

Yoga as Science

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Among the many ways we can approach, interact with and experience yoga, there are two that symbolize how we use our brains and interact with life in general: we can make use of our capacity to analyze, explore and *illuminate* (science), and we can make use of our capacity to synthesize, embrace and *inspire* (art). In this article the focus is yoga as science.

One of Webster's definitions of science is "systemized knowledge derived from observation, study and experimentation carried on in order to determine the nature and principles of what is being studied", and "a branch of knowledge or study, esp. one concerned with establishing and systematizing facts, principles, and methods, as by experiments and hypotheses". This definition implies two aspects to science—one is interior or private, the other exterior or public. The interior aspect of science is the creative and inquiring side of its practice—the 'observation, study and experimentation that are carried on in order to ...' whereas the exterior aspect lies in the principles that guide the experimentation, the materials used to perform the experiments, and the data and principles that are discovered. As described so far, science has an individual aspect—the scientist. But science exists in the context of communities, those who evaluate the validity of the science, as well as the social environment that constrains and guides its progress. In other words there is a collective aspect to science, as well as an individual aspect. Accordingly, we can ask two questions of science: 1) What are its interior and exterior aspects? 2) What are its individual and collective aspects? If we combine these, then we have four possible answers or domains: (1) individual/interior, (2) individual/exterior, (3) collective/interior and (4) collective/exterior. Each domain, according to contemporary philosopher and integral psychologist Ken Wilber¹ generates its own kind of information, and uses its own criteria for evaluating the truth or validity of that information. And each domain is irreducible to any of the others. For example, attempts to understand human behavior include those which are individual and interior (introspection, psychoanalysis, contemplative practices—which includes yoga), individual and exterior (behaviorism), collective and interior (cultural beliefs and practices) and collective and exterior (social structures such as castes or economic classes, social action structures). Although each may claim to hold the only valid clues to behavior, Wilber argues that each provides valid and complementary knowledge. And although knowledge in one domain may correlate with knowledge in another domain, it cannot serve as its replacement. The attempt to replace knowledge in one domain with knowledge in another is called 'reductionism'. One example of reductionism, common in scientific studies of consciousness, but incorrect in Wilber's view, is experiments that study brain function, such as by MRIs (magnetic resonance imaging). Many events, if not all, in the mind (interior/individual) leave measurable traces in the brain (exterior/individual). But we cannot say that the phenomena of consciousness are no more than complex interactions of the brain's neurons. In the same way that a map is not the actual territory, externally observable physical information can never give someone the inner experience. Information that is generated in the domain of conscious experience itself serves to deepen our

understanding in that domain. And it is equally incorrect in this view to assume that interior experience generated from one's practice can replace or supersede externally verifiable data.

Consider now the well-known empirical scientific method that has generated all of our modern technology, and that continues to guide much of western medicine. There are several phases to the empirical scientific method, which are a) gathering data, b) organizing and looking for patterns in the data, c) coming up with descriptive models, d) finding explanatory models, which should also be predictive. That is, an effective explanatory model accounts for all the data that have been observed, plus it is able to predict phenomena that have not yet been observed. In each of these phases there are several steps in common that can be summarized as follows:

1. Perform an experiment to test an hypothesis
2. Gather the data, in accordance to the principles underlying the domain of study
3. Compare this data with others who have completed the same experiment. This gives consensual validation or rejection by a community of qualified individuals, which in turn allows us to confirm, refine or replace our initial hypothesis.

If we consider the practice or study of yoga a science, with valid and reproducible data, we must first specify what domain we are inquiring about: are we exploring yoga as an individual, or as a collective, from the interior or from the exterior? In other words, are we interested in whether our practice of asana is scientific in nature (interior and individual)? Are we interested in determining whether the principles of yoga have a scientific underpinning (interior and collective)? Or are we interested in scientifically studying some specific claim of the benefits of yoga (exterior and individual)? Here we look mainly at yoga as science (interior and collective or interior and individual), and give a few remarks about the scientific study of yoga (exterior and individual).

Yoga as Science

Suppose I am a practitioner, eager to implement Guruji's 3-step injunction for exploring asana (pose, reflect, repose), and I wish to ascertain whether I am generating scientifically valid data. I can be confident I have followed the generic steps of the scientific method above, provided that a) I subject my experiments to validation by a community of qualified individuals (certified teachers), and b) I perform my experiments in accordance with the principles of the method. If I meet both requirements, then I generate scientifically valid information about my own body and its interaction with my mind (really about all five *koshas* and their interactions), and I experience over time the changes that are intended by the method. What are the principles of Iyengar yoga? There are two aspects to this question: there is the technique, or the method of practice, and there is the theory that underlies the method. The method of practice of Iyengar yoga includes at least the following elements: linking, sequencing, timing, alignment, intricacy, and the iterative nature of refining a pose, as mentioned above. There is another element in the method that relates to the theory directly—the philosophical aspect that is meant to culture the mind together with the body. Yoga philosophy is partially interpretive in nature, as it relies on an interpretation of ancient texts. Some interpreters or commentators attempt to recover the writers' original intentions (the approach of 'hermeneutics'), whereas other commentators interpret the

text in the context of current understanding or their own experience. Each approach has to undergo tests for its validity claims. The importance of having such validated interpretation and a clearly elucidated theory is that these serve as a backdrop for any scientific inquiry into the practice of yoga and its benefits. Consider the following interpretation of the Yoga Sutras as a possible theoretical base for the Iyengar method. Due to space requirements, only a few aspects are considered.

Even though '*asana*' appears in only a few sutras, the *method* of Iyengar yoga appears in precisely the sutras that describe how yoga transforms consciousness. In particular, the principles of linking, sequencing, intricacy and timing are all embedded within the Yoga Sutras. 'Linking' appears in the Yoga Sutras as the term '*anvaya*' (connectedness) in III.9, 44, 47, in its 'positive' sense, and it appears as the term '*samyoga*' (correlation) in II.17, 23, 25, in a more negative sense. In YS III.9 *anvaya* is the linking of *citta* with its transformation at a moment of mental silence (the mind acquires the tendency towards silence only in moments of silence). In YS III.44 *anvaya* is the interconnectedness of different parts of the body, and in III.47 of the sense-organs. In Sadhana Pada, *samyoga* represents a mistaken correlation of seer and seen that is the source of *avidya*, and the aim of yoga to correct (through discernment). Linking actions within poses and from pose to pose achieves both the quieting of the mind that transforms consciousness in *nirodha parinama*, and fosters the connectedness in body and sense-organs that leads to awareness of more subtle *koshas*. And linking within poses also fosters the 'unlinking' that is the aim of YS II.17, 23, 25. That is, when we link two actions together, we 'lift' or 'unlink' our sense of I-am-ness (*asmitta*) away from identifying with the separate, individual, actions, in favor of more unified actions. We weaken our tendency to identify with what appears separate and divided, and strengthen our capacity to identify with what is connected and whole.

Sequencing of actions within a pose, and sequencing poses in a particular order has the intention of safely progressing from simple actions to more complex actions, and from simple poses to more complex poses. Sequencing also has more subtle aspects. The first is that sequencing makes linking possible: if I am not familiar with a new action that involves linking, then the only way I can learn it is to become stable in one part of the action first, then to add the next part—that is sequencing. Another aspect has to do with the observation that different sequences yield different results in the first place. In other words, given that the body is interconnected through the joints in ways that allow us to move into poses in many different ways, why should the order of movements (and the order of actions) have different outcomes in how we feel in the final pose? According to Patanjali (YS III.15), the fact that the different sequences *do* have different outcomes is the reason for the differences in the three *parinamas* of consciousness (YS III.9, 11, 12), and three *parinamas* of the elements and sense-organs (YS III.13). A deeper understanding of these sutras and their relation to sequencing comes from the following interpretation of the Yoga Sutra.

Yoga may be said to foster changes in four interrelated but distinct aspects of consciousness: states, contents, structures and levels. Each Pada of the Yoga Sutra deals primarily with one of these aspects of consciousness. The states of consciousness, the subject of Samadhi Pada, are its *panca vrttis*, plus the various states of meditative absorption (including *pratyahara*, *dhyana*, and the various kinds of *samadhi*). The states of consciousness are its overall form, and can influence the possible contents. The contents of consciousness, the subject of Sadhana Pada, are whatever thoughts, feelings and emotions

are present, and include the presence of active *klesas* (causes-of-affliction). The structures of consciousness, the subject of Vibhuti Pada, are its tendencies, governed by the *samskaras* that are active. The natural tendencies of consciousness can be inferred from the three *citta parinamas* to be generative, dispersive and dual (or compartmentalized). That is, the mind tends to generate thoughts spontaneously (III.9), those thoughts tend to be about unrelated topics from moment to moment (III.11), and there is usually a thinker that is thinking our thoughts (III.12). These are to be transformed to stilling, absorptive/integrating and non-dual (or unified), respectively (III.9, 11, 12). The tendencies, or structures, affect how the states and contents of consciousness may change in time. The levels of consciousness, dealt with in Kaivalya Pada, are the stages of consciousness that correspond with the four levels of the *gunas*, plus the stage of liberation at which the *gunas* no longer determine the form of consciousness. According to Patanjali (YS III.6) progression in the practice of *samyama* is gradual, through stages (*bhumisu*). Since the movements and tendencies of *citta* are governed by the *gunas*, we may infer that not only does consciousness develop in stages but it exists at various levels (*parvani*, YS II.19). Each level represents some relatively stable configuration of active structures, with states that are most likely to occur and their respective contents. Consider now the importance of sequencing in light of YS III.9-15.

YS III.13 describes the transformations in elements (*bhutas*) and sense-organs (*indriyas*) that occur when consciousness undergoes its changes: *dharma parinama* (change in form), *laksana* (change in characteristics) and *avastha parinama* (change in condition or time variation). Since elements (body) and sense-organs are only ever experienced through *citta* we can make the following identification: *dharma parinama*, which is the change in overall form of elements and sense-organs, also describes transformation in states of consciousness; *laksana parinama*, which is the change in characteristics of elements and sense-organs also describes transformation in the contents of consciousness; and *avastha parinama*, which is the change in the temporal condition of elements and sense-organs (how they tend to change in time) also describes tendency of consciousness to change in time—its structure. In other words, *avastha parinama* includes the three *citta parinamas* of YS III.9-12 and corresponding changes in body and sense-organs. The division of *citta* into states, contents and structures is partly arbitrary, since when one of these changes, the other two also tend to change. For example, if I enter into a meditative state (change of state) then the *klesas* (content) become attenuated. And if the *klesas* become attenuated then some *samskaras* become inactive and others become active (the structure changes). Conversely, if I change the structure of consciousness then the content and states change. Does it matter then whether we try to change states first, or contents or structures of consciousness? According to Patanjali in YS III.15 it *does* matter, since the outcome of our actions depends on their order, their sequence (*krama*). That difference, according to Patanjali, is the reason why he distinguishes among the three *parinamas* (YS III.15). I propose that the most effective way to create lasting change in consciousness—its level—is to change its structures first; then to complement changes in structures with changes in states and contents. Change the *samskaras* that are active, and the contents (*klesas*) will reflect the structural changes. But if we try to attenuate the *klesas* without also changing the structures, then we may find the *klesas* easily becoming reactivated. In other words, I can practice *asana* as shapes, without special regard to intricacies of alignment, sequencing and linking, and still experience many benefits. I may experience tranquility, feelings of well-being, and even blissful

states. But how well do those feelings and states trigger lasting changes in how I see the world, or how I respond to changes and challenges in my life? I believe that the Iyengar method also leads to experiences of tranquility, feelings of well-being and states of bliss. But embedded within the method are the structural changes in consciousness that Patanjali describes. And the new structures are the substrate on which tranquility and blissful states rest.

Linking and sequencing in the practice of asana have been argued above to be closely integrated with the yoga philosophy of Patanjali. Timing, alignment and intricacy can be treated in a similar way, and this sort of interpretation can be used to generate testable hypotheses. For example, we can design a study that compares Iyengar yoga with other forms of yoga along the following lines: a) How do states, contents, structures and levels of consciousness change in each style of yoga over the course of, say an eight week intervention?, b) How well do these changes persist over the following months of the intervention? (Note that there is published work on the various developmental stages of the mind in psychological and psychoanalytic literature that can serve as external validation for any scientific inquiries of yoga psychology and philosophy.^{2,3})

Science of Yoga

Information I generate as a practitioner, which resides in the interior/individual domain, may or may not satisfy the needs of an empirical study of the benefits of yoga. Conversely, whereas empirical studies which are in the individual/exterior domain, generate valid and reproducible information about the benefits of yoga for various conditions (for example, anxiety and depression, lower back pain, carpal tunnel syndrome), they do not address the role that *manomayakosha* (layer of the perceptual mind) plays in lower back pain nor, at an even deeper level, the role that particular *samskaras* play. Such studies can be designed, given a proper understanding of the four domains of experience Wilber describes. The notion of *kosha* comes from the Taittiriya Upanishad, not the Yoga Sutra. But it is a very useful concept that helps us understand the effects of yoga (see, for example, Light on Life, by B. K. S. Iyengar). Proper sequencing of actions within poses, and from pose to pose progressively takes one's awareness deeper into the layers of the being. And this process of going deeper is the intention behind the intricacy of the instructions in the Iyengar method. It is through such intricacy and the iterative nature of posing and reposing that we may attain the depth of experience and deeper levels of consciousness that are the aim of yoga.

Science represents our capacity to investigate, to explore and discover, to create change and to quantify or to give conceptual structure, to illuminate the unknown. These are all aspects of the *niyama* of *svadhyaya*, and also of *abhyasa*, so science or at least the scientific spirit is an essential part of any yoga *sadhana*. And public awareness and appreciation of the benefits of yoga both ride on scientific validation of the principles and effects of yoga.

References:

1. Wilber, Ken, The Eye of Spirit, Shambala, 1997.
2. Cloninger, C. Robert and Dragan M. Svrakic, Integrative Psychobiological Approach to Psychiatric Assessment and Treatment, *Psychiatry*, Vol. 60, 120-141(1997). This article describes a 15-stage

model of personality development along three character dimensions: self-directedness, cooperativeness, self-transcendence. Each of these character dimensions may be argued to be related to one of the structures of consciousness described in the body of the present article.

3. Matte Blanco, Ignacio, The Unconscious as Infinite Sets: An Essay in Bi-Logic, Ducksworth (1975). This book lays out a detailed model of the mind that is clinically based and able to account for the timeless and nonlocal nature of some aspects of the unconscious. This reference is one possible contemporary resource for understanding *samskaras*.