A subsystem questionnaire as a tool for differentiating states of consciousness
by Toren Doyle McCarthy

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Psychology
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Abstract:
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A subsystem questionnaire employing frequency and depth scales was designed and administered to students in psychology and sociology classes. The four groups of 25 individuals that were used for data analysis were experienced meditators, experienced alcohol users, experienced marijuana users, and a control group. Criteria for experience were established within the questionnaire. The analysis of variance indicated a significant interaction between groups and subsystems on the frequency scale as well as on the depth scale. A significant correlation was also found between the two scales. It was concluded that a subsystem approach to the study of states of consciousness is useful. The Consciousness Questionnaire proved to be a useful tool and can be used and easily modified to study other aspects of Tart's theory of subsystems.

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Signature Loren Doyle McCarthy

Date May 25, 1976

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by

TOREN DOYLE McCARTHY

A thesis submitted in partial fulfillment
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ABSTRACT

Although different induction methods do not necessarily produce different discrete altered states of consciousness, it was hypothesized that different patterns of change in Tart's (1975) proposed subsystems might generally occur as a result of a particular induction method. A subsystem questionnaire employing frequency and depth scales was designed and administered to students in psychology and sociology classes. The four groups of 25 individuals that were used for data analysis were experienced meditators, experienced alcohol users, experienced marijuana users, and a control group. Criteria for experience were established within the questionnaire. The analysis of variance indicated a significant interaction between groups and subsystems on the frequency scale as well as on the depth scale. A significant correlation was also found between the two scales. It was concluded that a subsystem approach to the study of states of consciousness is useful. The Consciousness Questionnaire proved to be a useful tool and can be used and easily modified to study other aspects of Tart's theory of subsystems.

Introduction

The present upsurge of interest in the study of consciousness has produced the usual confusion that any new or revived discipline must confront. The study of consciousness is often referred to as noetics, contemporary functionalism, the mind-brain problem, or state-specific sciences. The numerous current theories of consciousness are as different as the terms used to refer to consciousness. John White (1974) points out two basic requirements for the study of consciousness--a need for a model from which evaluations and predictions can be made and a need for standardization of terminology. Important aspects for consideration are defining consciousness and qualitatively differentiating proposed states or levels of consciousness.

Metaphysical questions concerning consciousness have been pondered for ages. This thesis examines specific psychological theories which range from a simple identity theory to a complex systems approach to the study of consciousness.

Shallice (1972) proposes an identity theory in which mental processes are identical with certain physical processes in the brain. He uses an information-processing model derived by cybernetic analogies to describe the physical processes of the brain. According to Shallice's model the brain has a set of somewhat independent systems that are coordinated by selector input to a dominant action system which the selector input chooses. Shallice defines consciousness as this selector input.

Selector input can come from perceptual and motivational systems. It provides the activation that allows an action system to become dominant and sets the goals of the action system. This activation and goal setting are the dual functions of consciousness. There are two additional assumptions regarding selector input. The first assumption is that selector input can be internally generated by imagery or inner speech. The second assumption is once the selector input has activated a dominant action system toward a goal, if that action system does not reach its goal, it will remain submaximally activated.

In Shallice's model an action system is a unit of control, similar to a plan or a TOTE unit (Miller, Galanter, and Pribram, 1960). A TOTE unit involves a goal toward which an organism tends and a hierarchy of tests and mental operations (Posner, 1973). The speed and accuracy of an action system depends on its level of activation. An action system has the capacity to inhibit all other action systems to become dominant, similar to the process of lateral inhibition in the sensory systems. An action system reaches its goal by output to an effector unit. An effector unit does not have the inhibitory control that an action system has.

Shallice's information-processing model of the dual functions of consciousness is hard to make specific predictions from because it is somewhat vague and abstract. His terminology tends to obscure his theory. In assessing this model in terms of the considerations posed

by White, this model does little to further the study of consciousness. Shallice equates consciousness with the physical processes in the brain, apparently ignoring the possibility of emergent phenomena. He also does not consider the important issue of altered states of consciousness, an issue that seems to be inseparable from the study of consciousness.

Sperry (1969) defines consciousness or conscious awareness as "a dynamic emergent property of cerebral excitation" (p. 533). Unlike Shallice, Sperry's theory is not a simple identity theory because the

> emergent property or phenomenon or the conscious properties of the brain excitation are conceived to be something distinct and special, different from and more than the collected sum of the neurophysio-chemical events out of which they are built. (p. 533)

Consciousness therefore exerts an "active causal influence" on and "supervenes" over cerebral activity. More simply, "the neurophysiology, in other words, controls the mental effect and the mental properties in turn control the neurophysiology," noting that consciousness occupies a higher position of command (p. 534).

The overall problem with Sperry's theory, as Bindra (1970) sees it, is that the theory is dualistic, circular, and does nothing to promote a unified theory "of the varied phenomena of life."

Basically, Bindra sees the theory as having two independent propositions, the first being that of an emergent phenomenon, and the second being the causal control of consciousness upon neural activity

and behavior. Bindra states that Sperry creates the impression that his two basic propositions are interdependent and mutually supportive. In defense of Bindra's charge of dualism, Sperry (1970) states that he proposed a "single unified system extending from subnuclear forces near the bottom up through ideas at the top." Sperry comments further that

> Consciousness as a dynamic property of cerebral excitation is inseparably tied to, and a direct property, of, the brain processes, and not a disembodied or supernatural agent. (p. 586)

The importance of Sperry's theory of consciousness in relation to this thesis is threefold. First, the theory of emergent phenomena is a direct improvement over Shallice's identity theory. The implicit assumption here is that emergent phenomena do exist. Second, Sperry, among others, is calling for the scientific study of subjective experience and consciousness "by giving consciousness a functional role in brain activity with a causal potency" (p. 590). Third, the theory gives consciousness importance in respect to how an individual functions according to its causal potency function. Again, as in Shallice's model of consciousness, Sperry does not discuss altered states of consciousness. In relation to some of the considerations posed by White, Sperry does define consciousness, but his definition is hard to work with in an operational sense. Sperry knowingly proposes his theory in a general sense for the purpose of defining an approach to the study of consciousness.

Ornstein (1972) proposes a rather explicit and simple theory of consciousness. In choosing terminology like personal or individual consciousness, Ornstein emphasizes his belief that consciousness is a personal construction, the main purpose of which is individual biological survival. Similarly, Huxley's (1954) "Mind at Large" is a survival-oriented concept for the reason that "to make biological survival possible, Mind at Large has to be funneled through the reducing value of the brain and nervous system" (p. 23). Theoretically Ornstein (1972) defines the contents of consciousness as "the appropriate survival-related objects and events" (p. 43). Like Ornstein's concept of contents, experientially don Juan (Castaneda, 1974) proposes the perpetual mechanism of "internal dialogue" which inhibits sentience.

Ornstein (1972) believes that sensory systems have evolved selectively in response to the environment. More generally he states:

> Our sense organs gather information which the brain can modify and sort. This heavily filtered input is compared with memory, expectations, and body movements until, finally, our consciousness is constructed as a "best guess" about reality. (p. 19)

At this point in his study of consciousness, Ornstein (1972) proposes that personal consciousness operates predominantly in one of two major modes. These two modes of thought have a physiological basis since each one predominates in a different cerebral hemisphere. The mode of the left cerebral hemisphere is characterized by sequential information processing, such as required for language ability, and

analytic thinking. The mode of the right cerebral hemisphere is characterized by a more simultaneous, holistic information-processing, such as required for space orientation, intuition, body awareness, artistic talents, and facial recognition. Ornstein remarks that the left hemisphere in Western culture is considered the major mode and feels that this emphasis on one mode is unfortunate since the development, use, and integration of the two major modes could help man reach his highest potential.

Although his major premise concerns mostly the major modes, left and right brain thinking, Ornstein does not rule out the possibility of other types of consciousness. "If ordinary consciousness is a personal construction then other constructions and other consciousnesses are potentially available to us" (p. 46). For a theory of consciousness including experientially proposed states, a science of consciousness must be developed.

Ornstein's theory of consciousness has a firm physiological base. Experientially it also seems plausible. It contains insight into the future development of the science of consciousness since it considers the possible existence of other states of consciousness. Ornstein does not propose a comprehensive workable model of consciousness nor does his theory improve the present status of consciousness terminology. In consideration of these two important requirements Ornstein's theory needs improvement.

In much the same way, but to a greater extent than Ornstein, Tart (1975) proposes the establishment of state-specific sciences and a systems approach to the study of states of consciousness. Some clarification of terms is needed to fully explain the concept of state-specific sciences. Tart (1975) uses the term discrete state of consciousness (d-SoC) and defines it as:

> a unique, dynamic, pattern or configuration of psychological structures, an active system of psychological subsystems. A discrete altered state of consciousness (d-ASC) refers to a d-SoC that is different from some baseline state of consciousness (b-SoC). Usually the ordinary state is taken as the baseline state. (p. 5)

Science, as it is now conceived, is a science created within a b-SoC or ordinary consciousness. This b-SoC is considered by Tart to be more or less a stable phenomena within cultures due to the effects of enculturation on the molding of consciousness. State-specific sciences as proposed by Tart would be sciences developed while the scientist was in a d-ASC investigating it's contents. The scientific methods of our ordinary state of consciousness would still be employed. Many of the areas now investigated and new areas would be researched from and within other states of consciousness. The important point here, on which Tart and Ornstein are in agreement, is that our ordinary consciousness filters out much of reality. State-specific sciences might be more sensitive to some phenomena than our ordinary state science. "The possibility of developing certain state-specific

sciences means only that certain kinds of phenomena may be handled more adequately within these potential new sciences" (Tart, 1972, p. 1207).

Obviously many methodological problems exist in establishing state-specific sciences as with the establishment of any new science. Tart (1972) is aware of some of the inherent problems in the training of researchers. One problem is the obvious perception of truth which is characteristic of some d-ASC, which might lead the researcher to stop questioning the concept under study or might negate the need for consensual validation. Specific problems pertaining to consensual validation are state-specific communication, individual differences, and what Lilly (1972) calls self-metaprogramming.

On state-specific communication Tart (1972) says,

> Given that an ASC is an overall qualitative and quantitive shift in the complex functioning of consciousness such that there are new "logics" and perceptions which would constitute a paradigm shift, it is quite reasonable to hypothesize that communication may take a different pattern. (p. 1205)

The implicit assumption underlying the following is that adequate communication does exist between d-SoCs. In addition to the problem of different communication patterns, Tart (1975) cites problems including ineffability of experience, inadequacy of language, and a hypothesized lowness of the ordinary b-SoC that makes us incapable of understanding "higher things" (p. 201).

The problem of individual differences is also complex. Not only must one assume that each individual in his b-SoC has a somewhat varied

configuration of psychological structures but that each person will react differently to induction methods, such as the ingestion of LSD. Two people may be in different states even though they both experienced the same induction procedure. The researcher can not assume that identical induction procedures produce identical d-ASCs across individuals.

Self-metaprogramming (Lilly, 1972) takes into account the concept of the realization of expectations in entering various d-ASCs. Tart (1972) comments that

> A second major problem in developing state-specific sciences is that in some ASCs one's abilities to visualize and imagine are immensely enhanced, so that whatever one imagines seems perfectly real. Thus one can imagine that something is being observed and experience it as datum. If one can essentially conjure up anything one wishes, how can we ever get at the truth? (p. 1208)

Tart proposes that such imagined experiences would not be consistent in frequency or nature and could thus be eliminated from the data.

The more obvious problems of having scientists do research in a d-ASC are "bad trips" and "good trips." A bad trip could be physically and psychologically dangerous and might discourage further research by the scientist. Good trips might have a tendency to become ends in themselves, wherein the researcher would forget or ignore the research at hand. In conclusion, Tart calls not only for the establishment of state-specific sciences but for a training program for researchers in these sciences. The training program would have to include learning

about oneself, the cultivation of open-mindedness, flexibility, discipline, and experience in d-ASCs.

Tart's (1975) approach to the study of states of consciousness is a systems approach, since he emphasizes that consciousness is made up of many components or subsystems. To understand the complexities of the interrelationships of the parts and the whole of consciousness a systems approach is proposed. At this point in the development of his theory the systems approach is used mainly as an organizational tool.

The following is a brief outline of Tart's (1975) systems approach to consciousness. Aspects of the approach concerned with the subsystems and the depth dimension will be examined in detail because of their centrality to this thesis. As a basis for his theory, Tart proposes the existence of awareness and structures. He defines awareness as "the basic knowledge that something is happening, to perceiving or feeling or cognizing in its simplest form" (p. 27). Assuming there is some volitional control over awareness, Tart expands the term to attention/awareness. This attention/awareness is the "major energy of the mind" (p. 28). The functions of this attention/awareness energy are activating, inhibiting, and maintaining structures automatically.

Tart defines structures as "those relatively permanent structures/functions/subsystems of the mind/brain that act on information to transform it in various ways" (p. 4). The structures of importance to Tart's theory are psychological structures which require the energy of

a attention/awareness for activation. Some structures, such as biological and physiological structures, are permanent and innate. The psychological structures are those structures arising from learning, conditioning, and enculturation and being limited by the permanent structures. Psychological structures require attention/awareness to be formed, to operate, to inhibit operation, to modify the structure or their operation, or finally to dissolve the structure.

Structures interact not only with attention/awareness but also with other structures. Tart comments that "individual structures have various kinds of properties that limit and control their potential range of interaction with one another" (p. 23). Tart proposes four criteria in order for structures to interact. The structures must be in some way connected to each other or connected to a mediating structure. The information must be in a usable form, strong enough to be perceived, and yet not so strong as to cause an overload.

To introduce the concept of subsystems it is necessary to diverge briefly and rediscuss and define the concepts of states of consciousness. As stated before, Tart (1975) defines a discrete state of consciousness (d-SoC) as a

> unique dynamic pattern or configuration of psychological structures, an active system of psychological subsystems. Although the component structures/subsystems show some variation within a d-SoC, the overall system properties remain recognizably the same. In spite of subsystem variation and environmental variation, a d-SoC is

> stabilized by a number of processes so that it retains its identity and function.
> A discrete altered state of consciousness (d-ASC) refers to a d-SoC that is different from some baseline state of consciousness (b-SoC). Usually the ordinary state is taken as the baseline state. A d-ASC is a new system with unique properties of its own, a restructuring of consciousness. (p. 5)

The stabilization processes apply to all d-SoCs, since these processes control and limit the interactions of structures and subsystems. In order to change from one d-SoC to another these processes must be interrupted by disrupting forces to allow new patterning. The stabilization processes then in turn maintains the new d-SoC. These processes are loading stabilization, negative feedback stabilization, positive feedback stabilization, and limiting stabilization.

Loading stabilization is an indirect process, since it works by either storing energy or consuming it. It does not act directly upon subsystems or structures. Tart defines it as "any activity that draws a large proportion of the energy of the system so that the system does not have excess free energy available" (p. 64). Tart cites repeated day to day activities, body movement or kinesthetic feedback, and the thinking process "which runs through familiar and habitual associative pathways and keeps you within your ordinary consciousness" (p. 65), as examples of loading stabilization. Castaneda (1974) comments on the role of thought processes and terms it "internal dialogue":

> I mentioned to don Juan that on that occasion I also became cognizant that stopping the internal dialogue

> involved more than merely curtailing the words I said to myself. My entire thought processes had stopped and I had felt I was practically suspended, floating. A sensation of panic had ensued from that awareness and I had to resume my internal dialogue as an antidote.
> "I've told you that the internal dialogue is what grounds us," don Juan said, "The world is such and such or so and so, only because we talk to ourselves about it being such and such and so and so." (p. 21-22)

Negative feedback stabilization is a correction process exerting direct pressure upon subsystems or structures to return their quality or rate to within the limits of their functioning. Positive feedback stabilization is basically a reward system. Limiting stabilization is also a direct process whereby the range of possible functioning of subsystems or structures is limited.

Both Tart's theory and this thesis rely heavily on the concept of subsystems. A research tool, a Consciousness Questionnaire (see Appendix), which was directly based upon Tart's proposed subsystems, was designed to test the central hypothesis of this thesis. A representative question from each subsystem will accompany each description of individual subsystems. Tart (1975) defines subsystems as assemblies of

> multiple structures into major experiential and experimental divisions--subsystems--of consciousness. They are concepts I have developed by classifying the greatly varying experiences and behaviors reported in d-ASCs into clusters of phenomena that seem to hold together, on the basis of both their own internal similarity and other known psychological data. (p. 88)

The ten subsystems Tart proposes are exteroception, interoception,

input-processing, memory, subconscious, emotions, evaluation and decision-making, space/time sense, sense of identity, and motor output.

These ten subsystems function as a system in a state of consciousness. Tart (1975) basically sees the system functioning in the following way.

> Information from the outside world comes to us through the Exteroception subsystem (classical sense organs), and information from our own bodies comes to us via the Interoception subsystem (kinesthetic and other bodily functioning receptors). Data from both sets of sense organs undergo Input-Processing (filtering, selecting, abstracting), which in turn influences the functioning of Exteroception and Interoception. Input-Processing draws heavily on stored Memory, creates new memories, sends information both directly into awareness and into our subconscious, and stimulates our sense of Identity and our Emotion. Information we are aware of is in turn affected by our sense of Identity and Emotions. We subject this information to Evaluation and Decision-Making; and we may act on it, produce some sort of motor output. This Motor Output subsystem produces action in the body that is sensed via Interoception, in a feedback process through the body. The Motor Output also produces effects on the external world that are again sensed by Exteroception, constituting feedback via the external world. Our perception and decision-making are also affected by our Space/Time Sense. (p. 89)

The exteroception subsystem is made up of the sense organs. These organs are active but have limited responsiveness and some voluntary control over sensory input. Feelings of increased sensitivity in these organs can be due to changes in the input-processing subsystem or in the focusing of attention. If input from the environment, which acts as loading stabilization, is changed by such techniques as sensory deprivation, saturation, or overload, a destabilization of the b-SoC

could occur. A representative question for this subsystem is "Do you experience changes in your vision?"

The exteroception subsystem reports from the external environment whereas the interoception subsystem reports what is going on inside the body by limb position and movement, amount of muscle tension, temperature, and internal organ pressure. By focusing attention/awareness, many internal body signals can be brought into awareness to a certain extent. Interoceptive input can also be controlled to an extent. Biofeedback research has shed some light on this issue. Loading stabilization occurs from various interoceptive inputs, such as the body image concept, for the reason that the body is always perceived in a certain way. Ways of changing the body image and thus causing some destabilization include reducing input by immobilization, overloading input by exercises, and patterning by assuming different body positions. In some d-ASCs body image changes do occur, which is probably due to input processing. One of the questions helping to operationally define the interoception subsystem is "Do you feel changes in your heart rate?"

According to Tart input-processing subsystem involves a learned and totally automatic process. Its major functions are rejection and abstraction. This subsystem is selective in nature due to the process of comparing new information with old information then selecting the relevant information for further analysis. As input-processing

changes supposedly fixed "properties of perceptual organization" change. Tart (1975) discusses illusions and hallucinations as functions of input processing.

> An illusion is Input-Processing's interpretation of a stimulus in a way that does not match consensus reality standards. A hallucination is a functioning of Input-Processing whereby stored information is drawn from memory, worked over by Input-Processing, and passed along to awareness as if it were sensory data. (p. 100)

One of the questions representing this subsystem is "Do you perceive objects that are not physically present?"

The main function of the memory subsystem is obviously storage. Tart proposes three types of memory, "short-term, medium-term, and long-term memory," and proposes that these three types may be affected differently depending upon the d-SoC. There is a particular quality of memory that says "This is a memory." This is probably what happens in the case of déjà vu. Somewhat to the other extreme, in a hallucination when a memory is experienced it is experienced as a perception. Ease of retrieval, completeness and search pattern characteristics of memory are presumably altered in some d-ASCs. A representative question examining the concept of a search pattern is "Do you experience inappropriate memories when trying to remember certain information?"

The importance of the elusive concept of the subconscious subsystem is, as Tart (1975) points out, that:

> subconscious processes occur outside awareness from the viewpoint of the ordinary d-SoC. What is subconscious

> from the reference point of the ordinary d-SoC may become conscious in d-ASCs. (p. 110)

The subconscious includes intuition and creativity. Tart hypothesizes that it represents "right hemisphere modalities of thinking" (p. 110). It is holistic and atemporal. Because the subconscious subsystem has feedback to input-processes it also may have some control over perceptions. The subconscious subsystem was not considered in the questionnaire due to its lack of operational defineability. Tart comments that the subconscious of a b-SoC may become conscious in a d-ASC. If it becomes conscious material, it does so through the mechanisms of one or more of the other nine subsystems.

The evaluation and decision-making subsystem consists of "those intellectual, cognitive processes with which we deliberately evaluate the meaning of things and decide what to do about them" (p. 114). This subsystem involves thinking, problem solving, understanding, and logic. Tart emphasizes that logic is a "self contained, arbitrary, assumptive system, heavily influenced by culture and personal history" (p. 114). The process itself is endless and self-perpetuating. Loading stabilization, or "psychological inertia" is a direct result of this process. As Tart (1975) says "You cannot hear your senses over the noise of your thoughts" (p. 116). In the b-SoC there is some quantitative variation in this subsystem as seen in the quantity of thoughts, redundancy of thinking, accuracy checking, and the distorting of logical evaluation

by emotional factors. In d-ASCs there is much qualitative variation as measured by acceptance of contradictions, which is thought to be necessary for creative thought and the use of different logics. Also in d-ASCs associative patterns of thinking may change systematically. A representative question concerning this subsystem is "Do you think according to different rules of logic?"

Tart (1975) says that emotions are "feelings that can be named but not easily defined" (p. 124). The emotion subsystem is very important because it in essence controls the evaluation and decision-making subsystem via its control of memories which can be utilized. Indeed strong emotions can occupy all of consciousness and in their extreme may even constitute d-ASCs since they cause changes in perception and cognition. In the b-SoC there is normally poor control over emotions mostly because of denial or suppression. On the other hand in d-ASCs there can be either decreased or increased control without the use of defense mechanisms. In d-ASCs there can be new emotions and changes in the intensity of familiar b-SoC emotions. One of the questions for this subsystem is "Do you react in an unusual way to stimuli?"

In reference to the space/time subsystem, Tart defines space and time as "experiential constructs that we have used to organize sensory stimuli coming to us" (p. 125). This organization has been so successful in dealing with the environment that "we have come to believe that we are simply perceiving what is 'out there,' rather than automatically

and implicitly imposing a conceptual framework on what comes in to us" (p. 125). In the b-SoC there is very little variation in the space/time sense. In various d-ASCs there is much variation in many ways. Variation in rate and direction of time flow can occur, such that an effect can sometimes seem to precede its causes. In some states there is an emphasis on the present, a "here-and-nowness," whereas in the b-SoC the past, present, and future are intermixed. In various d-ASCs there are also quantitative variations in space perception. Distances can increase or decrease with movement. Depth perception can change. Two dimensions can be seen as three. Most amazingly space might not be perceived as being empty, but rather filled with vibrations or energy. The concept of space, rather than being just visual can be auditory or tactual in a d-ASC. A representative question for this subsystem is "Do you feel changes in the rate of time passing?"

According to Tart "The primary function of the sense of identity subsystem is to attach a 'This is me' quality to certain aspects of experience, to certain information in consciousness, and thus create the sense of an ego" (p. 130). This quality has the ability to generate strong emotions when something affects the "me," and thus has much basic control over attention/awareness. This sense of self also helps to block out unwanted or unacceptable knowledge about the self. Variations of this subsystem in d-ASCs are much greater. Basically the sense of self can be destabilized by having memories that seem to

be someone else's, by feeling detached from the physical body, or by feeling detached from possessions and responsibilities. The above are ways of detachment, but attachment may occur along those same lines. A question based upon the subsystem is "Do you feel detached from your body?"

Tart states that the motor output subsystem "consists of those structures (skeletal and voluntary musculature) by which we physically affect the external world and our own bodies" (p. 136). This subsystem receives important input from the evaluation and decision-making subsystem and the subconscious subsystem. The subconscious subsystem adds "qualities to a person's movements." Obviously the motor output system operates reciprocally with the exteroception and interoception subsystems. In d-ASCs the motor output subsystem shows great variation in three major areas. The first of the three areas is deautomatization and automatization of motor actions. Deautomatization is the awareness of all the parts of a movement that are normally automatic. Automatization is having to directly will a normally automatized action to occur. The second area of variation is operating characteristics. "You may have to perform a different kind of action internally in order to produce the same kind of voluntary action" (p. 138). Variation also occurs for the reason that there are changes in the awareness of functioning. Emphasis here is placed on the knowledge that the actual performance of a task does not necessarily change but feelings of

increased or decreased skill, strength, or speed accompany the task. A question based upon this subsystem is "Do you experience a change in your physical abilities?"

Tart proposes that a particular d-SoC is made up of a certain pattern or configuration of his ten proposed subsystems. Important to his subsystem hypothesis is the concept of depth. His concept of depth accounts for variation within a d-SoC. The changes in a d-SoC that are considered in the depth dimension are quantitive changes, a "more or less" type of change. The concept of a d-SoC refers to qualitative changes in the patterning of consciousness whereas the concept of depth refers to quantitative changes within that pattern.

In conclusion, Tart's theory of consciousness stands up well to the considerations for a science of consciousness proposed by White (1974). It is believed here that Tart's theory is the most comprehensive theory on consciousness to date. Much of Tart's terminology is new but because his theory is so comprehensive it is believed here that his terminology will become standard for the science. His terminology emphasizes a very important concept, that of states. The assumption of more than one legitimate state of consciousness is both overpowering and practical. In his theory Tart considers many of White's proposed requirements. Tart makes distinction between higher and lower states and between awareness and consciousness. In essence his systems organization provides a framework for research in the

beginnings of a new science. As Tart points out,

> One of the major tasks of future research is to fill in the details about each of these subsystems, their changes in d-ASCs, and their interaction with other subsystems. (p. 90)

The present research is designed to test Tart's concept of specific subsystem patterning within d-SoCs. It is hypothesized that although different induction methods do not necessarily produce different d-ASCs, that different interactions of subsystems will be evident within different d-SoCs. It is also hypothesized that the research tool developed here, a subsystem and depth questionnaire, will be useful in a possible redefinition of Tart's subsystem.

Method

Subjects

The Consciousness Questionnaire was given to 312 students from all levels of psychology and sociology classes. A total of 25 questionnaires were selected for each group. Random selection was used for groups for which more than 25 questionnaires were received. The four groups were experienced meditators, experienced marijuana users, experienced alcohol users, and a control group that had not experienced meditation, marijuana, or alcohol. The assignment of individuals to groups was based upon criteria for experience as defined in the questionnaire.

Apparatus

The principles for the design of the Consciousness Questionnaire

(see Appendix) were based upon questionnaire design as proposed by Warwick and Lininger (1975). Each person was asked to work quickly, since the first response that comes to mind is usually the most reliable. A written guarantee of anonymity was included, since the questionnaire dealt with sensitive areas, (marijuana use).

Criteria for experience were established for two reasons. The criterion of having had experience with meditation, marijuana, or alcohol "at least 12 times" was used in an attempt to eliminate the effects of novelty. The criterion of having had a particular experience "at least once within the past 6 months" was set in an attempt to minimize effects of memory distortions.

Each individual was asked to respond to an open-ended question before responding to the subsystem questions. The purposes of the open-ended question were to stimulate interest, to help establish a conducive frame of reference, and to allow every student to participate in a personally meaningful way.

The questionnaire consisted of a frequency scale and depth (amount of change) scale. Both scales used the same questions which were first responded to according to how often the item in the question is experienced and secondly to what depth the item is experienced. The response scale used numbers as well as verbal labels in an attempt to minimize the different interpretations possible of words like "sometimes," "usually," or "often."

The 45 questions used, covering nine of Tart's (1975) proposed subsystems, were based upon theoretical and experiential criteria as cited by Tart. Each subsystem was operationally defined by five questions. The questions were not based on exact experiential knowledge of effects of certain d-ASC because that would tend to bias the questions in favor of a specific state. The questions were grouped by subsystem for ease of response and data analysis.

Procedure

A preliminary questionnaire was given to an upper division psychology class. Minor changes were made based upon the comments and criticisms received from this class.

Before each administration of the final questionnaire the experimenter introduced herself to the class, gave a brief description of her research, and asked for everyone's participation.

The procedure for assignment of subjects to groups was as follows: To be considered for inclusion in the control group, the individual had to check only the "no experience" category on both the first and second page of the questionnaire. To be considered for inclusion in each of the other groups the individual had to check the appropriate boxes on both the first page and the second page of the questionnaire. Thus, an individual was not placed in the pool used for random selection for a particular comparison group if that individual did not meet the criteria for experience.

Results

The data support the present hypothesis that the proposed d-SoCs are characterized by certain configurations of Tart's proposed subsystems. On both the frequency and depth dependent variables, there was a significant interaction between the nine subsystems and the four groups. An unreplicated nested model analysis of variance was used for the analysis. The results are shown in Table 1. The data were collapsed for the analysis by summing the individual scores within subsystems for each questionnaire. Table 2 and 3 contain the means for all the individual subsystems for each individual group on both the frequency and depth scales, in the order of highest frequency to lowest frequency for the frequency scale and most change to least change for the depth scale. Tables 2 and 3 also contain a mean for all nine subsystems for each group and a mean for each subsystem within the four groups.

Insert Tables 1, 2, & 3 about here

The two main effects on each scale were group interaction and subsystem interaction. The main effect of groups on the frequency scale was that the meditation group experienced the highest frequency of change, the marijuana group the next highest, the alcohol group the next highest, and the control group experienced the lowest frequency of change. The main effect of groups on the depth scale was that the meditation group experienced the most change, the alcohol group