allowed, but none are required.

While the world is a single thing, the state of affairs that includes all other states of affairs (and object, processes, and events), the permissiveness of the SAS makes explicit the (logical) fact that *which* world it is is not logically, physically, or in any other way determined. This is a recognition of the everyday fact that what any particular set of facts add up to is ambiguous. Using the language of states of affairs, the SAS system and the representation Units codify the fact that *which* state of affairs a given set of object, processes, etc., are constituents of is logically, and practically, indeterminate. I cannot decide that the ring on my right hand is not there; I can decide to look at it or not, to recall where I got it, to think about my father (who gave it to me), to count the gift as part of one relationship or another, ad infinitum. The "brute facts," in other words, do not determine the world they are part of, or the position P of the person in that world.

Describing the World

The Transition Rules are a formal system of concepts that appear to capture the proper intuition of what the world is, but in themselves they give little guidance in distinguishing kinds of objects, processes, events, or states of affairs, or describing actual things of each sort. We need a systematic way of specifying the ways in which one object (or process, etc.) can differ from another, if we are to use these concepts for technical work. As Ossorio (1978) points out, such a specification of how particulars can vary amounts to a parametric analysis of the reality categories of object, process, event, and state of affairs.

Any particular object, process, event, and state of affairs is described by an Object, Process, Event, or State of Affairs Unit. This Unit is a specification, by formal name, of the constituents that make up the thing being specified, along with a specification of any relationships necessary to that thing being what it is.

The Descriptive Units, or formats, are the public, observable forms of the corresponding reality concepts, in much the same way that mathematical symbols are the public, observable forms of mathematical concepts (Ossorio, 1978). They provide a different, and in some ways more straightforward, answer to, "What do you mean by a process (or object or event or state of affairs)?" For example, the State of Affairs Unit, defined immediately below, is an answer to "what is a state

of affairs?": A state of affairs is something described by a State of Affairs Unit (or State of Affairs Description).

In this section we present only the State of Affairs Unit (SAU). The Process Unit (PU), Object Unit (OU), and Event Units (EU) may be found in (Ossorio, 1978) Examples in which the Process Unit is applied to a complex real-world domain may be found in Jeffrey & Putman (1983).

Each of the descriptive Units is comprised of a name and a description. The description is a formal specification of what must be the case, in order for this thing to be what it is: its constituent parts, the way those constituents must be related, etc. The specification is complete, at that level of detail, i.e., while there may be more to say about this thing, whatever else that remains to be specified will be a further elaboration of some constituent. The State of Affairs Unit is presented below. Object, Process, and Event Units may be found in Ossorio (1971/78).

A State of Affairs Unit is an ordered pair (N, D), where:

N is the name of the state of affairs. It may be a sentence, a clause, a formal name, a formal symbol, etc. SA1.1.01, "the gun was fired," and "The cat is on the mat" are examples.

D is the description, composed of:

Relationship: A specification, by name, of the n-place relationship that characterizes this state of affairs. An attribute or property is a unary relationship.

Elements: A list of the N elements, specified by name, that are the logical roles of the relationship.

Classification: Identification of each constituent as an object, process, event, or state of affairs.

Individuals: A list of the actual historical individuals, identified by name, number, symbol, or any other identifying locution. ("Individual" is not the same as "object.")

Eligibilities: A specification of which Individuals may or must participate as which Elements in the relationship.

Expansions:

Elaborating the Classification of a given Individual *via* an Object, Process, Event, or State of Affairs Unit.

Elaborating the Classification of a given Individual as an Attribute by giving an SAU description of the state of affairs in which the Attribute is the Relationship.

Contingencies:

Specification, involving either attributes of the individuals or combinations of conditions of constituents, that specify which combinations may occur and still be a case of this state of affairs.

Constraints on the use of a particular Name as contingent on the use of other Names for other Elements. For example, "the catcher threw out the mammal at second base" violates this kind of contingency specification.

Constraints such that the use of a particular Element is contingent on its being an element of the SAU in which it is an Element. For example, "the right rear leg of the table is dirty" names a state of affairs including relationships between the top of the table and the legs; the relationship between the legs and the top is Supports (leg, top).If the table is disassembled, there is no longer any such thing as the right rear leg of the table because the state of affairs in which the legs are in those relationships to the top no longer is the case. (However, the individual that was assigned to that Element still exists.

For example, at this moment, my stapler is sitting on my desk. That sentence is a description of a situation, i.e., a state of affairs. A SAU description of this state of affairs is:

Name: My stapler is on top of my desk.
Description:
  Constituents: Stapler, Desk
  Relationships: One binary relation, with the name "on top of"
  Classification: Stapler and Desk are both objects
  Individuals: my stapler, my desk
  Eligibilities: my stapler is eligible to be Stapler; my desk is eligible to be Desk
  Contingencies: none

This SAU illustrates some important points. First, *all* objects, processes, events, states of affairs, and relationships are given by name. This is the same idea as using relationship names such as friend, mother of, etc., in predicate calculus formulas (see, for example, Ginsburg, 1993). The appearance of ordinary English sentences as names may appear odd, but is not different in principle.

Second, this description is obviously "incomplete," in the sense that nothing about the desk is described, nor the stapler, its condition, etc. Thus, "my stapler" is hardly a complete description. Just as with other forms of description of the real world, further information is given by other descriptions, including Object Units.

In giving a state of affairs description, one first specifies a name, with any kind of identifying name or description. For example, "the necklace is more expensive than the ring." (Shideler, 1988) In ordinary discourse, in English, the most common usage is to give brief descriptions. Just as in ordinary discourse, much more might be said, but we do not need to say it all (and indeed could not). Whatever more needs to be said is given in the Expansions, the OUs, PUs, EUs, and SAUs that give the details of the constituent objects, processes, events, and states of affairs. That one object in this example is a necklace is a state of affairs (Rule 9), and that the necklace has a price of $900 is a state of affairs, that the ring has a price of $700 is a state of affairs, that they both have prices is a state of affairs, and that one price is greater than the other is a state of affairs (Rule 8). The expansions allow explicit representation of decomposition, the inclusion of all objects, processes, events, and states of affairs that are constituents of the one named "the necklace costs more than the ring," systematically and to any level of detail. Contingencies (particularly No. 2) allow composition, the specification of larger states of affairs of which this state of affairs is a constituent (following Transition Rule 2).

Specification of relationships by Name should not be taken to imply that the relationships are of any particular kind, such as physical, mathematical, or Turing–computable. It is often the case that the relationship that is central to the state of affairs being what it is is not a physical one. A relationship is specified simply by name. The relationship named "on top of" is physical, but "friend of," "in love with," "understood by," and innumerable others are not *per se* physical. (We would not be inclined to say that since we cannot give a definition of "friend" in terms of physical quantities and relationships there is no such thing as friend.) In fact, many of the relationships central to the conduct of physical science are not physical: that a conclusion is justified or not, that an empirical result is consistent with a given theory, that a reader agrees or does not agree with a theory, etc.

There is nothing in the State of Affairs System to keep a describer from taking a position that only those relationships reducible to a finite set of physical relationships are acceptable (which is the materialist position). However, this formulation reveals that position for exactly what it is: an *a priori* commitment to only giving, or accepting, certain kinds of descriptions. Nothing is gained in the way of precision by such a commitment, although the narrowing of scope it affords may be useful to the describer. In general, limiting oneself to physical, or any particular kind of, relationships, objects, processes, events, and states of affairs does not make one's descriptions more, or less, scientific.

Additionally, while relationships and constituents are named explicitly, this does not indicate that actual cases are always "all or nothing." That two constituents have a relationship to some degree is a common occurrence, one which itself is a state of affairs. Thus, fuzzy, unclear, or approximate cases are included, like any other states of affairs.

A more complex example, and one in some ways more illuminating, is the following one, due to Shideler (1988) of two humans in a traditional two–person marriage:

Name: John and Jane's Marital Relationship
Description:
    Constituents: Husband, Wife
    Relationships: One binary relation, with the name "married";
    Husband, Wife each have the unary relation (the attribute) "Human."
    Classification: Husband and wife are both objects
    Individuals: John, Jane
    Eligibilities: Jane is eligible to be Wife
    John is eligible to be Husband
    Contingencies: Husband, Wife not in the relation "married" with anyone else; John and Jane were Groom and Bride, respectively, in a Wedding Ceremony.

In addition to illustrating the description of non–physical states of affairs, this example illustrates an important and somewhat subtle point about these descriptions: they are descriptions, not definitions. The names of constituents and relationships are not intended as definitions, but (depending on the use of the descriptions) as simply formal names for identity coordination or for identifiers usable by persons with the knowledge and competence to recognize instances of them. Certainly this simple SAU could not "define" the state (or relation) of marriage, in the sense of giving the particular characteristics that distinguish this state of affairs from others, or describe any of the myriad details and complexities of how that state of affairs relates to others. (In general, though, considerable detail can be represented by the contingencies of the description.)

In particular, much of what would ordinarily be called the "meaning" of the term "married" includes facts about how one is treated differently if one is married. This aspect of "meaning" is not excluded here; it is just not represented within this state of affairs description. Such connotative meaning is explicitly included by representing it in other Object, Process, Event, and State of Affairs descriptions of objects, processes, events, and states of affairs in which the original state of affairs is involved. As an example, part of the concept of (traditional, two–person, Western) marriage is that neither Husband or Wife is married to someone else, which we see in the above State of Affairs Description.

Sometimes the further detail needed involves some part of one of the constituents of the state of affairs. Further description of constituent objects, processes, events, and states of affairs are given by Object, Process, Event, and other State of Affairs Units. Any object, process, event, or state of affairs may be further described, down to any level of detail necessary or appropriate (as discussed in some detail by Ossorio, 1978).

Names and Definitions

As accustomed to definitions as we are, there is a tendency to think of the Name of the unit as a definition, but it is not, nor is the entire Unit. The descriptive format approach allows one to specify all that is known about some element of the world, at that level of detail, without having to have a definition. The thing (object, state of affairs, etc.) being represented is identified by a formal name; when further information is needed, it is represented by the appropriate descriptive format, which is always of the form (Name, Description). The Description gives the immediate constituents and their relationships. Any component, at any level, can be further described *via* the appropriate object, process, event, or state of affairs description. A particular set of descriptions, giving further description about constituents at various levels of detail, is however only that: further information. Further description is only that, however, not definition or a complete specification of all of the constituents and their (recursively specified) sub-constituents.

For example, one commonly encounters the statement that ordinary objects are "really" sets of fundamental particles, and therefore to "really" specify, say, a pencil, one would have to specify the attributes of all the particles the make up the pencil. By contrast, following the descriptive format approach, to describe a pencil, one gives an Object Unit, specifying the pencil's immediate constituents and their relationships, and as much further detail as necessary or useful *via* further Object Units. The set of Units does not define the pencil, nor say everything that could be said about it and its parts, but this does not make the description defective. It is worth noting that this is the form of description persons most commonly employ in describing the everyday world.

As the above example of "John and Jane's marital relationship" illustrates, this device allows us to name, describe, and use the descriptions of states of affairs, objects, processes, and events that we would be hard-pressed to define. It is hard to imagine what a definition of a particular couple's marital relationship could even look like.

In the same way, the following are also names of states of affairs, whose description at this level can be given by specifying their constituent states of affairs and how those constituents are related: (1) "The nation experienced wide-spread social unrest in the 1960's"; (2) "Runaway inflation contributed to the rise of Nazi Germany"; (3) "Oppression by the patriarchy has led to the current status of women in the world" (Ossorio, 1982). While each of these names can be treated as assertions, they are not serving that function here. They are rather brief descriptions, being used as formal names. Their "meaning" is specified by giving the corresponding Description: the constituents, relationships, etc., from the SAU.

Thus, the (Name, Description) format is a technical device that provides the capability for stating and describing a far greater portion of the world than can be defined. It allows us to formally specify the objects, processes, etc., of any part of

the world, or the world itself, by identifying the elements of interest and representing whatever information we have about those elements.

The Relationship to Frames

There is an obvious similarity between the Object, Process, Event, and State of Affairs Units and the notion, familiar in the Artificial Intelligence literature, of frames (Ginsburg, 1993). Ossorio's work can be seen as a development of the concept of frames, and the descriptions using the Units could be termed "frame-based." However, while not actually incorrect, such a characterization would be misleading.

Ossorio's analysis is a conceptual analysis of the relationships between objects, processes, events, states of affairs, and relationships, and of what it takes to specify one of these things. Whereas the basic concept of a frame is "a group of things usually found together," the basic concept of a Unit is the quite different, and much more rigorous, concept of what it takes to *be* that object, process, event, or state of affairs.

The descriptive formats are a technical resource for representing situations, objects, and aspects of human behavior much more completely than previously. They have been used to allow the direct representation and technical use of actions and circumstances that have never been possible before, including unique formulations of intention, choice, and concepts (Jeffrey and Putman, 1983; Jeffrey *et al*, 1989). Also, it should be noted that historically Ossorio's work pre-dates all published work on frames by several years.

Identity Coordination

One other aspect of the concept of a world needs a bit more discussion, that of identity coordination. This is the notion of the "connectedness" of a world, and of the real world in particular. There is a familiar reminder that "it's one world." I am writing this article on a particular computer (which I might identify by the phrase "my computer"), looking at the specific monitor and typing on the specific keyboard that are object constituents of "my computer"; People reading it receive it on paper by delivery by a person; The paper is manufactured at a specific site by a process involving several objects; These objects are manufactured by other persons, at other specific sites, using other objects; ad infinitum. All of these objects (including the special kind of object, a person), processes, events, and states of affairs are part of the same single one world, which is referred to above as Limiting Case 1. However, what makes it one, connected, world is identity

coordination, i.e., that this piece of paper is *the same thing as* the piece of paper manufactured at the paper-manufacturing site, and so forth.

We refer to this logical phenomenon as "identity coordination." This is one aspect of the world being the actual world, the one we live in and are parts of, rather than theoretical, hypothetical, or merely possible worlds. If the pen I use to make notes on the paper beside me is not the same pen as the pen I lay down on the desk a moment ago, and nothing has happened to change the pen, then my description of the world is recognizably defective.

We now turn to the central goal of the paper, formulating consciousness. We use the logical fact that the world is a single whole to provide a logically consistent and coherent account of the phenomenon of experience. We will show that the relationship between a person's experience of a thing and the thing itself, and the inaccessibility of one person's experience by another follow from the fact that a person has a world, and that it is a world, i.e., a single thing, not something else.

CONSCIOUSNESS

The previous section presented a formal system of reality concepts that can be used to describe, *via* the (Name, Description) format, a world or any portion of one as both a single all-inclusive whole and as consisting of its constituents at any level. In this section we address a crucially important special case: A world that includes the person whose world it is as a constituent, i.e., the ordinary case of a person in the world. We shall show that consciousness, experience, and feelings are the logical outcomes of a person having a world, and having a very particular place within that world.

Parametric Formulations

One of the difficulties in talking about consciousness is that the word has been used in so many ways and so many contexts that clarification is necessary. It is very easy to give examples of phenomena that fit one aspect or another of our notion of consciousness, but it is very hard to do more than that. Guzeldore (1995) has nicely summarized the current situation, as well as the past 100 years, with the following: "To make matters worse it is not clear whether everyone *means* the same thing by the term 'consciousness', even within the bounds of a single discipline." In this vein, Penrose (1989) has stated that it is "premature" to try to give a definition of the term, and in view of the tremendous range of phenomena to which the word is applied he may be right. Certainly the great array of incompatible definitions currently in use would seem to point in that direction.

However, giving a definition is not the only way to clarify a concept. Another is to give a *parametric formulation*. A parametric formulation of something is a formulation of the possibilities for what the thing could be and still be a thing of that kind—a color, a chair, a baseball game, a theory, etc.

For example, one would be hard-pressed to give a definition of color, but a parametric formulation can be given, as follows:

Color = <H, S, I>, where

H is the hue
S is the saturation
I is the intensity

Any particular color is then specified by specifying actual values for each parameter.

The obvious questions are which parameters are appropriate, and how one decides. A choice of parameters is similar to a choice of a coordinate system. One selects a set of parameters necessary to capture the distinctions desired, and one decides by deciding whether a possible set of parameters do that job. Thus in the case of color, one decides whether hue, saturation, and intensity are appropriate parameters for the concept of color by examining the phenomena already recognized as examples of the concept of color, and determining whether these parameters capture those examples. (In this sense, and in this sense only, choosing a set of parameters is empirical, i.e., subject to verification, by observation, that they "work.") Just as one can have more than one coordinate system (e.g., Cartesian and polar), one may have more than one parameterization.

The color example also illustrates two additional points. First, a parametric analysis is not a definition, in the sense that one who did not have the ability to distinguish colors, and these aspects of colors, could not gain it from this analysis. Second, the same holds for the parameters. The analysis would be meaningless to one who did not have the concepts of hue, saturation, and intensity.

A parametric formulation is particularly useful when one can identify certain aspects of a phenomenon that are crucial to its being what it is, but cannot find an "underlying" explanation for those aspects. In the case of color, there is no further breakdown of hue, saturation, and intensity (although there could be such), and no such breakdown is necessary for characterizing the phenomenon of color, as long as one has the concepts used in the parameters.

Parametric Formulation of Consciousness

The phenomenon of consciousness has two fundamental aspects. One of those aspects is what one is aware of. We say that one is aware of, or conscious of, the

table, the pencil, the football, the relationship between the mother and daughter, the falling leaf, and so forth. Referring to the previous section, we see that elements of one's world can be "decomposed," i.e., described in terms of their constituent objects, processes, etc., as codified by the Descriptive Units, and they can be composed into larger objects, states of affairs, etc., i.e., described as constituents of larger, containing, objects, states of affairs, etc. A person's world is the totality of all of these objects, processes, events, and states of affairs. This is limiting case LC–I, the state of affairs that includes all other states of affairs, and thus all objects, states of affairs, etc., and all their constituents, at any level of detail.

More colloquially, one might say that a person's world is everything that the person sees around them, and all of the parts of those things, and all of the things those things could be parts of.

By "aware of" something, we mean that a person (1) observes the thing, and (2) knows that they are observing that thing. Thus, awareness is somewhat similar to cognizant action (Ossorio, 1981), in which the person knows X (i.e., is acting on the distinction between X and not–X), and knows they are. It is important to note that what a person can observe is not limited to objects, processes, events, or states of affairs physically present. One can be aware that war is imminent, that someone not present is a close friend, that one failed to turn off the oven before leaving on vacation three days ago, etc. In each case, one is observing a state of affairs involving various elements of the world.

This does not mean that the person is at any time, or ever, actually aware of each part of their world. It means only that they can be. In particular, all of the common phenomena such as "fringe of awareness," "back of the mind," and Heidegger's "readiness to hand" (Winograd & Flores, 1986) are phenomena related to the logical fact that a person has a world and can be aware of elements of it.

One particular element of a person's world is critical, namely, the person whose world it is. A person must be a part of a world; for any person, their world is the one that includes a place for them as an active agent, observer of their actions, and critic responsible for assessing the success of their actions (Ossorio, 1982). This is the logical minimum for a person to act at all.

The second fundamental aspect of the phenomenon of consciousness is that one's consciousness changes in more basic, profound ways than are accounted for by ordinary states of awareness. Further, this is an ordinary, everyday occurrence, that one ordinarily takes in one's stride without noticing it unless something goes wrong. "Altered states of consciousness" are more extreme or exotic forms of the same phenomenon. When one is at work, one is aware of various aspects of the work world: work relationships, things used at work, situations involving work, events at work, and so on. The phrase "work world" is not merely poetry. It reflects the reality that the elements at work comprise a world, as we have articulated that concept above. When one leaves work, and goes to home to one's family, for example, one's world is different: different objects, processes, events, states of

affairs, and relationships. The all–encompassing transitive closure of that set of things is a world, just as the work world is a world. When at work, one is conscious *as* some element in that world; when at home, one's consciousness is that of a family member, specifically as the position one holds in one's family. (Psychotherapists have found great value in examining exactly what that position is, as an explanation for a number of apparently intra–personal problems, and as a source of therapeutic strategies.) In other words, one is now conscious *as* an element of a different world. The second fundamental aspect of consciousness is what one is conscious as.

One need not change worlds entirely to be conscious as something different. That is merely the most common way. Other examples are also familiar and unremarkable. A university professor who audits a class in another discipline, for example, will be conscious as student in that class, but as a professor at other times, in the same world.

One special case of a person's world is extremely important: one's *entire* world. One's work world, family world, hobby worlds, etc., are worlds in the way discussed above, but they do not encompass everything about the person. One's entire world is the world that encompasses *all* of one's relationships, processes, objects, events, and states of affairs in one's life. While one can, and commonly does, move between one world and another, one cannot step out of one's entire world, for whatever one is conscious as is part of one's (entire) world.

The relationship between a person's worlds, and their entire world, is complex. Worlds logically are entirely separate. The world of baseball and the world of computing, for example, have no concepts in common. However, the worlds are related: they are parts of a person's entire world, and that person can routinely and without fanfare move between them. A computer scientist can play in a faculty–student softball game. Further, in the paradigm case we take objects, processes, etc., from one world to another and recognize them as the same object. Thus, I know that the pen I use to grade papers is the same thing I use to sign the credit card slip when I go out to dinner with my family. One need only try imagining a person who could never see connections between the events, objects, etc., in one world and another to notice that such a phenomenon would not correspond to our concept of consciousness. If, when I left work and went home, I retained no knowledge of my work world or anything in it—nothing about events, nothing about which processes were at which stage of completion, none of the people there, etc., and could never recognize when something in one world was the same thing as in another world, I would not be functioning in the way that people observably do.

There are exceptions to this automatic retention of knowledge as one moves from one world to another, cases in which recognizing something as the same object from two different worlds does not happen without some effort. The state of affairs in which one historical individual is "the same thing" as something in

another world, that is, is the same historical individual but is an Element in states of affairs in different worlds, is more complex than one which the two constituent states of affairs are in the same world, and it would not be surprising if the recognition of the more complex state of affairs sometimes went wrong or did not occur without deliberate effort. Colloquially, we say, "I had to think about it." A common example of this phenomenon is knowing someone in one setting and then being unable to recognize them in another.

Thus, a person's world is the entire world of that person, encompassing all the objects, processes, events, relationships, and states of affairs, including all their behaviors and possible behaviors. Or, to put it another way, a person has a unique position in his (or her) world: he (or she) is the one whose world it is.

Examining the foregoing, we see that there are two kinds of facts about a person and their world: (1) A person must exist in a real world, i.e., must have place in that world, and (2) The person recognizes and acts on elements of their world *as elements of a world*, i.e., as parts of the single connected thing they themselves are also parts of. A more poetic formulation of this, and one that perhaps is more informative, might be to say, "A person is in the world and the world is in the person." We summarize this by the reminder that a person has a world.

A person's consciousness thus has two irreducible aspects: (1) The world the person can be conscious, or aware, *of*, and (2) What the person is conscious *as*, in the world.

Deciding whether a set of parameters characterizes a phenomenon is a matter of deciding whether the parameters capture all the cases of interest, and only those case. In the case of color, hue, saturation, and intensity are an accepted parametrization of color because every actual color can be described by specifying values of these three parameters. In the case of consciousness, the world the person can be conscious of and what the person is conscious as appear to parameterize consciousness: any actual instance of consciousness can be specified by giving particular values for these two parameters, the name of the world and the name of the position in that world.

Thus, consciousness may be described as that phenomenon characterized by

$C = <I, W, P>$, where

I is the individual whose consciousness it is
W is the world of the things the person can he conscious *of*
P is the position in the world that the person is conscious *as*.

W and "Degrees" of Consciousness

Characterizing consciousness as phenomena involving the world of things which one can be aware of provides immediate conceptual access to all phenomena

to as "edge of awareness," "fringe of consciousness," and so forth. When I am typing this paragraph, I am immediately aware of the words I am typing and whether they convey what I am trying to convey; I am "peripherally aware" of the television in the room next to my home office; if I work long enough my hunger will "intrude" on my consciousness. These states of affairs are part of my world, but I may not be doing anything involving them. We have a rich language for first–hand reports of elements of our world that we could, under the proper circumstances, be aware of, but are not at that moment. Thus, the W parameter allows us to represent precisely many, perhaps most, of the ordinary phenomena we would consider as falling under the heading of consciousness.

Relationships Between P and W

P Must Be in W

Not all possible values of P and W are meaningful. P must be the name of a position, or place, in W. As an example, consider the world of baseball, in which there are batters, pitchers, fielders, gloves, baseballs, umpires, diamonds, baselines, and so forth, i.e., the kinds of the things mentioned in the rules that define the game of baseball. In that world, there is no such thing as an accountant, and thus one cannot be conscious *as* an accountant and be part of a game of baseball.

However, the same individuals may be parts of more than one world. The scorekeeper for a baseball game is conscious as an accountant, but is conscious of balls, strikes, runs, and so forth. Scorekeeper is a constituent of a different world, one that includes many of the same constituents as the baseball world, but includes others as well: scorekeepers, score books, batting averages, RBIs, and so forth. The world of baseball has no place for an accountant, but baseball can have a place in the world of an accountant.

Baseball further exemplifies the common observation that two people in different positions may be aware of the same things, but in another sense their awareness of those things is very different. A player and a scorekeeper are conscious not only as different constituents, but as different constituents of different worlds; both P and W have different values.

Conversely, to be conscious of some element E of W, one must be conscious not only as some element of W, but as an element of W that can be aware of E. When a baseball player is negotiating for a salary, he must be conscious of objects, processes, and states of affairs that are not parts of the baseball world, such as number of years in the contract, economic goals for the future, expenses, etc., and to be conscious of these things he must be conscious not as a baseball player but rather as a person, perhaps an economically concerned person, and that person is a member of the human world.

More generally, the position P must be a position in which an individual can be aware of the constituents of the world W. The pen on my desk is an object in my world, but it makes no sense (other than metaphorically) to speak of the pen's consciousness, or being conscious as the pen. (One could however sensibly speak of being conscious as a person acting as though they were a pen.)

Personal Identity

A person cannot be in a world without being in some particular position within it. Most commonly, this position is that of an Element that is a constituent of states of affairs in that world: researcher, teacher, professor, father, husband, mother, wife, man, woman, human, and so forth. In some cases there is no name for the position other than what might be called "derivative," i.e., names that refer to other objects, processes, events, or states of affairs. For example, "tight end" is a position on a football team, but so is "the guy that caught the pass that won the last Super Bowl." Similarly, "mother" is a position in a family, but so is "mother who went back to school to complete her graduate work." Thus, a person is always conscious *as* some element of their world.

A number of psychological phenomena, including several of direct interest to psychotherapists, are related to this fact. The familiar "identity crisis," in which the person reports, "I don't know who I am," can be seen as a report that the person does not know just what their place is in their world. One way (although not the only way) such a situation can arise is if a person finds themselves doing things that they do not see as consistent with any of the positions they can name. This phenomenon has become familiar as the women's movement has grown. In such a case an effective therapeutic strategy is often to enable the person to see just what their position in their world is, even though it does not have a simple name.

Wechsler (1995) has discussed in some detail how post–traumatic stress syndrome is a dramatic example of this logic. In PTSD, events have occurred which were, literally, not thinkable in the person's world, as they took the world to be. This leaves the person with the (quite appropriate) question, "What the hell kind of a world is it anyway where *this* kind of thing can happen?" The follow–on question is usually not far behind: "And if it's *that* kind of world, what's my place in it?" In such a case the person has the task of almost literally re–constructing their world.

Perhaps the most extreme example of problematical phenomena related to a person and their world is multiple personality disorder. The most striking characteristic of this situation is that the "personalities" are, in effect, different persons, with different worlds, and therefore distinct positions in those worlds. The therapeutic process is one of "integrating" the personalities, and the worlds, into one world. Ossorio (1995) has noted that there is some evidence that the crucial difference in the history of persons with this disorder is not only the occurrence of events impossible in their world, but that they were forced to act in ways that had

literally no place in their world, and hence were forced to act as though they were not any part of their own world.

The Consciousness Change Formula

It is a fundamental fact about relationships and actions that relationships are changed by actions. Ossorio has neatly formulated this fact with the Relationship Change Formula (Shideler, 1988):

If: A person P has relationship R1 with person Q,
Action A is inconsistent with R1,
A is consistent with relationship R2,
P engages in A with Q,

Then the relationship between P and Q will change in the direction of R2, i.e., will change to a new relationship R3, more similar to R2 than is R1

The interesting empirical questions are of course what characteristics of P and Q lead to what changes in which relationships, based on which actions.

We can generalize this to the *Consciousness Change Formula*:

If: A person is conscious as P1,
The person acts as P2.
i.e., the person engages in the actions one does in position P2,
these actions are not consistent with being in position P1,

Then the person's consciousness will change in the direction of consciousness as P2, i.e., will change to consciousness as P3, a position more similar to P2 than is P1.

As with the Relationship Change Formula, this formula is deliberately stated in such a way that it is not a claim to empirical truth. What must be determined empirically is which actions, for which kinds of persons, produce what degree of change from which P1 to which P2.

This formula has applications in diverse areas, of which we will mention two. First, a number of people are specifically interested in how to change someone's consciousness, including their own. This principle says that, to change someone's consciousness, have them do things that are characteristic of the position desired. In practice this is not simple, and the formula implies the reason: the person must be capable of the actions; the actions must not be consistent, in the person's world, with the position they already have; and the actions must not be so inconsistent with the person's current position in their world that they are unable to do them. One would expect variation in skill in judging these factors (which are states of affairs), and in fact that is what one finds.

Certain kinds of psychotherapy involve exactly this change of consciousness, either as part of the process or as an end result. Many of the techniques of Milton Erickson, the famous therapist who often used hypnosis in therapy, are of this sort (Haley, 1973). Erickson also exemplifies the above-mentioned importance of skill.

One would not expect, from the Consciousness Change Formula, that exhortation would be an effective technique to change someone's consciousness, and empirically it is not. (It may however provide sufficient reason for the person to do different things, in which case their consciousness may change, as codified by the formula.)

A rather different example can be found in large organizations. It is commonplace to want members of one part of the organization to understand and act on the point of view of members from some very different area. When an engineer and a marketing expert are working on a project, for example, this is necessary. Based on the formula, we would expect that for a person to actually see things from a different position they would have to do something other than simply receive the instruction to see things differently. Also, we would expect that, when the people go back to their respective usual positions their consciousness would revert to what it normally is, because they go back to doing what they normally do. Implications of this situation for software development organizations are discussed in more detail in Jeffrey (1996).

EXPERIENCE

Clearly, any conceptualization of consciousness that is limited to what is public and observable is not adequate. Some of the most striking and important aspects of consciousness, i.e., some of the most significant phenomena that are accepted as part of this subject matter, concern the relationship between what a person is conscious of "within themselves" and what is public and observable by others, the ancient and venerable domain of the "inner" and "outer" lives.

Experience clearly has some relationship to knowledge. I can know that I experienced the cold as biting, the words as hurtful, and so on. It seems clear, though, that experience is more than knowledge. Knowledge of the orange is not the same as the taste of the orange; knowing that an oboe is being played is not the same thing, categorically, as hearing an oboe.

Two characteristics of experience seem particularly important in distinguishing it from other phenomena. First, it is "immediate," in that there is nothing else one does in order to find out one's experience. This is perhaps the aspect that has led many to treat experience as what is real, and the public world, or the "real world" as a construct of "raw feels," "sensory impressions," or something similar. However, observational immediacy is a characteristic of the objects, processes, events, and states of affairs that make up one's world. There is nothing intervening

in one's experience, and there is nothing intervening in observations of the real world. I observe my fingers typing, hear the sound of the fan, smell the apple juice, feel the heat, etc., without first doing something else, and likewise I notice how it feels when my fingers hit the keys, how the apple juice tastes, and so on. Thus, immediacy is common to experience and to observations of the public world.

Second, experience is not public. You cannot feel the pain if I hit my thumb with a hammer; when you eat an orange I cannot have your taste of it. Thus, one's experience is unique to him or herself, and this non–public aspect of experience is logically necessary for the phenomenon to be part of what it is to be experience, rather than an ordinary observation. (If, for example, my thumb bleeds when I hit it, we do not say, "My experience was that my thumb bled.")

This uniqueness is of a particular sort, and one must be careful not to claim too much. There seems nothing in principle impossible with the idea of a telepath, as fantasized in science fiction, that could observe my experience of tasting the orange. However, he/she would be observing, perhaps even tasting, *as* themselves, not as me. That person's experience would then be whatever they experienced when they observed my experience of tasting the orange.

To articulate the concept of experience, i.e., to include the phenomenon and say how it is related to consciousness, using the parametric formulation, we must first examine certain aspects of the concept of position, and the logical relationship between position and behavior.

In general, what a person can observe depends on the position from which they are viewing a situation. As a heuristic analogy, consider looking at a chair in a room. The chair may be viewed from any position within the room, and what the observer will see varies with their position. The same principle holds with respect to the more general situation of position in the world. If I am in position P, there are various things I will not be able to observe. (Of course, I may be able to imagine what those things look like, if I have ever observed them or if I know someone else's description.) If I have observed them, I could not be said to be aware, or conscious, of them (although I could certainly be aware of others' reports of them).

The critical issue with respect to what one can see from one place in a room or another is the particular physical, geographic, relationship with respect to the object being viewed. There are any number of such relationships, and in general it is useful to be able to refer to a place, or position, in the room as a representation, or codification, of all the physical relationships. Cartesian 3–space is a scheme for giving names to positions. Similarly, in the more general case of the real world, the position of something in the world is a description, or codification, of the thing's relationships to all the constituents of the world.

A person's overall position in their world includes a number of different, less inclusive, positions: man, woman, computer scientist, psychologist, child, artist, runner, and so forth. (How many people have had the experience of things looking

different when they go visit their parents' home as adults? Or perhaps I should ask, is there anyone who has not had that experience?) This is almost the same phenomenon we began with, the fact that a person can be conscious as different elements of their world, and being conscious as those things makes differences in what they can be aware of.

With most positions in the world, many individuals can occupy that place. The position of Supervisor, professor, teacher of a class, child, student, coffee cup, bucket, car, etc., can be filled by any number of individuals. I used to have one accountant and now I have another, and I expect both individuals to look at my finances from the position of accountant. This is the ordinary, unremarkable situation with most positions. When I occupy that position in the world, I am in principle able to observe the things anyone else in that position can observe.

However, there is an exception: the position of *that person*. A person's overall position in their world is unique, much as the 0–point of a set of Cartesian coordinates is unique; it is *that* person's world, the one in which they are the actor, observer, and critic. No other individual can be in the position of me, i.e., the person whose world this is. Or, more succinctly, no one else can be me. For any person, there is in their world a position only they can hold, namely, the position of the person *whose world it is*.

Since what one can observe depends on the position from which one views the world, some of what a person observes of their world is not observable by anyone else, due to the fact that no other person can occupy the place from which these things are observable. In this sense, some parts of a person's world are irrevocably *private*; the only access another observer can ever have to these parts of a person's world are through observation of the person and their behavior, including that person's language (i.e. what they say about it).

One additional logical fact about experience is relevant here, namely, experience is not a separate kind of thing, somehow associated with real things. Rather, the term refers to things one observes when something happens in the world. Thus in the paradigm case (and the overwhelming majority of cases) we speak of the experience *of* something. My experience of hitting my thumb is what I experience when I hit my thumb, or, using the formulation above, my experience of hitting my thumb consists of those parts of the world that only I can observe when I hit my thumb. (And thus Ossorio's observation that my experience of walking across the street is whatever I experience when I walk across the street.)

These four facts appear to capture the concept of experience: it is the experience of something; it is real to the person who has it, i.e., part of that person's world; it is related to knowledge but categorically unlike it; and is essentially and irrevocably private. I believe we can, accurately and without doing injustice to the phenomenon, characterize experience as those aspects of a person's world that are observable only by that person, by virtue of it being that person's world. We can summarize this as follows:

A person's experience of X consists of the irrevocably private portions of the person's world, when X is the case.

We should note that nothing here indicates that experience is always present, or logically necessary. This is consistent with the observed fact that a person may have no experience of a thing or situation; I might walk across the street and have no experience of it.

Historical uniqueness of individuals plays a key role here. It is this uniqueness that makes the states of affairs the experience of *this* person. Nothing in principle prevents an observer from knowing of another's private states of affairs (as with the hypothetical telepath), but the observer cannot know them *as* that person because the observer does not have the same relationship to the states of affairs as does the person whose world it is. In other words, I cannot have your experience, because you and I are distinct persons and so have distinct places in our respective worlds.

Uniqueness of individuals, and permissiveness of the State of Affairs System, provide an explanation of another aspect of experience: the unpredictability of the experience of something. That two people can observe the same object, and yet have dramatically different experiences of it, is a commonplace occurrence. Since the two people have, from the outset, different relationships to the things observed and done, we have the "raw material" for two different worlds. In each of these worlds, a portion will be shared and public, and a portion will be unique to the person whose world it is, because it is the states of affairs, objects, processes, and events related to the state of affairs whose Relationships include the one in which the person whose world it is is an Element. Less technically (but perhaps more clearly), Peter and Paul have different experiences of the same thing because Peter is not Paul, and so must have a different relationship with the thing.

We note that characterizing experience as the essentially private aspects of a person's world is not derived from, but is consistent with, Wittgenstein's observation that the essentially private aspects of one's world have no special priority or reality, and in fact are in some sense secondary to the public ones (Wittgenstein, as quoted in Grayling, 1988).

FEELINGS

Other than terms specifically from the realm of religion and spirituality, probably none is more traditionally antithetical to scientific accounts than "feelings." However, an account of consciousness without a discussion of feelings is clearly not complete. In this section we show that we can make sense of feelings, that is, incorporate them into the conceptual model of consciousness and experience we have developed. We show that feelings can be treated as a particular

kind of a person's experience, i.e., a particular kind of private aspect of a person's world.

First, recall the concept of appraisal (Shideler, 1988). States of affairs do not all have the same behavioral status. Some descriptions are descriptions of states of affairs that have no particular immediate implication for action. Others, however, tautologically imply that an action is called for.

Ossorio's paradigm case example is that of danger and escape. I am standing in an empty room, the door opens, and a lion walks into the room. I take one look at the lion and leap through the window. Outside, someone (perhaps a psychologist) asks me why I did that, and I reply, "There was a lion in the room." "Oh, you mean that the lion caused you to jump out of the window?" "Why, no. The lion was dangerous and I escaped from the danger."

Notice that there is no further explanation called for, beyond the recognition of danger and acting to avoid it. Telling you I recognized danger is telling you escape was called for, i.e., danger and having reason for avoidance are tautological. "The lion is dangerous" is an *appraisal*. Other descriptions, by contrast, carry no implications for action (although they of course may be part of other states of affairs that do). "The lion is yellow" is such a *mere description*.

The lion example illustrates one further characteristic of certain kinds of actions: when the lion walks into the room, I immediately, with no further deliberation, leap out of the window. If sat quietly, examined a number of alternatives, tried one or two, and then jumped through the window, it is a different kind of action. In this case one would probably say I was behaving prudently, but not "reacting out of fear." Emotional behavior is an action such that: (1) It is acting on a recognition of a state of affairs that carries tautological implications for action, i.e., an appraisal, and (2) There is a learned tendency to act without further deliberation.

Recalling also that a state of affairs is characterized by its immediate constituents and the relationships between them, as codified in the SAU, we can say further one of the critical features of the appraisal and action is the specific relationship being acted on. As with the lion, this relationship is a real, public, relationship. The lion and I have the relationship that the lion is dangerous to me, and my recognition is a recognition of that public, real-world relationship. Finally, notice that the relationship involved in the appraisal must be a relationship between *that* individual and some part of their world. If I recognize that the lion is dangerous to you, that state of affairs in itself has no implications for my behavior. (I can of course recognize that your being in danger is in turn a state of affairs that is a danger to me, and most of us would.) Appraisals are thus always "first person."

Public, observable emotional behaviors, as defined in the above paragraph, are universally understood and recognized (although of course the specific relationships and the ways of acting on them will vary greatly from culture to culture). They are the unmistakable cases of a person publicly acting, without further deliberation, on an appraisal.

What then are feelings, and how are they related to the public, observable-by-others, world? Feelings are what a person experiences when they make an appraisal, i.e., feelings are the private, observable only by the individual, parts of a person's world that are present when a person recognizes a relationship between themselves and some part of the world that tautologically implies a kind of action. In short:

Feelings are the experience of appraisal.

A short hand form of this is to say that the feeling of fear is whatever you feel when you are afraid, if you feel anything. As discussed by Shideler (1988), the feeling of anger is whatever you feel when you are angry; the feeling of guilt is whatever you feel when you are guilty (in your own judgment); the feeling of joy is whatever you feel when enjoy good fortune; and so forth.

Just as one may have no experience of walking across the street, one may make an appraisal and have no feelings about it; the lion walks into the room and I jump out the window, but I have no feeling of fear. Thus, to be more complete, we might say, "Feelings are what a person experiences when they make an appraisal, if they experience anything."

Several points are worth noting here. First, this formulation encompasses both the real-world situation involved in the appraisal as well as the experiential, private, aspects. In addition, if we remember that we are talking about a person's world here, and how connected the parts of a world are, it is not surprising that a person's experience, or feeling, in a situation is not predictable and is highly individualistic.

Second, the formulation captures the undeniable connection between feelings and appraisals. This the reason why asking a person how they feel about something is often (although not always) a way to find out about what their actual appraisals of a situation are. However, it also is a reminder that the real issue is never the feeling itself; it is the person's appraisal of the world, specifically of their relationships to the elements of their world.

One may or may not be conscious of one's appraisals, and simply knowing one is expected to appraise a situation in certain ways is not the same as actually doing so. This formulation thus provides a different conceptualization for understanding language such as "I know it but I don't feel it," and the famous split between intellect and emotion. It also includes the situation in which a person does not know they are acting in an angry (or sad, etc.) way, and has no feelings about a situation, person, etc., but is recognizably acting in angry, etc., ways, i.e., ways a person acts when that is the relationship, whether they know it or not.

Finally, focusing on the public, real-world basis of feeling provides a basis for including feelings and experience as subjects of scientific study, without having to assume they can be reduced to physiology. An observer's only access to another

person's experience, including their feelings, is by observation and language. As a result, a person's report of their feelings is not subject to the same kind of direct observational verification that ordinary observation reports are. If I tell you I feel calm and peaceful, but you see my face turn red and my hands clench into fists, you can observe that my state and behavior are inconsistent with my report, but that is categorically different from what you can do if I tell you that there is an elephant on my desk. For this reason, statements such as "It's true that he is feeling X" cannot simply be taken literally.

Such a statement can however be understood in another way: It can be understood as, "That feeling is not the feeling one has when relationship R is the case, and the subject is not acting in any of the ways a person (in this culture, with this background) acts on that relationship." By doing this, the investigator has moved to the public realm of relationships and actions, where there are statements, theories, and conceptualizations, where things are observable by others and evaluations done.

We can summarize this with Ossorio's formulation: "Telling you my feelings is like making you a promise." Promises are not true or false, and so it would be nonsensical to ask, "Is it true that the subject made a promise?" Just as with feelings, though, we can observe the person who made the promise in situations in which, as far as can be determined, they have real opportunities to do what was promised, and determine by observation whether they did any of the things a person who had made such a promise would have done.

A SCIENCE OF CONSCIOUSNESS

In this section we use the parametric formulation of consciousness to address a few of the important questions about consciousness: (1) How does consciousness arise? (2) What is the physical "basis" of consciousness? (3) How can consciousness, experience, and feelings be studied scientifically but non–reductively? and (4) Can a computer be the basis for consciousness, i.e., is a conscious artifact possible?

How Does Consciousness Arise?

The usual formulation of the question of how consciousness arose in the course of evolution is in terms of a random development that provided a survival advantage. Further, it usually assumes that consciousness is some sort of process that takes place in addition to intelligence, problem-solving, etc. Certain aspects of consciousness have an obvious advantage in terms of survival, such as imagination (constructing portions of the world that the constructor knows are not real), planning, etc. There has been little success in assimilating the overall phenomenon to the model of survival advantage, however. For example, it is hard

to see how having an experience of eating an orange provides any survival advantage over simply knowing one is eating an orange, being able to recognize oranges, etc.

The parametric formulation of consciousness gives a different answer. We have seen that, as formulated in Equation (3), an individual's consciousness is not an independent attribute, but is rather the phenomenon articulated in terms of the individual's world and their position in it. The phenomena of consciousness are phenomena of one's world and one's position in it. "How does consciousness arise?" can therefore be re-stated as, "How do worlds arise?," i.e., how does it happen that individuals of some species acquire worlds, as such?

Since a world is a single totality, or more colloquially is connected in the way it is, having a world and having access to all aspects of one's world means that the individual has the potential for experience, i.e., aspects of their world that are in principle not directly accessible to any other person. Feelings, a kind of experience, are similarly a logical possibility. Thus, consciousness, experience, and feelings are names of phenomena that are aspects of an individual having a world. (Using the SAS concepts presented in Section 1, we can state this more precisely as follows: Consciousness, experience, and feelings are names of states of affairs that are constituents of the larger state of affairs of an individual having a world.)

The key issue is connectedness, the kind of connectedness a world exhibits. The question of how consciousness arises in intelligent beings is therefore the question of how beings who have a world evolve. The answer to this would seem to be similar in kind to customarily proposed accounts to the effect that over time individuals acquire greater and greater brain capacity. By formulating the question in terms of worlds, we can sharpen this notion: What develops is the capacity to recognize and act on the various aspects of a real world, in particular composition and identity coordination, until the individuals have a world, rather than partial or defective portions of one. Having a world means both being an element of a world and having a complete description of it, in the sense of including a representation for the being as actor, observer, and critic, and having the requisite capacities for re-description, including composition and decomposition. (Having a description here means only having the functional equivalent of a representation of the information the descriptive Units, not literally having those Units encoded in the brain.)

Giving detailed answers and explanations, and alternative theories of the details of this process, appears to hold great promise as a fascinating scientific endeavor.

The Physical Basis of Consciousness

Since consciousness is an aspect of a person having a world, and we have an independent characterization of what it means to have a world (Section 1), the question of the physical basis of consciousness takes on a different meaning. We suggest that the following reformulation of the question addresses the scientific

issue, but without having to make the assumptions other formulations require, and is more suitable as the basis for mathematical and empirical investigation. We ask:

What are the computational requirements for a brain to be the brain of an individual who has a world?

In a little more detail, what capabilities must a brain have in order for it to be the brain of an individual that has the capabilities with the real world concepts of object, process, event, and state of affairs that are codified in the State of Affairs Transition Rules? More informally, we are asking, "What has to go on in the brain for a person to have a world?"

This is in principle amenable to mathematical analysis and analysis of what operations must be done to maintain the knowledge of the world that persons observably have. Thus, we can ask, "What brain operations must occur for a person to make change X to their knowledge of their world, and how do those operations occur" "What must a person's brain be capable of for them to be able to recognize Y," etc.

Since the descriptive formats of OU, PU, SAU, and EU parameterize what must be specified to identify a particular object, process, etc., and the transition rules specify the kinds of composition and decomposition a person must have the capacity to do, and the names of the relationships that appear in the Units specify the relationships the person must be able to distinguish, this formulation seems directly amenable to analysis that could yield very specific and quantitative answers. It seems plausible, for example, that using this approach we could develop quantitative answers to questions such as when some entity has the capacity to have a world, i.e., could be a person in the usual sense of the word. Such an approach would be somewhat like information–processing arguments, but might more appropriately be termed a *description capacity* approach. (Some of the technical implications for the "processing" requirements are discussed in "computer–based consciousness" below.)

The Scientific Study of Consciousness

Before the question of the scientific study of consciousness can be addressed, a methodological and foundational issue must be dealt with. That issue is whether "scientific study" is synonymous with "reduction to physics." Most physical scientists, for example, seem to take this methodological assumption on faith. Further, the assumption seems to be rooted in the ages–old insistence that what is real is what is reducible in principle to physical objects, processes, events, and states of affairs. Given that assumption, scientific study has to be explanation in terms of physics.

We do not want to attempt to address that topic more than we have already done in passing. It is discussed thoroughly and definitively by Ossorio (1978). For

purposes of this paper, we simply wish to take the most conservative position possible: objects, processes, events, and states of affairs, and the relationships that are part of what it takes to be those things, are real if they are in principle observable or constituents of observable things, and there are ways of acting on them. Some of the actions may be linguistic, such as naming them, describing them, explaining them, including them in other descriptions, and so forth.

The relationships between constituents of an object or state of affairs are crucial to the thing being what it is, rather than something else, and this (logical) fact is codified in the SAU and OU. Examining the SAU and OU, it will be seen that nothing is specified as to whether the relationship is physical or not, or whether the relationship is computable. Limiting ourselves to physical (or computable) things and relationships does not allow for describing the full range of things and relationships one might need to describe a real world. (For example, the discussion of whether one description can be reduced to another, physical, one takes place in the real world. Reducibility is therefore a relationship of interest in the real world, and reducibility is not a physical relationship; it is a logical one.)

We indicated briefly in the previous section a different way to proceed with a science of consciousness. Ossorio's formulation of real world concepts provides a systematic and rigorous basis for formulating the twin phenomena of a person being conscious and a person having a world, i.e., a rigorous way to say what these phenomena are, without accepting any part of the reductionist program.

With the formulation of consciousness as a logical outcome of the (logical) fact that a person must have a world, and that a world is all one thing, "connected" in the ways discussed earlier, we are now in the position to make the first, fundamental, move of a scientist in any field: We can say precisely what phenomenon X *is*, independent of any assumptions or theories about what may "underlie" it, and then ask, "What physical processes are occurring when phenomenon X is occurring?"

Examples of non-reductionist inquiries and research based on this formulation are: (1) What are the differences in the brain of a person whose consciousness is different in the following ways? (2) For population P, what actions are most likely to succeed in changing a member of that population's consciousness from C1 to C2? (3) What changes in the brain of a person who becomes able to state something previously on the fringes of their consciousness? (4) What must take place physiologically for a person to become conscious of something they were not previously aware of? (5) How is the consciousness of a person who voluntarily becomes an element of a new world different from that of a person who is forced to become that element in that world? and (6) What kinds of changes take place in the brain of a person when they suddenly are forced to move from consciousness as an element of world W1 to consciousness as an element of world W2?

In short, an entirely different kind of research program is in order, in which the aspect of consciousness of interest is rigorously formulated as completely and

precisely as necessary, entirely without reference to brain processes of any kind, and empirical relationships between the two are researched experimentally, without having to accept anyone's philosophical position about what "must be" true. Within this paradigm, the hard and interesting questions remain, but in a different form. For example, with a rigorous formulation of the phenomena of consciousness, the question of the "basis" for consciousness is transformed into "how does the brain carry out the processes necessary for a person to be able to see the world in a certain way?"

Experience and Feelings

Experience and feelings constitute a special case. Since one person's experience and feelings are not directly accessible to another observer, research involving them can only be done indirectly. This does not invalidate them as candidates for scientific study. It does mean that it is impossible to reify them, and study them as though they were a type of object, process, event, or state of affairs observable in principle like any other.

For example, a person reports that they feel like they have a hot ball in their stomach when they see a certain picture. The straightforwardly scientific way to study such a phenomenon is not to try to find out how big, how hot, how heavy, etc., the ball "really is," because "really" is a meaningless term in this context. However, nothing prevents us from giving formal descriptions of the person's experience as completely as we like, using Unit descriptions or any other formalism.

With such a description of what is the case for the person reporting the experience, two kinds of scientific questions become possible. One is the kind described above, in which one is investigating what happens physically when the person has the experience. This kind of investigation occurs now, of course. When an investigator connects an PET scanner to a subject and has them visualize, say, a beach with gentle waves, they are creating a situation (a state of affairs) in which the subject has some (private) experience and the investigator is trying to find out what happens in the brain when they do. How do we know the subject is "really" visualizing the beach? We don't, of course, other than by the subject's language behavior, i.e., they say so.

The other kind of scientific study of feelings and experience is the behavioral investigation discussed earlier, in which one first determines the reality basis of the experience, the part of the world this is an experience *of*, and then asks to what degree, and/or in what ways, the person is acting in the ways a person in that situation acts.

The more usual questions, however, have no meaning. If my friend promises to pay me $10 next week, but doesn't, I cannot say that he did not really promise. I might, after investigation, say that he did not do any of the things a person does when they have made such a promise. There is no possible way to determine

whether he never really made the promise, i.e., "didn't mean it," or whether he changed his mind later. I can, in principle, determine that there is strong, even overwhelming, reason to take it that he never actually promised, but there is no possibility of direct observation. Analogously, I cannot say that you are not really feeling a cold feeling in the pit of your stomach. I might, after investigation, say that you are not acting in any of the ways a person would act if they had such a feeling. But your feeling might have changed, and there is no such thing as my determining that you did not really have the feeling, beyond your reports of it.

Certainly it is possible that extensive empirical investigation could result in a large body of findings about what kinds of physiological things happen when various experiences or kinds of experience are reported by subjects, so that we could have a statistically reliable body of correlates. In such a case one might be in a position to say that a subject appeared to be mis-reporting their experience because they did not show any of the physiological correlates known to accompany experience X. This would not constitute proof that the subject was not experiencing X, although it might well constitute basis for skepticism.

In summary, with this conceptualization, we have a way to incorporate the phenomena of (private) experience, rigorously and with as much precision as desired, without having to be uncomfortable about a lack of "proof" about what the subject is "really" experiencing. When a subject says that they are visualizing a beach, they are not giving a defective, pre-scientific report that we can hope will one day be replaced with a precise neurophysiological account. Rather, they are giving a straightforward account of a portion of their world, to which the investigator has no access other than their report, and to which the investigator can add a precise neurophysiological account of what is happening when the person has that experience. In this way, experience and feelings can be the subject of legitimate science, rather than inferior substitutes we have to live with until a real science of feelings comes along.

Computer-Based Consciousness

The question of what capabilities a brain must have for it to be the brain of an individual with a world was discussed above. In this section we apply that formulation to the question of whether an artifact with a digital computer as its brain could be conscious, and we discuss what appear to be the key elements necessary for developing a conscious individual whose brain is computer, i.e., a conscious artifact.

Having a World

The individual must have a world, as we have formulated that statement earlier. One way to implement a world on a computer is with a set of explicit

representations of the objects, processes, events, and states of affairs making up that world. This is, however, only the most obvious way. If a set of neural networks provided the requisite capabilities for the system to make the appropriate distinctions and act on them appropriately, including naming or describing them, it would have the functional equivalent of representations, and thus would have a world.

The State of Affairs, Object, Process, and Event Units provide the technical means for representing any set of states of affairs, objects, processes, and events. The (Name, Description) format allows one to describe any desired domain, at any desired comprehensiveness and level of detail. Further, the highest level states of affairs, processes, etc., are specified in the same form and with the same precision as the lower level processes commonly given formal representation. (Jeffrey and Putman1983; Jeffrey *et al*, 1989) and others have constructed several computer systems based on extensive sets of Process Unit descriptions, including descriptions of both very high–level, broad processes, and very low–level, detailed ones.)

In short, the SAU, OU, PU, and EU representation formats provide the capability of describing a world, including the place of the person whose world it is.

Actor Status

Knowledge is not sufficient. The necessity for the individual to have a place as an actor means that it must carry out actions in the world of which it is a constituent. In order for a computer–based individual, for example, to know the taste of an orange, it must taste the orange, and tasting must be part of its world, i.e., the processes, objects, events, and states of affairs involved in the act of tasting must be connected, in the descriptions that represent the individual's world, to other objects, states of affairs, etc. The physical machinery of this action is merely a technological problem. What makes it tasting *per se*, and not the processes of chemical sensors, is what makes human tasting what it is: it is part of a world. Since it part of a world, the taster has the experience of tasting the orange, and we can say knows the taste of an orange.

Since the individual, whether computer–, protoplasm–, or some other material–based, must have a world, and a world is the structured, all–inclusive thing it is, in order for an individual to be conscious it must have autonomy, the ability to recognize non–computable relationships, and the capacity for private experience.

Autonomy

Persons as we know them value some states of affairs over others, and act to achieve them. (This position may appear radical to one who holds a determinist or physicist position, but in actuality is not. It is simply a reminder that there is a concept of a person as an active agent, choosing actions based on valued goals, and

that ordinarily that is what we mean when we say someone is a person.) As Ossorio (1978) has discussed in considerable detail, these values and the way they are used in selecting actions can be represented elegantly by the maxim that a person will not choose less behavior potential over more.

It is not clear, at this point, whether a computer-based individual must value some states of affairs over others. While they must be actors, it may be that they can "do what they are told." They must make appraisals, because appraisals are the descriptions directly related to action, but perhaps these appraisals can be relative to a goal imposed by some other individual. However, a conscious individual not acting on its own would seem to violate our ordinary intuition of what it means to be a person.

Enabling the computer-based entity to act on its own is, however, is within the capabilities we have described. If the computer system incorporates values, such as its continuation as a conscious being, appraises possible actions according to hedonic, prudential, esthetic, and ethical standards, and selects its action in accordance with those appraisals, it would be, in effect, acting on its own.

Recognition of Non-Computable Relationships

If a computer-based system can only recognize relationships reducible to physical or computable ones, it would be so limited that it could not be said to have a world, because the set of relationships reducible to computable ones is so limited that any set of descriptions would qualify only as a caricature of a world. The technical feasibility of computer-based consciousness therefore depends crucially on the system being able to recognize relationships not reducible to computable ones.

This would appear to be the end of any discussion of computer-based consciousness, and has been considered to be such by a number of authors (Dreyfus, 1991; Winograd & Flores, 1986), for the limits of computability are known and well-understood. Much of the work in the physical basis of consciousness is an attempt to show the possibility of a physical mechanism not limited by computability (see, for example, Penrose, 1993). However, there is a different approach to this problem, originally due to Ossorio (1966), and since used by the author (Jeffrey, 1991; Jeffrey, 1993) and others to produce practical, working computer systems with the equivalent of the ability to recognize certain relationships that are not reducible to numerical ones.

The relationship investigated in Ossorio (1966), subject matter relevance, is one of the clearest examples. We desire a computer system that can judge the degree to which document D is relevant to subject matter field F. A vector space with an orthogonal basis is produced such that calculating the location of a document in the space reproduces the judgment of the degree to which the document is relevant to each of the types of subject matter represented by each of the orthogonal axes. The space is produced by factor-analyzing a matrix of judgments, by human experts,

of the degree to which each of a set of terms t_i is relevant to each of a set of subject matter fields F_j. The measurable factors are the basis of the space. New items are indexed in the space, giving in effect a judgment of the subject matter relevance of the item, by finding all known terms in the item and combining their vectors in the space into a single vector, a location in the space. (The procedure is described in some detail by Jeffrey, 1991.)

Ossorio used the factor–space technique to reproduce the ability to recognize other relationships as well:

- R2, a means–end space, in which the judgment data matrix consisted of the degree to which means M_i is an effective means of accomplishing state of affairs E_j.
- R3, an attribute space, in which the judgment data matrix consisted of the degree to which X_i has attribute A_j. An item's location in the space is calculated by combining the vectors for its constituents and relationships. Calculating this location is, in effect, judging the attributes of the overall item, based on the attributes of its constituents and their relationships.
- R4, a functor space, in which the judgment data matrix consisted of the degree to which D_i is a significant dimension of variation of object X_j, i.e., what is important to know item X_j. An item's location in the space is calculated as in R3. In this case, locating the item in the space is, in effect, judging its significant dimensions of variation.

The technique is not merely theoretical, but has been used to produce working computer systems. A subject matter relevance space has been used to create a document retrieval system whose performance exceeded that of all keyword–based document–retrieval systems (Jeffrey, 1991). J. D. Johannes (1977) created a system to diagnose thyroid disorders, using two factor spaces: One to do initial diagnosis based on patient signs and symptoms and one to recommend tests.

What has happened here is not that uncomputability has been somehow circumvented, but that computations, such as a location in a vector space, are being used to represent relationships that themselves have nothing to do with numbers.

Privacy of Experience

That an individual may have experience, i.e., states of affairs directly accessible to no one else, is a logical consequence of having a world in which the being is the unique individual whose world it is. How then can a computer-based system, in which one can obviously insert probes, have intermediate readouts, and so forth, have states of affairs that are inaccessible to any other being?

Consider first a related case, the telepathic human hypothesized earlier. The telepath can observe directly what I experience when I taste an orange. However, this is not enough; they cannot observe *from my position*. Specifically, the telepath

is not the person whose world it is, and therefore he/she is not having the same experience I am: The telepath is engaged in the action of observing me; I am engaged in the action of eating an orange. The actions, and the positions in the world, are different. Thus, the telepath can *know of* my experience, but cannot *have* my experience. My experience of eating the orange includes states of affairs dependent on the fact that I am the actor in my world in this instance, i.e., that I am playing the role (Element) of "eater." That it is me, not someone else, is a state of affairs, and therefore represented in the description of my world, which includes my actions and my role in those actions.

The same logic holds for a computer-based individual. It can be observed as it acts, and complete knowledge of the states of affairs involved in the processing in the computer is possible. However, assuming the computer-based individual has a world and knows (i.e., has a representation of) its place in that world, it knows that *it* is engaged in the action, not someone else, and therefore the states of affairs in its world that include it as a constituent will be different. Thus, the individual observes that it is engaged in the action, and knows that it is observing that state of affairs, i.e., it is aware that it is doing this thing.

Recalling the SAU, to be a description of *this* individual in *this* world, the description of the computer-based individual's world must include a specification of the particular historical items that are in the logical roles designated by the Elements. Otherwise, it is a description of a class of individuals or a possible individual, not this individual and its world.

As with the case of experience for human beings, it is historical uniqueness that makes the states of affairs that comprise the computer-based individual's experience unobservable by any other person, for it is this uniqueness that makes the states of affairs the experience of *this* individual.

Nothing prevents an observer, such as a human being, from knowing of the computer-based individual's private states of affairs, but the observer cannot know them *as* that individual because the observer does not have the same relationship to those states of affairs as does the individual whose world it is. In other words, an observer cannot have the computer-based individual's experience, because the two are distinct individuals and so have distinct places in their respective worlds.

One candidate for the private states of affairs of a computer-based individual is those states of affairs involving objects physically unique to it: its embodiment. If the computer-based individual had the capability of observing states of affairs including its embodiment, and incorporating them as states of affairs in its world, it would have the basis for sensations, experience, and feelings. It would make sense in such a case to talk of that individual's experience of printing a paper, turning on a light, and so forth, in the same way that it makes sense to talk of a human's experience of writing on a piece of paper, etc. The computer-based individual's experience, involving its bodily states of affairs, would be inaccessible

to others because no other individual has those unique body parts, and thus their experience would be different.

Acknowledgments

The observation that one of the basic questions to ask about a person's consciousness is, "What is he conscious of?" is due originally to Ossorio. The observation that a second key fact about a person's consciousness is what they are conscious as is due to Putman (1981, p. 206).

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