

How do the ideas of psychologists, neuroscientists, and philosophers compare to those of the Dalai Lama? Dr. Daniel Goleman, author of bestsellers such as *Emotional Intelligence*, chronicled the eighth meeting of the Dalai Lama and a diverse group of Western scientists in his book *Destructive Emotions: A Scientific Dialogue with the Dalai Lama*, from which the following article is excerpted. At the conference, called the Mind and Life Institute, the group discussed the nature of consciousness and the transformation of destructive emotions. In this excerpt, one of the scientists, the late Dr. Francisco Varela, who specialized in the deep philosophical questions of neuroscience, engages in a dialogue with the Dalai Lama about the sequence of the mental activity of a moment, from perception to action, and how such scientific findings correlate to Buddhist epistemology.

The Brain's Melody

DANIEL GOLEMAN

Dr. Francisco Varela mapped out two complementary goals he saw in the research agenda for the Mind and Life Institute, his own work focusing on the dynamics of mental activity within a moment's time, while Richie Davidson explored lasting changes in the brain over a much longer time span: months or even years.

“For example, when anger arises, there is a refractory period where you just have time to catch the anger arising and try to suppress the action that will follow. It follows that you need to understand very precisely the dynamics of the emergence of that state. You need to understand in great detail a moment of experience. How does a moment of consciousness, a moment of cognitive activity, a perception, or an emotion actually arise?

If we understood it better, then we could clarify how to apply that understanding to work with it. But very little is known about the minute details of how it arises.”

At this, the Dalai Lama perked up; he had a keen personal interest in just this question. Though the ensuing presentation seemed quite esoteric to many in the room, from the Dalai Lama’s perspective it was to be one of the richest parts of the entire week.

Varela continued: “When we perform a cognitive act—for example, we have a visual perception—the perception is not the simple fact of an image in the retina. There are many, many sites in the brain that become active. The big problem, Your Holiness, is how these many, many active parts become coherent to form a unity. When I see you, the rest of my experience—my posture, my emotional tone—is all a unit. It is not dispersed, with perception here and movement there.

“How does that happen? Imagine that each one of the sites in the brain is like a musical note. It has a tone. Why a tone? Empirically, there is an oscillation. The neurons in the brain oscillate all over the place. Each goes *whoomph*—(his arms rising as in an expansive gesture)—and then *ffhbb*—(falling in deflation). The *whoomph* is when different places in the brain oscillate, and these become harmonized. When you have a wave here and another there, from different parts of the brain, several become synchronized, so they oscillate together.

“When the brain sets into a pattern—to have a perception, or to make a movement—the phase of these oscillations becomes harmonized, what we call phase-locked. The waves oscillate together in synchrony.”

“Am I right in understanding your metaphor,” the Dalai Lama asked, “that each of these oscillations is like a different tone and when they are combined together you create music?”

“You create music, exactly,” Francisco agreed. “Many patterns of oscillations in the brain spontaneously select each other

to create the melody; that is, the moment of experience. That's the *whoomph*. But the music is created with no orchestra conductor. This is fundamental."

Francisco mimed a conductor, waving his arms in the air. "You don't have a little man in there saying, 'Now you, and you, and you.' It doesn't work that way. So again, to understand the large-scale integration of the whole brain, the basic mechanism is the transitory formation of synchronous groups of neurons that are distributed widely. This was a beautiful discovery that gives us an account of how a moment of experience can arise."¹

FAMILIES IN THE BRAIN

Here the Dalai Lama donned his familiar debater's hat as the scientific interlocutor: "Does this process vary from individual to individual? Would it be faster in some cases? Is it stable? Does it depend on age?"

"Those are very good questions, Your Holiness," Francisco replied. "It's probably very constant. There seems to be a universal law of how the brain works—we see the same thing even in animals. However, the specific patterns that arise certainly change from individual to individual depending on their learning and their unique history. Quite frankly, the answer to that is still unclear.

"If you put electrodes on different parts of the brain, you can measure oscillating signals. Then you put another electrode on another part of the brain, and what you see is another oscillation—a *whoomph*. And they enter into synchrony: they start and stop together. That's the basic mechanism."

The Dalai Lama asked, "Within one specific brain location, will there be a difference in what can be detected, depending on how far apart you put the two electrodes?"

"Absolutely," Francisco said. "We use a cap of electrodes that covers the brain. We are interested here in locations that are



No-perception
condition



Perception
condition

really far apart because we're interested in the large-scale integration. The small scale is a different story—where the neurons are so tightly together they are almost inevitably synchronous because they are interconnected. They are like a family because they are so close together. But the question is, can a family here in Dharamsala have synchronicity with a family in Delhi? That's the analogy. That's a different story because it requires they have a mechanism to get synchronized."

Then Francisco showed a slide of an extremely high-contrast black-and-white image that on first glance seemed to be just a set of blotches, but with more scrutiny suddenly revealed itself to be the face of a woman.

"Do you see it now?" he asked. "Once you see it you cannot stop seeing it, right? These are called moony faces, like the man in the moon—in other words, high-contrast faces. They're not easy to see, but most people can immediately detect them with a little attention.

"These faces are easily recognized when they are presented right side up." Then, showing the same image upside-down, he asked, "But now, do you see a face there? Very few people ever do. The upside-down stimuli are much more difficult to read. For the purpose of the study, we call the first image the perception condition—people eventually see the face—and the more difficult one the nonperception condition, because people usually don't recognize it at all."

THE ANATOMY OF A MOMENT IN THE MIND

At that, Francisco displayed a chart showing the sequence and timing in his experiment deconstructing a moment in the mind.² While volunteer subjects in Francisco's Paris lab had their EEG measured, they were simply asked to press a button the instant they could recognize an image. The sequence occurs with extraordinary rapidity, so fast that it must be tracked in milliseconds—thousandths of a second.

As the chart showed, during the first 180 milliseconds, when the black-and-white pattern is presented, the person's mind begins to stir into action. The act of recognition takes place from 180 to 360 milliseconds after the initial presentation—that is, by about the end of the first third of a second. The person's brain goes back to resting from that act of recognition during the next sixth of a second. The movement—the person pushing the button—occurs during the following sixth of a second. The whole sequence ends before three-quarters of a second has elapsed.

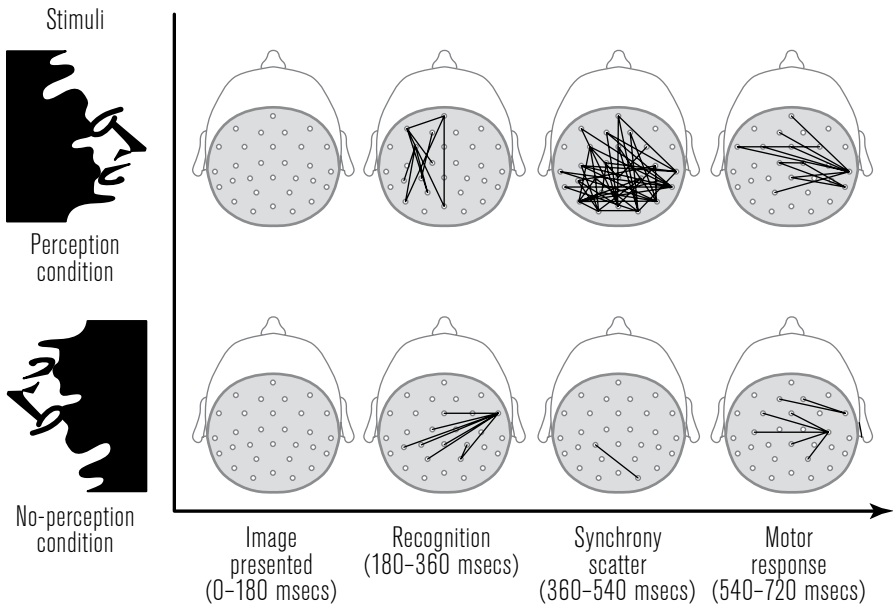
“When it starts, there's about a tenth of a second where nothing happens. I like to think of it as everybody's trying to get started, going *rrr-rrrrrr*,” he said, making the noise of an engine revving up. “Everyone is trying to make allies to form the synchronous groups,” he pointed out, referring to the first head on his chart, where there were barely any connecting lines—and the image had not yet been recognized.

On the second head, there were suddenly many cross connections, indicated by black lines, as alliances were made by brain cells in disparate areas. “Then the groups begin to form; there is a pattern that emerges. This is truly a case of emergence, because nobody told them to be synchronous—say, between this electrode and that electrode. They self-synchronize with each other. That corresponds, we know from all kinds of other evidence, to about one-third of a second after

the stimulus—to the moment the person actually recognizes a face.

“From that moment of recognition on, you can see lots of green lines, which mean the opposite of synchronous. Everything in the brain is going out of synchrony. Everybody is oscillating on their own. The whole *whoomph* is now going *poof*,” he said, waving his hands wildly around his head. “In other words, the brain says, ‘Erase that oscillation pattern.’”

The Dalai Lama had been listening with particular attentiveness, gently rocking back and forth in his chair. Now he asked, “Could you conceive a study where instead of showing a visual stimulus, you have an auditory stimulus—a sound? Then could you see these processes—in the second stage this synchrony, and in the third this dissynchrony? And then compare that dynamic to the visual stimulus, to see if there’s the same pattern in the third stage?”



“We have done that experiment,” Francisco replied, “and you will see the same patterns. We have done experiments with audition, with memory, with conflict of attention between visual and auditory. The answer is always the same: you have one particular pattern at the moment of the arising of the perception, and then you have a moment of recognition, and then you have a new pattern being formed at the moment of the action, which is pushing the button.

“Another set of synchrony arises in a new group of neurons as the person remembers that he has to push a button. The recognition arises, and then *poof*, the dissynchrony. Then the person remembers to push the button, and that needs a new pattern or synchrony in a new pattern of neurons.”

“It’s almost as if once a synchrony is formed, the role of those neurons is finished,” the Dalai Lama observed.

“That’s right—they are transient. And that’s what I like. It’s like the transience of mental factors.” Francisco was referring to the basic elements that compose each moment of awareness in the Buddhist Abhidharma model of mind. “They come and they go, and they correlate to transient patterns in the neurons. That was clearly a big discovery for me. The brain actively undoes itself; it creates a gap where the transition from one moment to the next is actually marked. There is recognition and then action, but they are punctuated.

“It’s like saying ‘perception, comma, action,’ rather than a continuous flow. This is systematic; we have seen it in all kinds of different conditions.”

TIMING THE MIND

Francisco’s results accord with those of other researchers who have been timing the fine movements of the mind. Benjamin Libet, a neurosurgeon at the University of California at San Francisco Medical School, found, for example, that electrical

activity in the motor cortex begins about one-quarter of a second before a person is aware of his or her intent to move a finger. And there is another full quarter second between the awareness of the intention to move the finger and the beginning of the movement itself. Like Francisco's work, Libet's unpacks otherwise invisible, fine-grained components that in our experience seem a single, solid event: the recognition of a face, the movement of a finger.

The Dalai Lama pursued such an unpacking of a moment's mental activity in his next question: "The measuring device you use seems highly sensitive, to milliseconds. So is there still a gap between the initial exposure and the recognition if you show a photograph of a face that is so familiar that the person would instantly recognize it without having to actually think about it or recall from memory?"

"We have actually done that, and the answer is that the gap shortens but it is still there," Francisco replied.

At this point there was a heated discussion in Tibetan on the issue of whether there is an initial phase of nonconceptual awareness before memory and other aspects of cognition create Francisco's *whoomph*. The Dalai Lama, pleased at this opportunity to explore a topic of high personal interest to him—the distinction between conceptual and nonconceptual processes in the mind—continued, "Would you agree that this would indicate that the first moment is nonconceptual, purely a visual perception that apprehends the form in question, and the second is conceptual, which recognizes, 'Oh, this is that'? This seems to corroborate Buddhist psychology."

"Which leads you to decide to push the button," Francisco said. "It's only when I say 'Oh, I recognize that' that it leads to the moment of decision, where you then push the button. So it is a conceptual moment. The first one is just the pattern being perceived, without the conceptual process."

The Dalai Lama pushed on, intrigued by the implications he saw: “Would you agree that this corroborates a point in Buddhist psychology, that the first moment is a purely visual perception that is nonconceptual and the second moment, no matter what its duration might be, is when the conceptual mind apprehends, ‘This is that’? For example, as I look at Alan Wallace here, I immediately recognize his face without having to figure it out. Grossly speaking, it seems like it’s instantaneous, but in fact—”

“In fact it’s at least two hundred milliseconds,” Francisco interjected.

“This is exactly the Buddhist point of view,” the Dalai Lama continued. “Even though, grossly speaking, it seems to be instantaneous, in reality it’s not instantaneous. First there’s an impression, and then the labeling—the conceptual recognition—and it’s a sequence.”

“Absolutely,” Francisco agreed. “Typically, under normal conditions you cannot compress a mental moment to less than a hundred and fifty milliseconds. Even when it’s something that’s virtually immediate.”

This is, in fact, a key point in Buddhist epistemology. The first moment of, say, a visual cognition is pure perception—a raw percept without a label—but shortly thereafter comes a mental cognition, the murmur of a thought, drawing on memory and enabling one to recognize and label the visually perceived object for what it is. Realizing that the first moment of cognition is nonconceptual and that those thereafter are conceptual offers a gateway, an opportunity for inner liberation, in the Buddhist model. This insight into the nature of our ongoing construction of reality represents a necessary step (though not in itself a sufficient one) toward freeing the mind from the inertia of mental habit.

As we entered this territory in our discussion, we left behind most people in the room, including many of the scientists. But

the Dalai Lama was keenly interested to hear what science had found about what happens during the arising in the mind of a moment of experience, and to see how these findings fit with Buddhist models as described in the texts he was familiar with. This was a rare opportunity to hear a detailed scientific description of the process, and he found striking parallels between the scientific and Buddhist views, the two versions largely supporting each other.