Buddhist Wisdom, Cognitive Neuroscience, and Contemplative Experience

Introduction

In this essay we apply Buddhist knowledge and cognitive neuroscience insights to explain contemplative experiences as measurable changes in cognitive processing. These changes enable experiences of the *Fundamental Ground* of the universe as a continuum of bliss and knowingness. We propose that contemplative experiences across religions and practices most likely arise from similar experiences of the Fundamental Ground. Different religions have distinct names for such experiences, and often interpret them in different ways (e.g., Are contemplative experiences messages from God, or just some infrequent physical experience?) Nevertheless, if an experience in two different individuals elicits nearly the same physical response in the brain, one could argue that the individuals are having similar experiences.

In seminal research, Davidson and colleagues (Goleman & Davidson, 2017) studied the role of skill level (i.e., novice/expert differences) in individuals who practice meditation. They recorded twenty-one highly experienced meditators and a similar number of novice meditators projecting non-referential compassion for one minute, followed by a fifteen second break, for four cycles. The experienced meditators showed an increase of over eight hundred percent in gamma ray amplitude compared to the novices. In addition, some experts report experiencing *panoramic perception*, where the subject simultaneously perceives the whole visual field. This state was not experienced by the novices. This research clearly demonstrates that individuals can differ in their cognitive receptiveness to contemplative experiences and that contemplative brain states can be distinguished and recorded by brain scanning machines, EEG (Electrocephagram), in this instance.

Our ordinary experience is limited by our reactions to previously established perceptual and cognitive concepts: We see what we expect to see; and this seeing is based on and incorporates cultural expectations and understandings (Hoffman, 2019). A Buddhist description of this is that we are imprisoned in *Samsara* until we overcome our conditioned understanding and achieve *Nirvana*.

Samsara is the reality we experience. From a Buddhist perspective, it consists of a cyclical process of birth, life, and death, where a sentient being travels endlessly through uncountable types of existence experiencing a range of states from intense pleasure to extreme suffering. In contrast, nirvana is a state of intense bliss and openness beyond the duality of self and other. It occurs when you extinguish the cognitive process that creates Samsara. Achieving nirvana is getting off the "wheel of life" (i.e., the endless migrations) and dwelling in "supreme bliss" possessing "omniscient wisdom" forever.

Freemantle (2021) provides additional detail concerning Samsara: "We suffer because we imagine what is not self to be self, what is impermanent to be

permanent, and what, from an ultimate viewpoint, is pain to be pleasure. Existence with these three characteristics is called samsara, which means we are continually flowing, moving on, from one moment to the next moment, and from one life to the next life. Samsara is not the actual external world or life itself, but the way we interpret them."

One way to think about the challenge of uncovering our primordial being is by comparing it to twirling a sparkler (see figure 1.). A sparkler is a point source of light. However, when you spin it fast enough, it looks like a continuous circle of light. In this analogy, a thought is similar to a point of light. When you generate enough of them in rapid secession, it creates the illusion of a solid permanent self, and covers up the primordial awareness (i.e., the experience of nirvana) which is our original nature.

Figure 1 Spinning Sparkler
https://www.flickr.com/photos/audiotribe/3720849100

Finally, another way to conceptualize our mind is that it is a set of potentialities to behave in certain ways, dominated by desire, anger, and ignorance. These reactions provide the fuel that keeps us spinning in samsara.

Sentient beings wander in Samsara until they achieve Nirvana. Nirvana literally means "blown out", like a candle or a lamp being blown out by wind or breath. Another phrase used by Tibetan Buddhist practitioners is "extinction into reality", where you quit living in a fictitious world of your own creation (Wallace, 2000). In both cases the event seems to refer to ending the fictitious being of our historical self and rediscovering our original mind, which is also known as the ground of all being (i.e., *dharmakaya*, *Buddha Nature*, or *dharmadhatu*). This experience is described as exceptionally positive. While all teachers say this experience cannot be fully understood by sentient beings who inhabit the *six realms* (six states of conditioned being that individuals move among driven by karma), it is said to involve achieving omniscience and perhaps greatly expanding one's mind.

The first step out of this cycle of samsara frequently is a spontaneous experience in which we glimpse a deeper reality. Suddenly, the world seems intrinsically lit. The world becomes *luminous*, and all objects seem to glow diffusely from within (Thrangu, 2001; Wallace, 2007). Often, those who have experienced luminosity report looking around trying to find the source of light, and not being able to find it. This experience is often accompanied by awareness of multiple streams of consciousness and a deep feeling of calmness.

While we draw here on the tradition of Tibetan Buddhism, we note that similar experiences are described in many religions. For example, Zen practitioners call the discovery of the fundamental ground *Kensho*, and it frequently occurs after

studying a word puzzle that is unsolvable by analytic means for many hours, and sometimes many days, or even months (Kapleau, 1980). Within the Judeo-Christian tradition, we might include the description in scripture of the radiance of Moses' face when he descends from his encounter with God on Mt. Sinai (Exodus 3:1-3), or Pascal's experience of fire (B. Pascal), as well as contemporary accounts of an experience of luminosity (e.g., White, 2019).

In this paper we conduct a multi-level analysis of such glimpses of luminosity and knowingness. We consider contemplative experiences from the perspective of subjective experience, computational models of cognition, neurophysiological knowledge, and a select analysis of Buddhist literature describing meditation techniques. The multi-level analysis ties together and explains several lines of research, and proposes new research to potentially validate the proposed model.

We believe all these experiences refer to interactions with what the Tibetan Buddhists term *Rigpa* (wisdom), the ground of all and everything (i.e., fundamental ground). The experience of Rigpa is a continuum. When one initially clearly perceives it, it is the luminosity (described above) or the "*Glory of God*" (Borg, 2005). This experience, no matter what you call it, is an experience of briefly perceiving the fundamental ground. It is not an analytic understanding, but a direct perception. At what might be called a second stage, one actually "touches" the ground and realizes that matter is matter and also, simultaneously, awareness; it is cognizance. This realization is called the discovery of *primordial awareness* and/or *pristine cognition*, if you are a Buddhist (Guenther, 1975; Khenpo Samdrup, 2015); or (we propose) the discovery of *Elohim Hayyim,* the *living god,* if you are Christian.

If these experiences of Rigpa involve the mind on some objective level, we should be able to correlate them to cognitive processes. Here we describe such glimpses of Rigpa within a cognitive framework of matter-as-awareness (Young, 2017, 2022). In this view, all matter can be characterized as both a physical substance and a potential building block for subjective experience. All the matter that surrounds us is living, not in a biological sense, but rather it is a form of awareness or cognizance. In addition, different varieties of matter have distinctive flavors (e.g., the subjective experience of air is different than that of water). It is important to note, that unless matter is specially structured it is not conscious, nor is it a mind that processes select information (Young, 2022). Whether an object is conscious or has sensory systems depends on how the object's matter is structured. Further, you cannot have cognition or consciousness without a substructure—like a nervous system—that selectively organizes matter so it can process information (Young, 2017, 2022).

Glimpses of Rigpa can serve as the starting point for a progressive change in cognitive awareness. According to Buddhist teachings, the realization that there really is a path out of samsara usually starts with the experience of a mental state of either non-conceptuality, clarity, or bliss (Thrangu, 2001). In the non-conceptual state, you are looking at things and realize you aren't thinking (which immediately

causes the thoughts to flow again); with the experience of clarity, all objects seem to glow diffusely from within and space seems to fill up with "aliveness" or energy; and, with the experience of bliss, you feel warmth in various places within your body, frequently where some teachers have proposed that there are *charkas*, or nexuses of subtle forms of energy.

Experiences of Rigpa are difficult to achieve and stabilize. They frequently take years of effort to realize. Further, experiences of Rigpa deepen with practice. For example, the experience of luminosity can deepen to when you look at the world, like you are looking into a mirror; at a much deeper state, objects take on a symbolic character, and it almost seems that you can perceive the mind that created the object, in the object itself. The most striking aspect of these states of consciousness is that you realize energy is everywhere, and, empty space is not empty but is filled with energy which is cognizant.

For the reader who would like additional information on these experiences, the appendix has several accounts of contemplative experiences, two of which describe the experience of luminosity, and another that describes the discovery of "matter as awareness" (see appendix below).

Thoughts, Thoughts, and more Thoughts

Perhaps the most common metaphor Buddhists use to describe our inability to see the Fundamental Ground is that it is covered by clouds, and that the clouds are thoughts. Consequentially, the challenge facing a meditator who wants to traverse the path is that they must dramatically reduce the number of thoughts running through their head each day. That is, there appears to be an inverse reciprocal relationship between the number of thoughts a person has in a day and the likelihood of experiencing a contemplative state like those discussed above. In general, the more thoughts you have, and the more emotional states associated with them, the less likely you will experience a contemplative state.

Research studies vary widely in the estimates of the number of thoughts we think per day, with most estimates being between 12,000 and 60,000 (Harris, 2015). There are, however, a few newer studies that use measured data to create their estimates, and they have found the number to be significantly less, around 6,000. For example, a recent study developing and testing methods to identify narratives, large scale thought structures, found evidence of 6.5 thought transitions (from one to another) per minute. Doing the math puts the number of thoughts per day at 6,000 per day. What is important is that this study based their calculations on measured data, as opposed to estimated data. Most researchers, however, would still agree that additional research is needed to better refine the number.

In addition, experience-sampling studies, which query individuals randomly throughout the day on what they are thinking, estimate that approximately 95% of today's thoughts were thought yesterday as well; the thoughts in our mind are highly repetitive (Harris, 2015). Further, at any given moment, 46% of our ongoing

thoughts have nothing to do with what we are doing. These stimulus-independent thoughts (SITs) are streams of thoughts and images unrelated to immediate sensory input and actions. So, if we are not attending to the world, what are we doing? "We are creating our world by talking to ourselves. We rehearse past conversations thinking about what we said, what we didn't say, and what we should have said. We anticipate the future by generating a ceaseless string of words and images that fill us with hope and fear" (Harris, 2015). The thoughts we create are like clouds in the sky which block out the sun (i.e., Rigpa) and prevent us from experiencing underlying reality (i.e., Dharmadhatu, Fundamental Ground, or Buddha Nature).

A question that has plagued philosophy and cognitive science for hundreds of years is, what is the self? We argue that the self is a set of positions about what is correct and true, beliefs about how to behave, and accepted cultural values. These positions are embedded in the brain/mind as a collection *schema* and *scripts*. Schema are structured representations of things found in the world, and a system for organizing and perceiving new information. Further, a schema is a knowledge structure that defines categories of information by delineating the relationships among exemplars that make up the category (Wikipedia: Schema). Each schema can be instantiated with particular attributes representing specific instances of a class of things.

A script is a decision tree where sets of branches represent behavioral paths that can be followed. The classic example of a script is the restaurant script which guides one's behavior through the process of entering a restaurant, ordering food, getting food, etc. For simplicity, consider a script with two major paths, one being "fast food", the other "a sit-down restaurant with a menu". Script branches, whose activation is triggered by contextually specific stimuli, encode relevant options in a coherent structure that controls behavior. For instance, the first script branch followed might depend upon whether there is there is a menu hanging the over cash registers or whether a sign "please wait to be seated" is present when you enter the facility. Other *sign stimuli*—contextually specific patterns of information—that control specific behavioral activation include whether you pay when you order your food, or whether the waiter brings a tray with your bill on it after you've eaten.

Both schema and scripts become active when sign-stimuli sufficiently match the schema or scripts activation function. The schema consists of attributes that define the concept or object. When enough of the sign stimuli attributes match schema attributes, the schema becomes active (i.e., the attributes fire together in a synchronized manner, defining what is perceived). Schema and scripts can become active with partial attribute activation (i.e., partial information). Schema activation is best described as an *attractor basin*. Different stimuli create varying amounts of activation in distinct schema (i.e., they match to a greater or lesser extent). This varying activation is collected into the "basin" until there is sufficient energy to activate the schema.

Schema are organized heterarchically (i.e., the elements of the organization are unranked and non-hierarchical). A single schema receives information/activation from what can be called goal-directed/top-down, and contextual/"sideways" activation, in addition to data-driven/bottom-up activation. Full signal activation from a few sources is equally as likely to activate a schema as partial activation from several sources. In this framework, activation spreads in a non-linear manner due to the use of threshold functions. Activation increases until the threshold is reached, then the schema fires denoting that an attribute has been perceived and categorized, or a concept has been activated. What specifically is perceived (or activated) depends upon where the activation occurs within the heterarchically organized network of nodes. In general, nodes that are closer to the edges of the network represent concrete objects, while nodes more centrally located represent more abstract objects and/or ideas (concepts), while the number of nodes that becomes active is a rough indicator of complexity.

Co-activation of schema attributes strengthens interconnections among them via Hebbian synaptic modification, making it easier to jointly activate the (separate) attributes next time. Conversely, the connection strength of attributes that do not fire together, or only do so rarely, decays slightly, making it harder to co-activate the next time (i.e., more activation energy is needed). The first phenomenon creates a means for learning to occur, increasing the complexity of the concept. For example, in *chunking* an initial stimulus produces a more complex response over time due to strengthening attribute associations (i.e., learning occurs). The second phenomenon results in memory loss through disuse. Combining the two phenomena creates a dynamic knowledge base continually adjusting to changes in the environment. It constantly is learning new associations and disregarding unused knowledge (which can still be recalled with additional effort).

From a meaning perspective, activation is successful categorization, which causes activation to spread further via the synchronized firing (i.e., there are "consequences" to identifying objects). A sequence of scripts/schema executing is called a *thread* and results in overt perception and execution of a behavior cycle. This may potentially include losing oneself in a day dream.

In this discussion, we are primarily interested in *narrative schema* which are schema that embody an individual's array of cultural knowledge, societal factors, and personal events. The attributes (slots) of narrative schema are composed of *tropes* which are stereotypical representations of actors, settings, and events. They are the key story elements that individuals run recurrently in their minds. Schemas composed of tropes probably arise from a desire to either get something, or to push some experience away. Perhaps because a goal can't be realized at the moment, our mind starts to imagine what it would take to achieve the goal, playing out the imaginary steps over and over again. This strengthens the interconnections among elements forming the trope schema. *Sign-stimuli* develop from repeated association among elements in the external environment and the internal sensory desired state.

Frequently, sign stimuli include popular cultural elements like music and trope themes from movies.

What happens to task-associated-energy (i.e., the energy that normally spreads) when the mental process underlying its behavior is disrupted? This frees up energy which potentially grows into a new narrative (i.e., set of schema) or it can be redirected into *open awareness*, a state where mind relaxes into an integrative state not disrupted by thoughts (sometimes called *open presence*). Imagine a situation where you lose something that is very important, like a spouse or your job. There probably are a lot of strongly associated narrative schema that have become decoupled from their sign-stimuli (i.e., there are no sign-stimuli to active the schema due to spouse having left or place of work no longer present). Activation still builds up, albeit at a slower pace, eventually sufficiently to where the schema can spontaneously fire. Activation then flows through the brain. This potentially can activate low-threshold tropes (i.e., schema elements). If the activation situation is just right, then associations forming among elements may result in a new schema being formed. Part of the formation process involves the *self* identifying with the story. The self is a set of schemas, called a *complex*, that identifies with a part of the narrative, the internally told story. This identification contributes activation energy via spreading activation which facilitates schema formation.

We believe that there are several threads (and partial threads) forming and dissipating continuously. Our minds are not limited to performing one task at a time. Some threads represent real work of the organism (e.g., searching for food or reproducing opportunities), while others are the narrative stories (and fragments) we continuously play in our minds. These narrative schemas are activated by sign stimuli, just like other schema, but do not have access, or the ability, to take control of motor controls, probably due to inability to access executive functions due to weak connectivity. The schema just run repeatedly in the mind as vignettes, organized thoughts which turn our attention away from sensory inputs to the stories of our lives.

It is easiest to see this process of continuous schema activation (i.e., thread formation and execution) when you perform a boring task that doesn't need your full attention (e.g., raking leaves, working (or waiting) at a grocery store checkout, driving home from work); or when you are having personal conflict and rehearse imagined conversations with others, usually trying to rationalize what you did, or to prepare yourself for what is to come (Harris, 2014). It is these thought processes that must be disrupted if we want to gain familiarity with deeper contemplative experiences and eventually escape samsara. This frequently requires dismantling the sign-stimuli (e.g., knowing what music activates what schema) and letting go of elements that we strongly identify with to dissipate some "clouds"/thoughts. This can be accomplished through mindfulness meditation discussed below.

The Holon Cognitive Architecture

In the previous section we provided a descriptive overview of how the mind functions; i.e., created a model of the process under study using concepts to characterize the model's functionality. In this section, we further refine the model by exploring a possible computational implementation of it. This allows us to more fully understand the characteristics and capabilities of the model. The framework we are introducing is the holon cognitive architecture (HCA; Young 1998). The HCA is an Artificial General intelligence (AGI) framework for demonstrating how an associative, schema/script-based approach to modeling intelligence works. The HCA is named after Koestler's (1967) proposal that objects are both part of other objects, and independent objects of their own; they are *holons*. We will use an example of a mammal recognition holon to demonstrate key features.

Figure 2.Notional Depiction of Holon Backcloth
https://s.yimg.com/ny/api/res/1.2/0XLvXWmpu_f6drsnjv7NHA--/YXBwaWQ9aGlnaGxhbmRlcjt3PTk2MDtoPTY0MA--/https://o.aolcdn.com/dims-shared/dims3/GLOB/crop/5000x3332+0+221/resize/1600x1067!/format/jpg/quality/85/https://o.aolcdn.com/hss/storage/adam/5dbff716deccc1c47131f8925e7ec4ac/122374839.jpeg

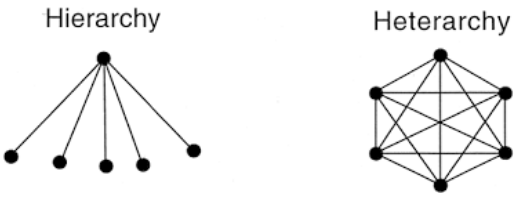

Figure 3. Hierarchy & Heterarchy

Holons simulate the functionality of a *cell assemblies*. Cell assemblies are collections of neurons with local inhibitory and distal excitatory connections. They are comprised of sub-populations of cells whose function is to detect distinct features within a data stream. When a feature is detected, local cells are inhibited, and distal are excited. Cell assemblies are distally connected via both feed forward and feedback (or reentrant) connections. We model cell assemblies as *holons*.

A cell assembly/holon's primary purpose is to categorize information. Any specific holon usually can identify several objects. When it identifies an object (or feature), it fires, signaling what it detected to those holons to which it is connected. Holons are part of large associative networks, called backcloths. Figure 1 is a notional depiction of a holon backcloth mapped onto a brain. Note that a backcloth is organized heterarchically, not hierarchically. In a hierarchy, the nodes are ranked, information flow is mostly one way, and information is frequently abstracted during processing. In a heterarchically ordered backcloth, nodes (holons) are not ranked, information flow can be in any "direction" (bottom-up, top-down, side ways, etc.), and information may be abstracted or expanded depending upon the study need. In Figure 1, white lines and spots indicate notional holons connected together. Brightness (white spot size) indicates holon activity. Note that there is not just one input and/or output to the backcloth. Further, multiple simulations at different

scales of abstraction may be running simultaneously in the backcloth, with no clear line demarcating where one model ends and another begins.

			Hair	Length				Hair	Color			Size	of	Body		Tail	Length			Eye			
			Short	Medium	Long	White	Gray	Black	Striped	Gold	Brown	Small	Medium	Large	V Large	No Tail	Stub Tail	Med Tail	Long Tail	Color		Where	Seen
			A1	A2	A3	B1	B2	B3	B4	B5	B6	C1	C2	C3	C4	D1	D2	D3	D4	Blue	Zoo	Forest	House
		μ	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	E1	F1	F2	F3
	Gold Ret	Y1	0	0	3	0	0	0	0	2	0	0	4	0	0	0	0	4	0	0	0	0	3
Dogs	Gold Lab	Y2	0	5	0	0	0	0	0	4	0	0	0	5	0	0	0	5	0	0	0	0	0
	Blk Lab	Y3	0	7	0	0	0	6	0	0	0	0	0	6	0	0	0	7	0	0	0	0	0
	Shepherd	Y4	0	4	0	0	0	5	0	0	0	0	5	0	0	0	0	6	0	0	0	0	0
	Burmese	Y5	0	0	7	0	6	0	0	0	0	5	0	0	0	0	0	6	0	0	0	0	5
	Persian	Y6	0	0	4	5	0	0	0	0	0	4	0	0	0	0	0	5	0	3	0	7	0
Cats	Manx1	Y7	7	0	0	0	7	0	0	0	0	5	0	0	0	0	5	0	0	0	0	0	0
	Manx2	Y8	7	0	0	0	0	0	0	6	0	5	0	0	0	0	5	0	0	0	0	0	0
	Cougar	Y9	0	8	0	0	0	0	0	0	5	0	7	0	0	0	0	0	6	0	0	0	0
	Tiger	Y10	0	9	0	0	0	0	4	0	0	0	7	0	0	0	0	0	8	0	4	0	0
	Polar Bear	Y11	0	0	4	4	0	0	0	0	0	0	0	0	4	7	0	0	0	0	4	0	0
Bears	Brn Bear	Y12	0	0	7	0	0	0	0	0	6	0	0	0	6	7	0	0	0	0	0	0	0
	Blk Bear	Y13	0	0	8	0	0	4	0	0	0	0	0	7	0	7	0	0	0	0	0	8	0
	Raccoon	Y14	0	0	6	0	0	1	0	0	0	5	0	0	0	0	0	9	0	0	0	0	0
	Possum	Y15	0	0	9	0	8	0	0	0	0	5	0	0	0	0	0	8	0	0	0	0	0

Figure 4. Incident Matrix Depicting Five Holons.

The HCA is a feature-based system; that is, objects are composed of features, or attributes, which can be assembled to represent sophisticated concepts or broken down further into smaller components, ultimately bottoming out into individual cell assemblies. Figure 3 is an incident matrix for a mammal recognition holon (MRH). The MRH can recognize 15 mammals, depicted along the Y axis as Y1 (Golden Retriever) to Y15 (Possum). The features of the animals are depicted on the X axis as X1 to X21. These features come from 6 holons: Hair Length (Short, Medium, or Long: X1 - X3 to X21 Where Seen (Zoo, Forest, House: X19 – X21), etc. The key information from the incident matrix is summarized in Figure 4.

	♣	Vertex Set	Dimensions
Gold Ret	y_1	$<x_3,x_8,x_{11},x_{16},x_{21}>$	4
Gold Lab	y_2	$<x_2,x_8,x_{12},x_{16},>$	3
Blk Lab	y_3	$<x_2,x_6,x_{12},x_{16}>$	3
Shepherd	y_4	$<x_2,x_8,x_{11},x_{16}>$	3
Burmese	y_5	$<x_3,x_5,x_{10},x_{16},x_{21}>$	4
Persian	y_6	$<x_3,x_4,x_{10},x_{16},x_{18},x_{21}>$	5
Manx1	y_7	$<x_1,x_5,x_{10},x_{15}>$	3
Manx2	y_8	$<x_1,x_8,x_{10},x_{15}>$	3
Cougar	y_9	$<x_2,x_9,x_{11},x_{17}>$	3
Tiger	y_{10}	$<x_2,x_7,x_{11},x_{17},x_{19}>$	4
Polar Bear	y_{11}	$<x_3,x_4,x_{13},x_{14},x_{19}>$	4
Brn Bear	y_{12}	$<x_3,x_9,x_{13},x_{14}>$	3
Blk Bear	y_{13}	$<x_3,x_6,x_{12},x_{14},x_{20}>$	4
Raccoon	y_{14}	$<x_3,x_6,x_{10},x_{16}>$	3
Possum	y_{15}	$<x_3,x_5,x_{10},x_{16}>$	3

Figure 5. Summary Information from Backcloth

As examples, the golden retriever (Y1) consists of 5 features: X3 – long hair; X8 – gold hair color; X11 – medium body size; X16 – medium tail length; X21 – seen around houses. The polar bear consists of 5 features: X3 – long hair; X8 – white hair color; X13 – large body size; X14 – no tail; X18 – seen in zoos. The brown bear consists of 4 features: X3 – long hair; X9 – brown hair color; X13 – large body size; X14 – no tail.

Information is embedded in the backcloth as dynamic schema. A schema is structured knowledge about a category. Features are connected via slots. There can be 1 – n number of slots, although most schema have a few to several. For each slot there are a number of values that it can assume. In the backcloth depicted in Figure 3, there are six slots, A,B,C,D,E,F, with

each slot having a set of values it can assume. In Figure 3, for example, the slot 'hair length" has three potential values, short medium and long, while the slot "where seen" also has three potential values zoo, forest, and home. Traditional schema (and holons) can be activated with partial information (i.e., not all slots filled), and regularize the information. That is, subjects often recall the most common slot value, rather than the actual one that occurred, when trying to remember a specific situation.

So how is any specific animal seen? Once again, a holon consists of a set of feature recognizers, or attribute categorizers. Each categorizer is further defined by having its own firing threshold. Portraying activation in the incidence matrix entails replacing the scalar integers. One can then rank order the thresholds for each categorizer within a holon, with the lowest being easiest to activate, given that all other things are equal (i.e., there is no additional contextual activation). If there are other activation streams, the system factors them in when calculating whether to fire or not.

Thresholds can be modified by a procedure that mimics long-term potentiation (LTP) which lowers firing threshold by up to 25 percent temporarily (it decays back to near original threshold in 24 hours), and categorization activation effects which permanently slightly lower the firing threshold of the categorizer and the connections to other categorizers in other holons (via Hebbian synaptic modification).

When activation flows through the system, attributes are activated. When an attribute crosses threshold, it fires once globally, signaling successful categorization, and then locally a second time, inhibiting the other categorizers in the holon (e.g., a thing can only be one color at a time). When enough attributes are activated, they begin to fire in synchrony (which might activate additional attributes) and a referent (e.g., object, concept, or symbol) is formed. A person may or may not be conscious of the referent (i.e., it might be a symbol or a just a thread of execution). The referent does not exist until synchronized firing brings it into being. Prior to that, it exists as a potential state that can be assumed. The synchronized firing of several holons may trigger other referents forming "downstream" via spreading activation.

The continually changing threshold along with a lack of fixed structure is what makes an HCA schema dynamic. One does not search a fixed structure looking for a category match. Instead, the system adjusts to its environment via continually changing activation patterns which reflect varying sign-stimuli.

HCA models, cognitively, engage in associative information processing. From a knowledge perspective, spreading activation follows the ruts, or the path of least resistance, which is also the path of strongest associations. If you watch your thoughts, you will see that associations govern what comes next when thinking.

If activation could flow through the system equally, it would activate those attributes with the lowest threshold, the epitomes of each holon. If someone were to say "describe a bear", normally I would probably describe a polar bear because I like seeing them in the zoo, and they are losing their turf to global warming. Thinking about these things has caused me to deepen connections for the polar bear referent. However, if the model includes "contextual activation" (i.e., not solely bottom-up or sensory driven, but other parts of the backcloth also being active) the new default would probably be a black bear because they are frequently in the news these days breaking into homes.

A major point is that the backcloth, as well as your mind, is not a tabula rasa; it is not a blank slate. Consider Figure 2 again. Bright spots show activation, lines show interconnections. What is not shown are the differences in threshold values, and the two functions, LTP and Hebbian synaptic learning, that constantly adjust threshold values.

Knowledge is embedded in the backcloth as a set of potentialities. Again, schema are dynamic structures that are activated by the current situation including external and internal influences. Knowledge is not a fixed structure of data that can only be read from a slot.

We have described ways to conceptually and computationally model the operation of the mind. Knowledge is represented and encoded as schema and scripts. We now consider the neurophysiological plausibility of our model. While we cannot definitively ascertain how subject self-reports map onto brain activity, we can correlate changes in brain activity with changes in subjective experience. This, along with other data, allows us to make educated guesses about where specific functionality is located in the brain.

Cognitive Neuroscience

Default Mode Network

Raichle (2015), a leading neuroscientist, wondered what does the brain do, when it is not doing anything? That is, the brain is a biological system, it is always on, so what does it do when it is "in idle"? Raichle and colleagues noticed that when the brain prepares to perform a task, those areas that are known to be involved in the task become more active, while other areas, not involved, are turned off. What was interesting was while those areas that became active were dependent upon the task, the areas that turned off were the same on every task. They realized that the brain is never in idle, it is always working away. When the brain is not actively performing a task we are conscious of, it goes into a mode that might be considered fundamental processing. There are a sizable number of brain areas involved in this processing, which is named the Default Mode Network (DMN).

The DMN consists of several sub-networks in the Midline of Prefrontal Cortex (MPFC) and Post Cingulate Cortex (PCC) areas of the brain. Studies have determined that these areas help us navigate through space, interpret words and actions of others, recall past events, and imagine possible future events. Overall, DMN capabilities support a wide range of mental activities (Zadra & Stickgold, 2021).

When scientists asked individuals what they were doing during the period when it looked like they were doing nothing, they frequently replied that their minds were wandering from one topic to the next, thinking about themselves and their entanglements in the world. The majority of thoughts included an "I" component: "How am I doing?", "Do I like this or not?", "How do I feel?", "What do I need to do"?

Goleman and Davidson (2017) propose that the DMN frames almost all thinking and activities from a self-perspective, and that the DMN is in fact the basis of the self. The thoughts the DMN generates lead us to believe that there is a separate entity thinking them. The thoughts knit together into a story that appears to make us a real existing self. The story is told by the narrator who is really just a pattern of activity (i.e., set of schema) in the DMN, which can also connect with other areas of the brain to gather information.

Goleman and Davidson (2017) likewise show that when we are performing meditation and we get lost in thoughts it is the DMN and its wandering mind that has taken over. Further, long term meditators employing Vipassana meditation methods seem to be able to first inhibit the DMN, and then over time modify its circuits, weakening the bonds that tie the self, its stories, and interpretations together. This modifying via weakening connections is very similar to how schema weaken and change over time, and possibly is the mechanism that enables the techniques of renunciation and dechunking (discussed below) to work. In both techniques, thresholds and connection resistance appear to increase to the point where there is no longer sufficient energy to activate a schema.

We believe that the DMN activity can also create new schema, if DMN cells are connected via Hebbian-like synaptic connections (i.e., cells that fire together wire together). This enables the DMN to (physically) generate narrative schemas as well as the self-complex. Have you ever watched a movie and then replayed select scenes over and over in your mind after it was over? What you are doing is mentally creating tropes, or schema components. By repeatedly replaying them in your mind, these "snippets" are assembled into stories (narrative schemas).

Such imaginative replaying can condition subsequent cognition. For example, have you ever had "sparks" with another person, where the first time you meet them, you seem to recognize them and think very positive things about them? However, in reality, you really do not know them at all. It may be the case that in your reverie (where you replayed scenes) you repeatedly imagined interacting with

images that resemble the person. The co-activation of the person's features strengthens the interconnections among schema attributes resulting in a lowering of the amount of energy required to co-activate them in the future (i.e., you create a schema). Repeated activation of similar (but not exact) objects creates an attractor basin which is stimulated by sign signals. The sign stimulus itself, again, is a type of schema consisting of features which match, to varying degrees of exactness, schema attributes.

Pivotal Research

As noted above, neurons in the brain are constantly firing. Sometimes, the neurons synchronize their firing which then travels as waves of activity across portions of the brain; this activity can be measured by an EEG machine (electroencephalogram). There are several types of waves that are distinguished primarily by the frequency of which they travel. Delta waves are the slowest waves (less than 4 Hz), and they typically are associated with deep sleep. Theta waves are faster (4-8 Hz), and are associated with drowsiness. Alpha waves (8-12 Hz) denote a state of relaxation. Beta waves are fast (13-30Hz), and reflect thinking, alertness, and concentration on a task. Finally, gamma waves are the fastest (greater than 30Hz), and appear to synchronize activity in different brain regions. Gamma becomes active when you recall a rich memory that draws on different sensory modalities, or when a problem you have difficult solving suddenly "clicks" (Goleman and Davidson, (2017).

Goleman and colleagues conducted seminal research on the long-term effects of meditation on individuals (Goleman and Davidson, 2017). Through significant effort and research field support they were able to identify twenty-one individuals who practiced between 10,000 and 50,000 hours of meditation before participating in their studies; they call this group the yogis. It consists of both male and female individuals from multiple racial groups. They also identified another group of beginner practitioners (only a few months of practice).

The procedure was to connect meditators to an EEG recording machine, have them meditate on compassion for one minute, rest for thirty seconds, and then repeat the procedure three more times. This procedure was followed for both groups. The results were extreme: Yogis' gamma amplitude was twenty-five times greater than beginners, not only during meditation, but also when collecting baseline (resting) data. The difference in baseline data between the two groups indicate that something has permanently changed in the Yogis as a result of meditation.

Gamma wave manifestation is quite different between groups of yogis and beginners, even when not being formally tested (Goleman and Davidson, 2017). The average duration of a beginner's gamma wave in the brain is one fifth of a second; for a yogi over a minute. Further, the beginners cannot initiate or stop a wave

quickly; in contrast, the yogis seemed able to start or stop gamma waves nearly instantaneously.

Similar results between experts and beginners are found when changing the research paradigm to collect data in fMRI-based studies. In one study, Goleman and colleagues (2017) asked subjects to generate a state of compassion towards all sentient beings. The activity of brain circuitry that underlies feeling compassion rose by 700 – 800% in yogis; no such increase was seen in beginners. (Goleman and Davidson, 2017)

Physically, extended gamma wave activity is associated with synchronized neuronal activity across multiple brain regions, to include both sensory and cognitive centers. Subjectively, the yogis describe "an ongoing state of open, rich awareness during their daily lives, not just when they meditate." "The yogis have described it as a spaciousness and vastness in their experience, as if all their senses were wide open to the full, rich panorama of experience." (quote from Goleman and Davidson, 2017). This research was the first to demonstrate clear changes in the brain resulting from meditation.

Signatures and Stages

One of our research goals is to identify *brain-state-signatures* that denote milestones in contemplative growth. A brain state signature has an objective component consisting of brain states that can be recorded and measured, and a subjective component which is what the subject experiences. We discuss four potential brain-state-signatures below.

First, consider the results of Davidson's and colleagues' seminal experiment. The objective component was the presence of high amplitude gamma waves, which were substantially higher in yogis than control subjects. Further, the gamma waves recruited, or involved, more areas in the brain firing in synchrony in yogis. Yogis turned waves on faster and their duration was longer, as well.

The subjective component is described above. Yogis "described it as a spaciousness and vastness in their experience, as if all their senses were wide open to the full, rich panorama of experience." It is not clear how tightly coupled the two data collections were. It is unlikely that subjects were asked what they experienced while they were generating open presence and compassion. The subjective data seems to have been collected later and it might be appropriate to think of it as baseline data for highly skilled yogis. But the physical results do indicate that there is a signature; additional research is needed to refine the subjective component.

Second, what would a brain state signature for the experience of luminosity look like? Luminosity, "light" intrinsically arising within objects and empty space (a.k.a. Rigpa), is an experiential continuum that can "deepen" as a result of practice, resulting in the world becoming "brighter" over time (along with other apparent

changes in the perceived physical universe, such as space, as well). The experience of luminosity is correlated with a reduction of thoughts, which is brought about by letting go of your concept of self, weakening and eliminating the narrative schema process.

The subjective experience is the world looks brighter. For a moment one is not looking at the world through sunglasses of concepts. For the most part you do not see separate "things" (i.e., objects) that automatically active specific knowledge. For a moment renunciation and de-chunking, which try to stop associations from forming, are achieved. The mind does not "take off to the races" executing a narrative schema, but instead settles down like waves dissipating on a body of water. Further, as skill in letting go increases, the duration of the experience lengthens. The stages of the deepening process are described in the four Yogas of Mahamudra (Wallace, 2000).

It is not clear what parts and processes of the brain would underlie this objective (physical) brain state signature. Luminosity may be the product of a decoupling between select perceptual and cognitive processes, or perhaps a slowdown of the DMN. Research is needed to determine the actual details. This process probably can be perceived and studied with existing research methods. A research program might include both recording techniques (e.g., PET, fMRI, EEG, etc.) and tracking changes in narrative schema throughout the day by having subjects provide data on their state of mind via an app. One aspect to consider is that luminosity may not occur when the subject is actually meditating, but later when the subject's mind relaxes. This would make data collection more difficult. One would have to define a means to alert researchers when to look for an event. Subjective reports would probably play a key role in the early stages of research.

Third is *joyful-all-around* (Gyamtso, 2000). It corresponds to the first *bhumi* (i.e., first "official" stage of accomplishment on the meditation path; Samdrup, 2015). The joy comes from briefly experiencing the primordial ground from which being (Rigpa or Buddha nature) arises. It is similar to traveling for a longtime towards a goal without ever seeing it, and then cresting a hill and clearly seeing the magnificent goal for the first time. When discussing this stage, we prefer to focus on the understanding realized and refer to it as *matter-as-awareness* (as stated above). Subjectively, it is the discovery of *pure lands* (i.e., a place similar to heaven) and understanding of the term *primordial awareness*.

It is not clear what the objective component, the specific brain states, of this first bhumi might be. I would expect to see more order, perhaps larger trains of gamma waves, recruiting more areas, all firing in synchrony. I would also expect, in a reciprocal manner, that as the gamma waves grew, that communication and other activity with the DMN would decrease until all thinking has ceased and mindful awareness has hit its peak. At that moment the subject might experience primordial awareness. However, I am not at all sure of what the actual process is. Determining the objective component might require significant research. It is expected that a

limiting factor in creating this brain state signature for study (and the following brain state signature) is limited availably of subjects. Data collection may have to be spread over several years, necessitating the creation of a data repository to store individual results.

In our final example, we introduce a new stage called *treasures-of-the-senses*. We take the definition of this state from Tsultrim Gyamtso Rinpoche: "This refers to the fact that the sense faculties of a bodhisattva (i.e., an advanced spiritual being) undergo a complete change of state once emptiness is seen directly, and thereby acquire a great multitude of qualities. As was said before, the single sense-faculty of the eye of a noble bodhisattva, for instance, can perceive all visible things, sounds, odors, tastes, and forms of touch simultaneously" (Tsultrim Gyamtso Rinpoche, 2000). The subjective experience includes perceiving the world as "living" energy fields that fill space (i.e., there isn't any empty space anywhere). The unification of sensory data changes cognition: Cognition becomes more inclusive, and decisions are better informed because more data is considered.

We believe treasures-of-the-senses corresponds to a bhumi, although we are not sure which one. Treasures-of-the-senses is a state where all sensory data being received by your body (including that generated internally) is integrated into one gestalt. It is a state where you can't shift attention because there are no parts to shift among: you experience a unified state of being. The state of the brain is constantly changing, new information is arriving continuously, but all is completely integrated. A possible example of this state is provided by Goleman and Davidson (2017), when they describe DT Suzuki as a panelist during an outdoor symposium. Suzuki sat perfectly still looking at a spot somewhere in front of himself. He seemed zoned out, not paying attention, but when a gust of wind came up, he was the only panelist who successfully grabbed his papers. He was not actually zoned out, but rather seeing the world in a special way. This is reminiscent of a second similar quote from Khenpo Tsultrim Gyamtso Rinpoche (2000): "The consciousness behind the visual faculty of a bodhisattva is able to grasp every form, sound, odor, taste, and touch occurring in the ten directions simultaneously."

While it is not clear what specific changes would occur in the brain, it is clear that the changes would be significant (i.e., it is likely to entail more than increased gamma waves). What is described is a complete reprogramming of the system/process that allocates attentional resources in the brain, and creates the reality we perceive through our senses. Hence, there should be significant objective changes to be seen in the brain, although we cannot specify what they will be ahead of time.

The experience of these states is not permanent. They weaken over time; but this weakening can be offset through practice. Indeed, strong practice may allow one to stabilize, or even advance to another stage (i.e., to a more advanced bhumi). The occurrence of a meditator achieving one of the bhumis is probably relatively rare. They may only be a few that occur each year.

Again, what is needed is a program to collect brain state signature data over a long period of time (many years). This would provide a way to collect sufficient data to build and test models of brain activities even though the data set to draw from is sparse. It is generally agreed, that Davidson's and colleagues' ability to identify twenty-one yogis with very extensive background in meditation was critical to the success of their research program. In the future, all collected data could be placed in a repository where it would be available to researchers. To make such a program truly effective it would be best if a group of researchers could design standardized experiments, to the greatest extent possible, to maximize data collection usability. Standardized experiments would provide core data from all collections, and protocols could be modified as needed to explore specific questions.

Default Mode Network (DMN) and Mind

The Tibetan word *Sems* translates as "mind" and/or "consciousness," and refers to the ability of sentient beings to think and perceive. It is the process that fabricates subjective experience. Sems seems to behave very similarly to the DMN. This suggests that the DMN maybe the mechanism that underlies our sense of "mind". We propose that the subjective mind operates like a set of narrative schemas, or stories, that play over and over in our mind. These stories are activated by sign stimuli, patterns and sequences of objects and events that are perceived in the environment, and manifest as thoughts.

To help explain our proposal we offer a vignette involving stereotypes: You are a light-skinned person walking down the street in a rough part of town and you see a large dark-skinned male all dressed in black walking towards you. You become nervous, and wonder who he is and what is his intent. As he gets close, you see a clerical tab, realize what he is, and say "Good day Father". You might also, due to his race, assume (possibly incorrectly) that he is a Baptist preacher and not a Catholic priest. Example tropes in this vignette include *rough part of town, dark-skinned male, dressed in black, Baptist preacher, and Catholic priest.*

Backcloths consist of many (probably thousands or more) such narrative schemas. They are called narrative because we use them to narrate what is happening in the world to ourselves. They are embedded into the backcloth as potential states that can manifest when the appropriate sign stimuli are present. They can also manifest when appropriate sign stimuli may not be present, as when you are dreaming. Narrative schemas are probably being activated by the DMN when we are daydreaming.

Further, we mistake these continually changing narrative states as a self when they really are just changing states, driven by changing sign stimuli to include internally generated signals or stimuli. Consider also that tropes have meaning valences associated with them. For example, *rough part of town* might mean be alert and careful when visiting for some individuals and evoke fond memories in others

as they recall growing up in that neighborhood. The semantic and emotional associations for each perceived object vary from individual to individual. In addition, separating an object from its idiosyncratic associations is a crucial part of Vipassana meditation and will be discussed further below.

Additional research is needed to refine and validate this proposal that a set of narrative schemas form the core of the mind. One previously used method to research thoughts is to randomly send an alert to subjects during the day, using experiential sampling methods, and have them respond with what are they thinking and whether or not it relates to the task at hand (from Harris, 2015). As discussed above, the best estimate of number of thoughts per day is between 12,000 and 60,000 thousand. Of those thoughts, 95% are repetitive with thoughts of the previous day, and 46% of thoughts have nothing to do with whatever you are doing at the moment. We would like to increase our understanding by more thoroughly characterizing how various thoughts relate to our mind. We propose doing this by applying a form of experience sampling to characterize thoughts.

The goal is to determine to what extent do the type of thoughts, or thought classes, vary among individuals. Researchers who study dreams have created inventories of dream elements (e.g., *The Contents and Analysis of Dreams*; *Typical Dreams Questionnaire*), that allow subjects to check boxes if an element is present in the dream, allowing the researchers to quickly characterize the type of dream someone has, and how frequently it occurs. A similar inventory could be created for thought research. Again, we propose that thoughts are dynamic narrative schemas (and schema fragments). They consist of data elements (i.e., tropes) that characterize and provide meaning in situations. They are activated and tailored to specific situations via interaction with the chains of sign stimuli.

For instance, you might have schema for being a hero, and another for being a "Casanova". In terms of the setting, you could be a hero (or victim) in a Western (e.g., 1883), historical story (e.g., Henry Tilney, Jane Austen novels), or space environment (e.g., Star Trek). We do not necessarily need a high-resolution schema description; what we need is a large enough sample to see if there are patterns (i.e., are there heroes and Casanovas) in the stories of your mind. Further, we need to demonstrate that there are narrative schemas that are activated and controlled by sign-stimuli (i.e., can events that occur either consciously or subliminally influence what schema becomes active).

An emphasis here is mapping the co-occurrence of elements (tropes); are co-occurrences random, or do they define clusters with a narrative schema structure? We suspect that sets of schemas will differ in *strength* (stronger being easer to activate), and *complexity* (e.g., richness and range of elements). Those with the highest strength and complexity are probably more central to our identity. Further, comparing individuals could lead to the identification of new "personality types". There are at least two potential dimensions to study. One dimension would be number of story types. Are there only one or a few dominant themes, heroes and

Casanovas, per person, or are there many themes? Could statistics be applied to map distributions of component factors (i.e., tropes) across subjects? If yes, a second dimension of research might be able to find personality subtypes that predicted select behaviors, such as compulsiveness, or attitudes towards government, business, education, etc.

Kleshas, Stereotypes, Attitudes and the Alya-Vijana

Buddhism postulates that each human sentient being is dominated by one of five "bad attitudes": ignorance, desire, anger, pride, and jealousy. Frequently, these attitudes are called *kleshas*. We define kleshas as habitual reactions to stimuli and situations that give rise to emotionally toned patterns of thought. They are patterns of emotional reactions and negative behavior that cloud the mind and influence its reactions to events. Repeated activation of a klesha strengths it, making it easier to become active in the future.

Stereotypes are an example of a klesha. You see someone of a specific ethnicity (based upon dress or language, for example), which serves as a sign stimulus that activates group level beliefs about that group's members. These beliefs, or attributions, may or may not be accurate at either a group or individual level. Activating the stereotype provides contextual energy which influences subsequent perception and behavior activation: It works like a bias influencing choice. Kleshas are similar to stereotypes but work at the personality level, influencings all actions, and not just those associated with a specific group. Kleshas operate as a personality bias making it easier to "fly off the handle" (i.e., become angry) or see the world through green eyes (i.e., become jealous, or have difficulty appreciating another's success). Failure to eliminate kleshas results in them becoming stronger and increasing the likelihood of experiencing negative situations in this and future lives.

The western concept of *attitude* is very similar to the Buddhist concept of klesha. Allport defines an attitude as "a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related." (Allport, 1935, p. 810). Smith and colleagues define an attitude as "a predisposition to experience, to be motivated by, and to act toward, a class of objects in a predictable manner." (M. B. Smith, Bruner, & White, 1956, p. 33)

In reading these quotes and comparing them to the similar ones on stereotypes it is apparent that both attitudes and stereotypes have many similarities. They both are a state of readiness. And they bias, or predispose, an individual to respond to a class of objects in a specific way, either positive, negative, or neutral. In addition, they both have an affective component; they seem to frequently invoke emotional content. It appears that a stereotype is just a strong, perceptually based, focused attitude (i.e., stereotypes are a subset of the "class"

attitudes). A stereotype is a sign-stimuli that primes an individual to response in a biased fashion.

We propose that the alaya-vijnana or storehouse consciousness, working with sems, provides a process that explains the workings of kleshas, attitudes, stereotypes, and karma. The alaya-vijnana is a key concept underlying the Yogachara school of Mahayana Buddhism. Yogachara doctrine postulates that no external world exists. The only thing that exists is knowledge that can be known. Individuals are a set of "physical positions", distinct brain and sensory states, that the central nervous system (CNS) can potentially assume. A state is identical to knowing/experiencing it. Note there is no one who experiences these states (no homunculi watching a screen of changing images and objects), but rather *we are* the continually changing states.

The storehouse consciousness postulated by Yogachara doctrine is the ultimate basis of the apparent individual; it is where the potentials, or intentionality, for future actions reside. The storehouse consciousness is similar to the backcloth in that it contains the impressions of previous experiences which form the seeds of future karmic action. *Karma* is a force that creates categories of knowing that are in fact only fictitious; it creates Samsara. Further, the universe consists in an infinite number of possible ideas (states) that lie inactive in storage. This latent consciousness generates an interrupted sequence of thoughts, while it itself is in restless flux until all karma, or accumulated consequences of past deeds, is destroyed (Matt Stefon, Britannica – alaya-vijnana). We believe that the alaya-vijnana and the DMN characterize the same phenomena in similar ways.

To understand our position, we need to describe in slightly greater detail the genesis of the storehouse consciousness. Modern science postulates the existence of a field, sometimes called the grid, underling all of reality and coextensive with space (Wilczek, 2008; Economist, 2015). It is not completely clear how to characterize this grid, but it is believed to be pure energy (i.e., energy not yet formed into particles of matter), and could be described as a set of potentialities that unfold in space-time. The grid is believed to be continuously churning with spontaneous and unpredictable quantum activity (Wilczek, 2008). Grid activity creates and molds the physical universe. Matter (and perhaps even space-time) is considered to be a manifestation of it.

The grid is similar in several ways to the Buddhist concepts of *dharmadhatu* and *dharmata*. The dharmadhatu is all-encompassing space, unoriginated and without beginning, from which all phenomena arise (Thrangu, 2016; Taye, 1995). It is referred to as the expanse of phenomena, and is considered to be empty, even though all things arise from it. Dharmata refers to the same thing, focusing on the ultimate nature itself. Dharmata is also called "suchness" or sugatagarbha (i.e., those who have gone to bliss) representing the lucidity and bliss components of space (Taye, 1995). The dharmata is considered to be a vast network of interconnected

energy that is coextensive with space. Further, it is continuously churning with activity.

Note that in both the Western and Buddhist models there is no *empty* space. Note further, that in both models the ground cannot be characterized as to what it is. For Western scientists it is the primary reality, of which matter is a secondary manifestation (Wilczek, 2008). For Buddhists it is referred to as the primordial reality. Both the grid and dharmadhatu are unoriginated in the sense that while nothing has created them, they are the source of creation of all that exists, and they represent potential for future creation as well. Particles are formed and arise from the grid when it is disturbed (Wilczek, 2008). For the dharmadhatu, all forms (which really are just patterns of energy) arise from it (Thrangu, 2016; Taye 1995).

The main differences between the two systems of thought is *subjective experience*. The Grid has none (at least that physicists know about), whereas the dharmadhatu is considered to be the purified original mind, free of obscurations. The dharmadhatu is further described as being radiant intrinsic awareness that is beyond concept, thought, and differentiation. It is said that our intellectual minds cannot fully grasp nor comprehend it because the intellectual mind uses concepts and words which can only point towards this unity.

From an experiential perspective, the energy of dharmata is described as a quality of knowing or clarity that manifests in various ways. It is portrayed as clear and unobstructed, and does not involve the dualistic experience of an observer and an observed object (Taye, 1995). Experiencing the ground is described as similar to looking into a mirror that reflects back your own features, although most individuals do not recognize them as such. Further, the Buddhist Dzog Chen teachings suggest that the state of being in union with the field is a state of wonderment. Nothing is perceived as ultimately real or fixed, but all is seen as being similar to a dream, an echo, or a mirage (Guenther, 1976, Tulku Urgyen Rinpoche, 2006). Mind itself is a luminous cognitive capacity that gazes at itself in wonderment. Finally, it is also characterized as supreme bliss (i.e., sugatagarbha); an intensely "alive" state of being.

Sentient beings are prevented from experiencing the ground (a.k.a., Rigpa) by the generation of thoughts that arise from the storehouse consciousness (a.k.a., alaya-vijnana). That is, the thoughts generated by the DMN and storehouse consciousness are the same. Conceptually, the HCA backcloth stores karma as different thresholds and inter-connections strengths. These differences create the biases that influence behavior. Karma manifests as schemas with low activation thresholds. They also normally are bound to the sense of “I”. Becoming enlightened requires removing attribute biases to get to a state of emptiness where one has stopped automatic activation of concepts (schema) and chains of associations (thoughts).

Some Buddhists talk about polishing the mirror to get the dust off. What they are describing is removing all of the concepts and schema that automatically activate and run when appropriate stimuli are perceived. The goal of meditation is to change the backcloth into a tabula rasa, a blank slate, to remove differences in thresholds and make associative links to go away. The objective is to stop habitual responses to all stimuli, achieving the state where knowledge and experiences occur spontaneously, and are not the product of prior experience or rehearsal.

If one can accomplish this, with no automatic response (exempting reflexes), no intentionality, no hope and no fear, then you have achieved enlightenment and realize nirvana. As you work towards this state, your world will become progressively "brighter". Experiences of Rigpa deepen and lengthen, and you eventually realize the ground (a.k.a., dharmadatu, Buddha nature, etc.). You realize the universe is not "dead matter", but a field of supreme bliss. (see appendix for a description of the realized state.)

Uncovering Rigpa

Buddhism has many meditation methods that can contribute to uncovering Rigpa. Two of the most common meditation practices are *Samatha*, and *Vipassana*. Both approaches include a range of methods. In the following sections, we will discuss how these practices help dismantle sems and uncover Rigpa. We will concentrate the majority of the discussion on Vipassana because it is the most powerful and widespread set of meditation methods.

Samatha Meditation

The primary purpose of Samatha meditation is to improve one's ability to concentrate one's mind, by keeping it focused on something, or nothing at all. There are two general approaches to Samatha meditation with, or without, support. When practicing with support, you try to maintain focus on a referent. The referent can be almost any concrete physical object (e.g., statues, rocks, wood carvings, etc.), or something special like a statue of the buddha. When practicing with support, you can also focus your attention on your breathing, watching it come in, pause for a moment, and then come back out. The goal is to keep your attention resting, or focused, on the object you have chosen.

You can also practice Samatha without support. Here you rest your mind in an open state, let thoughts arise, but do not attend to them, which causes them to dissipate. In either case (i.e., with or without support), the intent is not to stop or suppress the thoughts that run continually through your mind, but to develop greater control over your ability to maintain focus on referents (e.g., external objects or your breath) and openness. This requires developing skill in balancing the amount of effort you put into the practice. Too much effort and the mind becomes agitated with thoughts running wild, too little and the mind drifts off into a daze. Over time your ability to stay focused increases, and this can eventually lead to the experience of altered states of consciousness, but not directly to enlightenment.

There are many documented benefits to practicing Samatha meditation. Benefits include physical changes such as less anxiety and lower blood pressure; and psychological changes such as greater ability to control one's life as evidenced, for example, by quitting smoking and losing weight. Finally, Samatha meditation is not unique to Buddhism. Most religions and many secular practices use methods similar to Samatha in their programs.

Vipassana Meditation

Whereas the practice and goal of Samatha is relatively straightforward, the practice of Vipassana is not. Among the various schools, there are professed differences in the goal, and there are at least two different approaches to meditation: analytic reasoning and direct perception. We first discuss the multiple goals named in the Buddhist literature and attempt to synthesize an understanding of them.

Vipassana meditation is described as being the goal of Buddhist practice (i.e., the liberating experience), and at the same time the method needed to accomplish the goal (Rey, 2004). As a goal, Vipassana meditation is a liberating insight that arrives suddenly and unexpectedly, and denotes awakening. It is seeing things as they are, without a conceptual overlay and interpretive framework being active.

There are significant differences among the major historical schools concerning what happens when you achieve Vipassana (Rey, 2004). "The Mahayana prajnaparamita describes it as seeing the utter emptiness of all relative phenomena. The classical Yogacara describes Vipassana as insight into relative phenomena as they truly are, without the least overlay of conceptual thinking. Chan and Zen speak of it as realizing "no mind." And Tibetan Vajrayana defines Vipassana as awakening to the inseparability of appearance and emptiness, clarity and emptiness, or bliss and emptiness" (Rey, 2004).

We maintain that the definitions/characterizations of Vipassana described by Rey all refer to this same experience of matter-as-awareness. Perceiving the emptiness of relative phenomena (Mahayana), insight into phenomena as they really are without any conceptual overlay (Yogacara), realizing no mind (Chan and Zen), and, awakening to the inseparability of appearance and emptiness, clarity and emptiness, or bliss and emptiness all refer to the same experience of realizing matter is awareness, which is the same as discovering the fundamental ground (aka Rigpa).

Further, we contend that Elohim Hayyim, Kensho, and glimpse of Vajra-like Samadhi also refer to this same experience. Elohim Hayyim (Jew or Christian), Kensho (Zen), and glimpse of Vajra-like Samadhi (Tibetan Buddhism) also refer to experiencing Rigpa, the ground of all and everything. This experience, no matter what you call it, is an experience of briefly touching the fundamental ground; not an analytic understanding but a direct experience of matter-as-awareness. This experience is also known in many schools as achieving the first Bhumi (first stage of

actually realizing enlightenment). Achieving this goal usually requires extensive application of Vipassana as a method.

Vipassana meditation is the process of developing clear seeing, free from automatic activation of concepts. This deepens insight and develops a new form of knowing, called wisdom, which enables one to see deeper meanings in situations. In addition, practicing Vipassana increases clarity, and eliminates the negative emotions and confusion which cloud the experience of the ground (Thrangu, 2003, 2006). One can practice Vipassana using either the path of reasoning, or direct perception.

On the path of reasoning, one employs analytic meditation to consider experiences from different perspectives. One forms mental questions and applies them to the problem. One must stay focused on the analysis, but can shift lines of analysis as needed. The overall goal of this practice is to disrupt the thought process (English: mind; Tibetan: sems). The topics used to accomplish this vary widely, depending upon the klesha, or attitude, one is working on. A common topic is ignorance, which frequently focuses on the mind: What color is the mind? Where is the mind located? Why am I angry? Who is angry? Who is proud about their accomplishments? Who is sad today? Where is happiness located? Who perceives the world? Note that the topics can be positive, neutral, or sad. Happy topics are harder to let go of, but all excessive mentation (i.e., stimulus-independent thoughts) must eventually be given up.

In contrast, in direct perception, rather than trying to cut through some concept or situation, or get control of an emotion through analytic means, you instead just watch the thoughts. You look for where they come from, and where they go. The goal is to understand the thought process, and then stop it, by not attending to the thoughts. Thoughts arise continually during the day, probably during sleep at night, and constantly during meditation practice. If you watch carefully, some noise or visual stimulus occurs which triggers a thought, and then the mind is off to the races generating more thoughts which are associated with each other. This thinking process can continue for a long time. In fact, the set of thoughts may make up a narrative schema, which is a story you repeatedly tell yourself. In direct perception, you stop re-iterating this narrative, and instead you just let the energy dissipate.

Our discussion of spreading activation above explains why it is necessary to disrupt the thinking process. Recall that all knowledge elements are interconnected heterarchically. When an element becomes active, whether it is an attribute of the schema, or the entire schema, it spreads activation along its connections. The goal of direct perception is to not provide adequate energy to the process to enable a sufficient number of schema attributes to fire, thus preventing the next schema from becoming active. This is achieved by not identifying with, nor attending to, the story elements (i.e., tropes). Not attending to the thoughts denies the associational process the energy needed to continue, and snuffs out the thought process similar to the way a flame is snuffed out when denied oxygen. That is, in many instances, you

need both the activation initiated by the sign-stimuli, and your attending to the process by providing via "top-down" attention to trigger and then maintain the thoughts. Without the top-down activation energy, the schema/trope may not have sufficient energy to become active, and just quickly fades away.

Some individuals (Rogers, personal communication) refer to this process as de-chunking, where, over time, you weaken or break some of the interconnections that comprise a story or an object by raising the activation threshold required for it to fire. This frequently happens through disuse (i.e., by not attending to the story elements, the energy needed to become active is not transferred), causing the story to fall apart, and the energy to dissipate like waves relaxing back into the ocean.

Other individuals refer to this process as renunciation (Deikman, 2000). Here, the focus is on breaking the semantic linkages that connect objects to meaning. This enables an object's meaning to be redefined, or even dropped. According to advanced Buddhist practitioners, this enables you to see the world anew, redefining the relationship between objects and space. For instance, one might realize that there isn't any empty space anywhere. Rather there is space that things can move through and other spaces they cannot. Buddhism has a traditional phrase to highlight these changes: Form is Emptiness, and Emptiness is Form.

In either case, when practicing de-chunking or renunciation, there still is energy that could cause a thread (sequence of semantic elements) to fire off (e.g., you could start a new story). In direct perception you try to prevent this by relaxing energy via the practice of mindfulness. Recall that above we stated that there is an inverse reciprocal relationship between thoughts and likelihood of contemplative experience. If you can relax into a state of mindfulness, where you maintain awareness of what your senses and mind are experiencing without chasing after them, you frequently can experience luminosity. The challenge is to grow your awareness. Early in the process, when you practice mindfulness, you might only be able to be partially mindful, say, aware of part of your physical body (e.g., your hands). The rest of the energy is still tied up in trope/schema threads. As these schema dissolve through practice (or non-practice), you need to expand the area you are aware of (e.g., hands, shoulder, and head). This enables the practice to absorb more energy and deepen your experience of Rigpa (wisdom), along the line described in the four stages of Mahamudra (Wallace, 2000).

Further, there are stages of "concentration" you go through where instead of applying focused application (or effort), you progressively relax your mind (Tulku Orygen, 2006). The first stage is called *mindfulness*. Initially, it takes a fair bit of effort to maintain your focus and not drift off into identifying with the narrative schema story. With practice, however, you achieve the stage of *watchfulness* where you can progressively relax your mind and still maintain focus of watching, but not following after thoughts. In the third and final stage, you achieve *awakeness* where you can automatically let go of involvement of thoughts and the dualistic processes

of mind, where one divides existence into self and other. This results in the ability to experience Rigpa almost as will.

Thrangu (2003) notes that in some Western therapeutic approaches, it is believed that if you focus long enough on a complex of thoughts that regularly repeats itself, what we call a trope/schema, you find at the core a powerful personal experience (usually frightening, sad, or grieving). Further, many Western approaches argue that the complex will dissolve if it is thoroughly experienced (i.e., you relive the experience a few times). Thrangu argues that this is not the case in Vipassana meditation. Applying a Vipassana analytic approach will lead you to the core of a trope that is triggered by a sign-stimuli. But this experience does not immediately dissolve the complex (trope). Using direct perception meditation, you still have to weaken the interconnections among the schema/thread elements. The meditator should stay focused on the process of watching thoughts and emotions arise and dissipate, this and will cause them to disperse.

It is interesting to note that the two approaches are quite similar. "Thoroughly experience" does not sound that different, operationally, from "watching thoughts and emotions arise and dissipate". This could be an instance *idiom confusion* where two experiences seem quite similar, but different words, and sometime concepts, are used to describe them. We further discuss idiom confusion below.

It is frequently the case in Vipassana meditation that the two approaches are applied sequentially, analysis and then direct perception. While direct perception is the goal, it is often the case that the mind is to wound up to just sit and watch thoughts. When this occurs, it is perfectly appropriate to practice the analytic approach until the mentation calms down. It usually takes a lot of effort over an extended period of time to cut through one of these narratives or fantasies.

To summarize, Vipassana meditation works to break down the system which generates the thoughts that prevent us from experiencing the underlying ground of reality. Wearing out stories (embodied in trope/schema) takes time and effort and leads us onto a path of increasing the experience of luminosity. The experience is not linear, but proceeds more like a spiral path moving ever higher. The advanced stages of this path are described in texts describing the four visions of Mahamudra (Wallace, 2000), and songs of realization by Buddhist meditation masters (e.g., (Paltrul Rinpoche, date unknown; Thrangu Rinpoche, 2001).

We end the discussion of meditation by briefly mentioning one of the most difficult practices in Buddhism: Nonmeditation. In many activities that you repeatedly perform, one goal is to improve one's performance over time. Samatha meditation is an example where you try to increase the amount of time focused on the object of meditation. But from a Buddhist perspective, what are you really trying to do? The ultimate goal of the most advanced meditation—*nonmeditation*—is not to become "stronger" at meditation, but to eliminate the mind (sems), and its sense

of I, by learning to relax the thought waves of your mind, while maintaining awareness. Skill in Samatha and Vipassana meditation are tools to help you achieve this goal; they are methods to examine and wear out the linkages among trope components. For instance, when you have daydreams of becoming a Mahamudra master, you are going the wrong way. You are creating and strengthening a new trope, perhaps based upon one of the stories in the songs of Milarepa (a popular Tibetan yogi), for example. One of the factors that makes nonmeditation difficult is that you don't know what happens to you, when you release or wear out the self. "What will I be, if anything"? Nonmeditation is almost synonymous with Rigpa. A glimpse of rigpa is a momentary occurrence of nonmeditation. Nonmeditation is a state of Nonintentionality; you strive for nothing nor do you reject anything.

One Reality, Many Interpretations?

Are contemplative experiences unique to specific religions (and individuals within that religion), or is there a set of states that all humans can potentially experience? Deikman (2007) was a physician who studied contemplative experiences. He noted that contemplative experiences are phenomenal (i.e., subjective), and have only received minimal attention by modern scientists who believe one cannot objectively study phenomenal experiences due to methodological issues. One example of a methodological challenge, is that subjects frequently can't agree on characterization of the object under study (e.g., the exact color of an object).

Deikman suggests that another part of the problem is that most of these experiences are described in a specific *religious idiom* (i.e., a specialized sub-set of language, or language meanings). This limits the accessibility of knowledge to those that have had experiences and know the idiom. An example introduced above by the Christian theologian Borge (2010) is his contention that the experience of the "Glory of God" is the same as experiencing Rigpa (Tibetan Buddhism). Having grown up in the Roman Catholic church I was totally unaware of this possible meaning even though I studied theology (primarily through the Jerome Biblical Commentary) and actively looked for it in the apocrypha (e.g., gospel of Thomas). It would be interesting to see how many contemporary Roman Catholic priests are aware of, and accept, Borge's correlation.

Another methodological challenge may occur if no one is alive to explain and validate specific contemplative experiences. Many contemplative traditions believe in the practice of establishing a lineage where a teacher must transmit their understanding of a teaching/experience to a student or disciple. Unfortunately, situations occur where a teacher has no one to pass their understanding on to, or a student (or multiple different students) creates a new understanding of the experience. This is especially a problem for teachings that require a student to have experienced specific states of consciousness to achieve understanding of the material being transmitted. This can be contrasted with teachings that only require

an analytic or intellectual understanding of the material. If there is no teacher to validate a student's understanding, the knowledge embedded in the lineage teaching may be lost.

A superb example of the challenge of reconciling different teaching threads is provided by Rey (2004), introduced above, when he defines the concept of Vipassana according to four contemporary schools of Buddhist thought: Mahayana prajnaparamita (seeing the utter emptiness of all relative phenomena); classical Yogacara (insight into relative phenomena without conceptual thinking); Chan and Zen (no mind); and Tibetan Vajrayana (awakening to the inseparability of appearance and emptiness). In general, all of the schools agree that other schools' understandings are authentic, however, they all also contend that their own understanding is the best. Each school has a large amount of detailed literature associated with their understanding. This makes comparison difficult. The situation is similar to the story of several blind people touching different parts of an elephant (e.g., trunk, legs, ears, etc.), and then insisting that their description was the most correct.

One might think that the easiest approach would be to identify a contemplative-state-signature using available best tools and methods. For example, record as many individuals as possible who are having an experience, and look for distinct brainwave patterns and biological activity that identifies the state of consciousness.

There are at least two major hurdles to accomplishing this. First, as mentioned above, these occurrences are relatively rare among individuals, even those who meditate regularly, so we need to try to locate as many potential subjects as possible. This problem can potentially also be overcome by focusing initial studies on identifying luminosity, which is the most common experience, and provides us the best opportunity to objectively define that state.

Second, we suspect that most experiences have multiple information processing components. At a minimum, at least one component that creates a percept, and another that creates the interpretation of the scene. Can we identify these specific processes in the brain? Based on general studies of perception (Zeki, 2024), the two components probably occur in different parts of the brain and occur sequentially with the cognitive understanding usually occurring 50 to 200Msec after percept is formed. Solving this problem may require the development of new methods that are better at simultaneously analyzing signals from a temporal and spatial perspective over longer periods of time.

To help concretize these challenges, imagine three individuals, one a Hindu, one a Christian, and the third a Buddhist, going for a walk together and encountering a burning bush that talks to them. Their percepts of the talking burning bush would probably be the same (i.e., the subject report and the areas of the brain that show activity should be the same for all individuals). Their

interpretations, however, would probably be quite different. In particular, you might expect differences between theistic (Christian) and non-theistic religious groups (Hindu and Buddhist). In HCA terms, the activation of their backcloths would show differences due to religious beliefs. The activation would reflect differences in the areas in which religious knowledge is inscribed.

To investigate these suppositions, studies could be set up with within and between subjects' components. The experimental design would have three groups of subjects, Hindu, Christian, and Buddhist. The initial hypothesis is that all subjects (across groups) would perceive the same burning bush. There would be little variation across groups on the perceptual component (i.e., their backcloths would be similar). Conversely, the cognitive interpretation of the scene, would probably vary significantly across groups, and in addition, there would be significant agreement within groups. Hindus, Christians, and Buddhists would disagree with each other as to the meaning, or interpretation of the event. If we could create techniques with sufficient resolution, we should be able to see the same visual brain areas active in all three group when forming a precept but different cognitive areas active when they contemplated the significance of the event. A key question is, would we be able to identify both components?

Based upon Davison's results (Goleman and Davidson, 2017), deeper contemplative experience would probably be correlated with more integrated brain states. For instance, there might be more gamma waves, with longer periods of time, encompassing more brain areas. A question is, would the integration component drown out the religious differences? In the instance where individuals from different groups were compared, if they were experiencing the same state (of consciousness) it might be difficult to separate the religious component from the overall signal. Answers to these questions will require significant resources and effort.

Conclusion

Science and technology have matured enough to enable development of a science of contemplative experiences. Seminal work by Davison and colleagues have definitively demonstrated that contemplative states exist and correspond to specific brain states. Creating this science will require sustained effort for many years, but promises to open a new vista of knowledge about sentience in humans and other creatures. It also promises to provide new approaches to the study of consciousness.

Appendix: Examples of Contemplative Stares

In this section we provide example descriptions of contemplative states that differ in their depth of experience. We identify three levels, seeing, touching, and communing, with the fundamental ground. We also include a short article by Borg (1995) that provides an excellent overview of the challenges and opportunities of contemplative practice in the modern age. We begin, however, with a short summary of contemplative practices by William James, who conducted a monumental study of the varieties of religious experiences over a century ago (James, 1902).

James reviewed many sources and hundreds of reports of spiritual experiences. Of interest to us is James' four factor characterization of the spiritual experiences. *Ineffability* indicates that subjects who have had spiritual experiences report that their contents are impossible to adequately express to others. In this sense the contents are similar to feelings that one must experience to understand (e.g., love or enjoyment of music). *Noetic quality* denotes that spiritual states embody knowledge, knowledge that is felt as deeper and more encompassing than our basic intellectual states. These moments are revelations or understandings that pass far beyond usual knowledge; and they are intrinsically meaningful. These first two factors are always part of a spiritual experience. The next two factors are normally part of the experience. *Transiency* acknowledges that spiritual states are temporary and normally only last no more than sixty minutes duration and usually much less. Further, these experiences fade with time. While the memory can be brought back, its emotional intensity weakens over time. The last factor *passivity*, refers to the subject feeling that the experiencer's own will is in abeyance and in some cases that they are controlled by a superior power. We have found that James' characterization of one hundred years ago is still applicable today.

Example Descriptions of Luminosity

We now present four reports that reflect different degrees of experience. The first description is from a published newsletter.
(White, 2019): "Then one day, quite unexpectedly, I actually did see with a clarity I have never known before. I didn't have a camera in my hand; in fact, I had just picked up my basket in the local supermarket and begun walking around the vegetable section, when I noticed something out of the ordinary: everything around me seemed to be suffused with light. It wasn't a brilliant light; everything was bathed in a soft, gentle radiance.

I looked from the cabbages to the pumpkins, and then across to the apples, trying to work out where the light was coming from. Instinctively, I looked out the window, then up to the ceiling lights. But this light wasn't located anywhere. It had no source. Actually, it's not even really accurate to call it "a light" because it was felt as much as it was seen, and the feeling was one of lightness; pure relief and refreshment. So profound was this

sense of relief that I was walking around with tears in my eyes, breathing out huge sighs of relief.

The lightness was actually a kind of knowing; not an intellectual knowing but the deepest intuition, which told me that, whatever this lightness is, it is wholly intrinsic and that no effort is required. The deep sense of relief arose from realizing that nothing had to be done, or could ever be done, to get this. The tears which sprang up spontaneously, like waters from a living source, told me that this being-at-source just is; the essence of who I am. As I continued to walk around doing my shopping, the light gradually faded and everything seemed to return to "normal," but the knowing of what I'd experienced did not fade."

I heard the second account, second hand. That is, I heard it from a friend of the individual, who heard it directly from him. I knew the individual, but he passed away before I had a chance to talk to him about his experience. When the experience occurred, he was in Notre Dame cathedral in Paris. The grand organ was playing Ave Maria (by Schubert). For no apparent reason, he was overwhelmed and had to sit down. He describes it being like he had multiple streams of consciousness accessible at once. He knew he was crying, but he was also analyzing the light coming through the stained glass windows that seemed to violate the physics of where the sun was. He was aware of people staring at him, and was struck by what he assumed was their misinterpretation of what he was experiencing. He normally didn't like crowds but there was a calm as if the other people were part of him, they were somehow connected.

It is interesting to compare the backgrounds of the two authors. The first author is a trained spiritual director who teaches meditation and spiritual methods to others. She is also an officer in the Shalem organization. This organization trains individuals to become spiritual directors and offers programs to the public. The second author was a retired Air Force officer. He had a PhD in electrical engineering and conducted research and taught for many years. Finally, he was a hard-core atheist, who always looked for physical answers to experiences (but he was also open minded, he just wanted a scientific answer).

The next report is from a medical doctor (Dr. Bucke) being driven home after a night of intellectual exchange:

"I was in a state of quiet, almost passive enjoyment, not actually thinking, but letting ideas, images, and emotions flow of themselves, as it were, through my mind. All at once, without warning of any kind, I found myself wrapped in a flame-colored cloud. For an instant I thought of fire, an immense conflagration somewhere close by in that great city; the next I knew that the fire was within myself. Directly afterward there came upon me a sense of exultation, of immense joyousness accompanied or immediately followed by an intellectual illumination impossible to describe. Among other things, I did not merely come to believe, but I saw the universe is not composed of dead matter, but is, on the contrary, ***a living Presence***; I became conscious in myself of eternal life. It was not a conviction that I

would have eternal life, but a consciousness that I possessed eternal life then; I saw that all men are immortal; that the cosmic order is such that without any peradventure all things work together for the good of each and all; that the foundation of the world, of all worlds, is what we call love, and that the happiness of each and all is in the long run absolutely certain. The vision lasted a few seconds, and was gone; but the memory of it and the sense of the reality of what it taught has remained during the quarter a century which has since elapsed. I knew that what the vision showed was true. I had attained to a point of view from which I saw that it must be true. That view, that conviction, I may say the consciousness, has never, even during periods of the deepest depression, been lost". Bucke named this experience cosmic consciousness. (James, 1902).

The fourth report is from a long-time practicing, advanced, meditation practitioner: "Slowly my focused changed: "I'm dead! There's nothing to call me! There never was a me! It's an allegory, a mental image, a pattern upon which nothing was ever modeled." I grew dizzy with delight. Solid objects appeared as shadows, and everything my eyes fell upon was radiantly beautiful.
These words can only hint at what was vividly revealed to me in the days that followed:
1) The world as apprehended by the senses is the least true (in the sense of complete), the least dynamic (in the sense eternal movement), and the least important in a vast "geometry of existence" of unspeakable profundity, whose rate of vibration, whose intensity and subtlety are beyond verbal description.
2) Words are cumbersome and primitive—almost useless in trying to suggest the true multidimensional workings of an indescribably vast complex of dynamic force, to contact which one must abandon one's normal level of consciousness.
3) The least act, such as eating or scratching an arm, is not at all simple. It is merely a visible moment in a network of causes and effects reaching forward into Unknowingness and back into an infinity of Silence, where individual consciousness cannot even enter. There is truly nothing to know, nothing that can be known.
4) The physical world is an infinity of movement, of Time-Existence. But simultaneously it is an infinity of Silence and Voidness. Each object is thus transparent. Everything has its own special character, its own karma or "life in time," but at the same time there is no place where there is emptiness, where one object does not flow into another.
5) The least expression of a weather variation, a soft rain or a gentle breeze, touches me as a—what can I say?—a miracle of unmatched wonder, beauty, and goodness. There is nothing to do: just to be is a supremely total act.
6) Looking into faces, I see something of the long chain of their past existence, and sometimes something of the future. The past ones recede behind the outer face like ever finer tissues, yet are at the same time impregnated in it.
7) When I am in solitude I can hear a "song" coming forth from everything. Each and everything has its own song; even moods, thoughts, and feeling have their finer songs. Yet beneath this variety they intermingle in one inexpressibly vast unity". (Kapleau 1980)

If we consider the four reports together, the first two suggest the two individuals *saw* the dharmadhatu (ground of being), the third report suggests the third

individual briefly *touched* it (i.e., saw it as it really is), and in fourth report, the individual *communes* with it. In some way, in the fourth example, the individual has linked into "the ground of being". They do not just perceive the universe through their senses, as determined by the structure of the neuronal architecture and the aggregate matter it is comprised of, but seem to commune with the universe in some other way. This other way is sometimes referred to as extinguishing the sense of I-ness which distorts our experience.

Another way to conceptualize this process is through non-duality. Several religions argue that the universe and ourselves are not two separate things. Explaining how that works is usually described as requiring the ability to go beyond intellectual understanding.

A key phrase in the third report is "I saw the universe is not composed of dead matter, but is, on the contrary, a living Presence". One way to interpret this phrase is in terms of the matter-as-awareness model: all matter/energy has a cognizant quality associated with it. Again, basic matter (i.e., matter which is not specially structured or aggregated) is not a mind or an entity, but the building material from which entities and mental states are created. Above, we mentioned how structuring matter in specific ways (i.e., creating neuronal architectures) enables the creation of living systems, in a biological sense (Young, 2022). Here, we are looking outward and realizing that all matter is truly awareness or knowingness; but it is not living, nor conscious in the traditional sense (unless it is part of a living being).

It is easy to imagine that most people would interpret these experience in terms of their religious beliefs (i.e., cultural model). For theistic cultures, cultures that believe in a God, this class of experience would probably be interpreted as encountering God. For Jews and Christians, one term used to describe this experience is Elohim Hayyim, which translates into English as *living God*. For non-theistic cultures, countries that do not believe in God, this class of experience is commonly interpreted as discovering the ground of being. For some of these cultures, common terms used to describe the experience are dharmadhatu, tathagatagarbha, suchness, or Buddha Nature which translate as variations of the ground of being. A second example of culturally specific interpretation is provided by Marcus (2010) who notes what some cultural groups refer to the perceiving luminosity, other cultures (or religions) refer to it as perceiving *the glory of God*.

There are important ramifications that occur at this stage of spiritual experience. One ramification is there is a shift from intellectual to experiential understanding. In intellectual understanding, you interpret the experience in terms of preexisting conceptual knowledge. In experiential knowledge you can discover something that is completely new, which does not match existing concepts, and consequentially may be very difficult to explain to others (c.f., Plato's Cave for some examples of such difficulties).

A second ramification concerns space. Right now, we perceive that our world is composed of solid things and empty space. In reality, however, space isn't empty. It is a field of energy/matter, of varying densities. This knowledge that the universe is a unified living presence, and not completely separate objects shifts the focus of perception to seeing the world more like a series of Gestalt images. This shift is caught in a sentence from the third report above: "Everything has its own special character, its own karma or "life in time," but at the same time there is no place where there is emptiness, where one object does not flow into another".
We conclude the essay with an extended quote from the modern theologian Marcus Borg (2010):

"My most formative religious experiences were a series of mystical experiences. They began to occur in my early thirties. They changed my understanding of the meaning of the word "God"-of what that word points to-and gave me an unshakable conviction that God (or "the sacred") is real and can be experienced.

These experiences also convinced me that mystical forms of Christianity are true, and that the mystical forms of all the enduring religions of the world are true. My experiences were what scholars of mysticism call "extravertive" or "eyes open" mystical experiences (the other type is "introvertive" or "eyes closed"). I saw the same visual "landscape" – a forest, a room, the inside of an airliner – that I normally see. There were no extra beings, no angels.

For a minute or two (and once for the better part of an hour), what I was seeing looked very different. Light became different – as if there were a radiance shining through everything. The biblical phrase for this is "the glory of God" – as the book of Isaiah puts it, "the earth is filled with the glory – the radiance – of God. The world was transfigured, even as it remained "the same." And I experienced a falling away of the subject-object distinction that marks our ordinary everyday experience – that sense of being a separate self, "in here," while the world is "out there."

They were experiences of wonder – not of curiosity, but of what the 20th century Jewish theologian Abraham Heschel called "radical amazement."

They were also experiences in which I felt that I was seeing more clearly than I ever had before – that what I was experiencing was "the way things are." And they were also experiences of complete peacefulness, marked by a sense that I would love to stay in this mental state forever. Anxiety and distraction utterly disappeared. Everything looked beautiful.

When I had these experiences, I had no intellectual understanding of mysticism. Indeed, whenever I tried to read mystical writings, they seemed like gobbledy-gook. I had no idea what they were about – they were completely opaque. But after these experiences, mystical texts became luminous. I recognized in them what I had experienced.

The effect was to transform my understanding of the word "God." I began to understand that the word does not refer to a person-like being "out there," beyond the universe – an understanding of "God" that ceased to be persuasive in my teens and twenties.

I began to understand that the word "God" refers to "what is" experienced as wondrous and compelling, as, to use William James' phrase, "the more" which is all around us. Or to use a phrase from the New Testament, the word "God" refers to "the one in whom we live and move and have our being" (Acts 17.28). "God" is not a hypothesis, but a reality who can be known.

Thus, to argue about whether God exists seems to me to be based on a misunderstanding of what the word points to. If "God" means a person-like being "out there," completely separate from the universe, then I am an atheist. I do not believe there is such a being. But if the word "God" points to a radiance that pervades "what is," as I now think – then, of course, God is real. Not just the God of Christianity, but the God of all the enduring religions.

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