

## New Light on Enlightenment: A Convergence of Recent Scholarship and Emerging Neuroscience?

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Gotama Buddha taught that compassion can produce enlightenment. So Richard Gombrich claims, based most notably on his reading of the *Tevijja Sutta*. First announced in his 1996 *How Buddhism Began*, Gombrich revisited this thesis (his “discovery”) the next year in his Gonda Lecture, “Kindness and Compassion as Means to Nirvana in Early Buddhism”<sup>1</sup> and has returned to it more recently in his 2009 *What the Buddha Thought*.

The first of the two sections of this paper explores Gombrich’s admittedly “radical” idea. Although I will tender some suggestions along the way, this section eventuates more in questions than categorical conclusions. In a different vein, the following section provides a brief overview of the recent plasticity revolution in neuroscience, with an eye to assessing the empirical plausibility of the basic idea that Gombrich discerns in the *Tevijja Sutta* that we can achieve enlightenment through compassion.

### Enlightenment by Means of Compassion

#### The *Tevijja Sutta*

The *Tevijja Sutta* purports to record a conversation between the Buddha and two young brahmins who wished to learn how to achieve companionship with the god

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<sup>1</sup>The text of this lecture is posted on the website of the Oxford Centre for Buddhist Studies, [www.ocbs.org](http://www.ocbs.org). The citations here are to that posting. It has also been collected in Williams, *Buddhism, critical concepts in religious studies*.

Brahma. (WBT 80) The text presumes a familiarity with the brahminical ideas that the universe is governed by an impersonal, unchanging principle (*brahman*) and that the way for someone to break the cycle of otherwise endless reincarnations is by achieving the realization (gnosis) that he is identical with *brahman*. To achieve this insight will mean that one's next death will be one's last. A more popular version of Brahminism personified the metaphysical idea of *brahman* as the god Brahma. (WBT 41) Thus when the young brahmins expressed their interest in learning how one may achieve companionship with Brahma, they were asking how to achieve the liberation promised by classical Brahminism.

The Buddha tells his questioners that he has personal knowledge of what they seek, that “he knows the brahma-world and the way to it as well as if he had lived there his whole life.” (WBT 80) He then proceeds to tell his two interlocutors how to achieve companionship with Brahma. One should first give up his householder status and take up life as a monk outside of society. In this setting one then “pervades every direction with thoughts of kindness, compassion, sympathetic joy and equanimity.” (WBT 81) The text, Gombrich emphasizes, stresses “the entirety of the pervasion,” that the mental exercise involved extends into all space, is “infinite in extent” and encompasses all beings; it “is said to be ‘extensive, magnified, boundless and without hatred or ill will’” (WBT 82) And once the entirety of the pervasion has been developed and the mind thus expanded, “no bounded (i.e., finite) karma remains there.” (WBT 82) “This,” the text concludes, “is the way to companionship with [Brahma]” that the brahmin youth sought—or should have been seeking. (WBT 82) As Gombrich puts it: “The way to the *brahma*-world is just Upaniṣadic language, borrowed from the interlocutor, for the way to nirvana.” (WBT 83)<sup>2</sup>

It is this passage in the *Tevijja Sutta* that provides Gombrich with his principal textual basis for the claim that “the Buddha saw love and compassion as means to salvation—in his terms, to the attainment of nirvana.” (WBT 76) For present purposes Gombrich's scholarly analysis and the “bold claim” he makes will not be at issue; the focus here will be on how we might better understand that claim.

Gombrich emphasizes the Skill in Means of the Buddha's metaphor of bounded and boundless karma. For brahmin ideology, liberation comes through an act of mind which effects a joinder of a finite mind with the infinite *brahman* that “per-

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<sup>2</sup>“However,” Gombrich goes on to say, “this was not understood by the compilers of [the Pali canon], let alone by the commentators.” (WBT 84) Gombrich attempts to explain why this misunderstanding occurred, but we will not look at that here.

vades the entire universe as consciousness.” (WBT 83) Thus a Buddhist monk, in “enlarging his consciousness to be boundless [would be] emulating the brahman gnostic who identifies with universal consciousness.” (WBT 83) So too, once a monk develops a full pervasion of the world with kindness and compassion, he attains a “release of the mind’ (*ceto-vimutti*)” in which “no bounded (i.e., finite) karma remains,” (WBT 82) and, “[h]aving transcended the finitude of normal . . . karma, he is fit, like the brahman gnostic, to join *brahman* at death.” (WBT 83)

But how shall we understand the metaphorical structure involved if bounded (finite) karma is developed into unbounded (infinite) karma? For, of course, there would have been no point in using such terminology as the Buddha does unless this way of speaking maps over to his own teaching, more literally expressed.

### Karma as *cetanā*

Karma, as a central idea in brahminical soteriology, had two features noteworthy here. First, in Gombrich’s words, the “Sanskrit *karman* and Pali *kamma* [basically] mean ‘act, action, deed,’” where it is understood that “an action is something which takes place in the physical world.” (WBT 7) But, second, not every physical action counts as karma; in the brahminical ideology only certain acts (or acts in certain situations) are soteriologically significant. (WBT 83) These were primarily the proper performance of rituals in prescribed circumstances. Doing one’s duty was good karma; failing to do so, bad karma.

Karma, so understood, was not sufficient to achieve the religious goal of Brahminism, the liberating union of oneself with *brahman*. But it was necessary. By living a life of good karma one not only increased the likelihood of receiving benefits in this life, such as health and prosperity, but also could enjoy a better social status in the next life. In this way, life by life, one might succeed in gaining rebirth as a priest and being able to study the Vedas—and in this way come to the liberating insight that culminates a pilgrim’s progress in Brahmanism.

Early Buddhism, traditionally understood, replicates the two-stage structure of brahminical soteriology and at the same time radically revises its content. The substantive divergence comes about through a shift in the understanding of karma. In numerous places Gombrich appropriately emphasizes the importance of the statement attributed to the Buddha that “It is *cetanā* that I call karma.” “*Cetanā*” is one of those Sanskrit (and Pali) terms that is rather elastic in meaning. Damien Keown, in his dictionary, renders it as: “Term denoting the conative psychological functions of intentions, volitions or motivation.” (51) For Gombrich—and ortho-

dox Buddhism generally—the Buddha meant by karma one’s intention in acting as one does on particular occasions. In this way intention comes to play much the same role for Buddhism that ritual did in Brahmanism; it was, as Gombrich says, “the Buddha’s answer to brahman ritualism.” (*HBB* 51)

So it is, as Gombrich puts it, that “when people die . . . they are born according to their moral deserts.” (*WBT* 11) If your life has displayed a preponderance of acting on good intentions, rather than bad ones, you will be rewarded (or punished) accordingly, in due course. This is the Buddha’s “law of karma,” which Gombrich also refers to as “the law of moral reckoning,” that “worked throughout the universe [and guaranteed] that good would be rewarded and evil punished in the end.” (*WBT* 27) Here is where the Vedic idea of karmic causality comes to rest in early Buddhism.

Presumably, one of the ways that this universal law works out is that living good lives eventually leads to you becoming a monk in some life or other, and in that status you may be able to accomplish the insight (gnosis) by which to achieve nirvana, if not in that life, then in another. In other words, as with brahminism, although karma is not sufficient for the attainment of liberation, it is a necessary step (or at least a conducive one) in that process.

### What the *Tevijja Sutta* has to tell us

What then is the notion of karma—or *cetanā*—that is at work in the *Tevijja Sutta*? I propose to consider this question in the context of the Noble Truths that *taṇhā* is the cause of *dukkha* and that the elimination of *taṇhā* awakens one to enlightenment (*bodhi*).

The story has it that soon after the Buddha achieved his enlightenment he sought out his five prior companions in asceticism to tell them of what he had achieved and how he had achieved it. His message, standardly stated, was that although life as we know it is unsatisfactory (*dukkha*) (*WBT* 10), this is because our actions are governed by thirst (*taṇhā*); but this thirst can be eliminated and this transcends the normally unsatisfactory nature of human existence.<sup>3</sup>

Given that the idea of *taṇhā* as the cause of *dukkha* lies at the center of the Buddha’s message so described, what is *taṇhā*? Thirst, as *taṇhā* is standardly translated, is an expandable term. Narrowly understood, it refers to a desire or

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<sup>3</sup>Early on this message became so central to early Buddhism that the compilers of the canon included it in what they arranged as the canon’s first *sutta*, even though, as Gombrich emphasizes, as there set out it is “far too concise to be intelligible” on its own. (*WBT* 131)

need to drink, typically to drink some water, and commonly a strong urge to do so. One may be in such a state without realizing it. But when one does, one (most typically) forms the intention to get something to drink and perhaps actively sets about doing so. If in this state one is offered a glass of water, the intention to locate and consume some water (typically) crystallizes into a here and now intention (or volition) to take the glass and quaff its contents. This is to say that thirst is a disposition; it is (roughly speaking) being disposed to drink or to ask for a drink or to look for something to drink (etc.). But the word “thirst,” of course, is also used more broadly. We speak, for instance, of a thirst for power or for fame. Such thirst is also dispositional, but refers to a wider universe of objects of desire. And these features of the English term “thirst” are evidently involved in the Buddha’s employment of the Pali *taṇhā* as the cause of *dukkha*: *taṇhā* is a disposition to seek satisfaction, to be disposed to generally act so as to survive and prosper.<sup>4</sup>

With *taṇhā* so understood, the Noble Truths apparently enunciate that the elimination of *taṇhā* is the way to enlightenment; anyone who wishes to achieve the awakening of *bodhi* must end *taṇhā*. This understanding suggests that the bounded karma of the *Tevijja Sutta* should be understood as the *taṇhā* of the Noble Truths, in at least roughly the orthodox understanding of this thirst. (Eliminating *taṇhā*=enlightenment; eliminating finite karma=enlightenment; therefore, finite karma=*taṇhā*.) This is as much as to say that when the Buddha speaks of karma in the *Tevijja Sutta* in terms of being bounded or boundless, he intends a dispositional sense of *cetanā*. (*Taṇhā* is a disposition to seek self-satisfaction; bounded karma is *taṇhā*; therefore, bounded karma is that self-directed motivational disposition.)

Accepting this (at least provisionally), we may additionally conjecture that the elimination of *taṇhā* that the Buddha speaks of in the Noble Truths is to be understood in terms of transforming *taṇhā* (i.e., bounded karma) from the disposition to act primarily for oneself to a disposition to act more broadly for the benefit of others—and that *this* is the way to companionship with Brahma. If so, how shall we understand this transformation?

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<sup>4</sup>In this regard, Walpola Rahula speaks for the orthodox in explaining that “the term ‘thirst’ includes not only desire for . . . sense-pleasures, wealth and power, but also desire for, and attachment to, ideas . . . and beliefs,” and that: “According to the Buddha’s analysis, all the troubles and strife in the world . . . come out of this selfish ‘thirst.’” (30; notes omitted)

### The *Metta Sutta*

Following Gombrich's lead, we may gain assistance in this endeavor by considering the *Metta Sutta*, an early *sutta* which, as Gombrich emphasizes, from first to last addresses "how one may become enlightened." (*WBT* 87) It opens with a reference to "the peaceful state," i.e., nirvana (*WBT* 7); proceeds to address "what one has to do in order to achieve nirvana" ("Kindness" 7; emphasis omitted); and concludes by stating, in a distinct echo of the *Tevijja Sutta*: "They call this divine living in this world." ("Kindness" 7)

The centerpiece of this poetic exposition is to be found in words which have become widely known: the *sutta* recommends: "Just as a mother would protect her only child even at the risk of her own life, even so let one cultivate a boundless heart toward all beings." This, apparently, is how one may achieve enlightenment. And with the *Tevijja Sutta* in mind, one can hardly miss the fact that cultivating a boundless heart sounds rather much like unbinding one's karma through thoughts of love and compassion.

The *sutta*'s specific example of a mother acting for the wellbeing of her child is a dramatic one. Why, we may ask, use such a striking example? Because of its seeming undeniability, I would suggest. It is easy to accept that a mother would put her child's welfare ahead of her own, and so be led to accept that even if we are born as creatures dominantly directed towards self-satisfaction, in exceptional cases we can (and do) act otherwise. Creatures of *tanhā* though we may be, it is possible to be moved to act directly and knowingly in a manner that favors another's welfare over one's own.

We may then reconceptualize this message of the *Metta Sutta*. We may say, for instance, that the mother considers her child so much a part of herself that she is prepared to count her child's wellbeing as the paramount part of her own self-interest. Understood in this way, the injunction to "cultivate a boundless heart" communicates both that it is possible to alter how we are moved to act so that the exceptional situation, typified by a mother's love for her child, becomes the general rule—and that we should do so. Our inherited conative constitution, although dominantly self-directed, can—in some as yet unexplored manner—be expanded to be boundless. And this is the way to "divine living in this world." In this fashion the *Metta Sutta* provides a way of understanding, at least formally, the transformation from bounded to unbounded karma.

### Expanding on Gombrich's claim

This way of understanding Gombrich's "discovery," his "radical" claim, through an interweaving of the vocabularies of the Noble Truths and the *Tevijja Sutta*, brings with it many questions. How, for instance, shall we understand such traditional Buddhist ideas as *dukkha*, *bodhi* and *nibbana*? These are large topics. But we may perhaps just dip our toes into these waters as a way of exploring a little more the conception of liberation Gombrich locates in the *Tevijja Sutta*.

*Dukkha*. The unsatisfactoriness of human life as we know it was a widespread idea at the Buddha's place and time. It fueled the pan-Indian conviction that endless reincarnation was a dire fate. Thus it would not occasion great surprise if, now and again, the Buddha introduced his message with the idea of *dukkha*. On the other hand, in speaking with the young brahmins the idea seemingly goes without mention. So on the understanding of the *Tevijja Sutta* that we are exploring, what is *dukkha*?

As featured in the Noble Truths, traditionally understood, *dukkha* covers all manner of possible unpleasantnesses; "all . . . forms of physical and mental suffering, which are universally accepted as suffering or pain, are included in *dukkha*." (Rahula 19) But on reflection, if *dukkha* is removed from human life by the elimination of *taṇhā*, it cannot so widely cover the waterfront of human dissatisfaction. As Sue Hamilton has colorfully phrased it, "the Buddha did not fizzle out of existence at his Enlightenment." (139) Nor was he rendered immune to intestinal discomfort or disappointment in his followers' uptake of his teachings. So we might better ask, what (more specifically) is the *dukkha* that the elimination of *taṇhā* brings to an end?

The *Metta Sutta*'s reference to nirvana as "the peaceful state" may be instructive. This might be considered a condition of calmness achieved through a certain detachment from the turnings of the world. Peacefulness in this sense would contrast with an inner agitation. Peaceful, however, may also contrast with conflict or strife, and in this sense it focuses on one's relations with others. When the *Metta Sutta* tells us—in a distinct echo of the *Tevijja Sutta*—that to be in the world "without enmity" is to enjoy "divine living in this world," it draws on this second meaning.

On either of these two understandings, being in "the peaceful state," still leaves one prone to many sorts of discomforts and disappointments. We will remain subject to frustration—however we may react to it—when the world does not go as we would wish, when (for example) our actions do not turn out to have

their intended effects. There is, however, a special case of frustration that is other than when the world—by flood (say) or fallen tree—impersonally impedes our progress. It is when we do not get what we want because of the actions of others. Adam wants to be the first to taste an apple; but if Eve lustily precedes him, he will be ever foreclosed from realizing his desire. And this, we may recognize, is a frustration of a different order from that of the fallen tree. Other people sometimes act in ways that thwart our aims, whether intentionally or not. Their acts preclude or make difficult our achieving our own ends. And at some level we appreciate this; we understand that others, as they pursue their own desires, are opposed to us, actually or potentially.

Moreover, the recognition (dim or distinct, as it may be) of this continuing potential conflict is disturbing. Not only, it appears, is the world we live in indifferent to us and occasionally thwarting our efforts; we also find ourselves at odds with the very beings with whom we could have the greatest rapport. This displacement from human society, this estrangement from others, is a particularly poignant, and particularly human, form of suffering. And this, we may conjecture, is the *dukkha* that the elimination of *taṇhā* brings to an end.

It is not that if we become more oriented towards acting for the wellbeing of all, others will automatically display reciprocity, acting more kindly towards us in turn. That is unlikely. But it is not the point. The point would be rather that if you eliminate *taṇhā* by becoming compassionate, you will bear no ill will—could bear no ill will—towards others. You will be without enmity. No matter what another does to you or to others you will not regard him as someone with whom you are in conflict. Instead you will regard him non-contentiously and be moved to act for his wellbeing just as with all others you may encounter or have dealings with.

Understanding Gombrich's "discovery" in this way, *dukkha* is that alienation from others that afflicts us so long as *taṇhā* remains in its otherwise natural state of dominantly motivating us to look out for ourselves.

*Bodhi.* For orthodox Buddhism, enlightenment is the second step in a two-step process of gaining liberation from the unsatisfactory condition of human existence. (In this it mimics the structure of Vedic liberation.) And each of these two components involves what we may call an either/or concept. On the Vedic view, each significant act either helps or hurts the actor in moving, life by life, towards attaining a position from which to be able to take the second step, the transformational realization that *ātman* equals *brahman*. And this liberating gnosis also involves an either/or idea: at any moment one either achieves the gnosis

or one does not; by dint of effort either the bar is cleared or it is not. Likewise, the traditional Buddhist view of enlightenment employs a two-step gnostic model of liberation, and the first step involves a similar bi-valent concept of karma. Every significant act carries either a positive or a negative charge depending on whether the intention out of which one acts is itself good or bad. In this way, time by time, someone can become a monk and undertake suitable training so as eventually to accomplish the second step, to achieve *bodhi*, the awakening that occurs through the insight that eliminates *taṇhā*.

The path to companionship with Brahma that Gombrich discerns in the *Tevijja Sutta*, however, apparently differs from the model of liberation common to Brahminism and early Buddhism in that it does *not* involve a two-step process. Karma, as there understood, is not only *necessary* for awakening to occur, it is *sufficient*. The meditation process (whatever exactly it is) by which one may shift the dominance of one's karma from bounded (finite) to unbounded (infinite) is itself the way to companionship with Brahma, to achieving, as Gombrich puts it, the religious goal that the young brahmins *should* be seeking. Otherwise stated, on this view *bodhi* is not to be thought of as rather like switching on a light.

In addition, the concept of karma implicit in the *Tevijja Sutta*, so understood, does not exhibit the Vedic bi-valent structure. When bounded karma is understood as *taṇhā*, the contrast between bounded and unbounded becomes not that of “plus and minus” but rather one of “more or less,” the concept of infinite karma involving some notion of increased generality.

This concept of karma, however, may appear at odds with that in play with the “law of moral reckoning.” This “law” relies on a bi-valent concept of karma, unlike the dispositional concept of karma (*cetanā*) of the understanding of enlightenment here conjectured, which does not. But we will not, for now, delve into whether or not these two concepts of karma should be understood as complementary to one another—or with how an answer to that question might affect how we understand the Buddha's thought more generally.

*Nibbāna*. In discussions of the Buddha, the term “enlightenment” is commonly used both for *how* Gotama became the Buddha and *what* was true of him as a result. Although right terminology is not an issue, it can be useful in this context to distinguish process and product, employing “enlightenment” for the former and reserving “nirvana” for the latter

It is a virtue (I would say) of the understanding of enlightenment here conjectured that it provides a unified—and non-accidental—account of the ending

of *dukkha* and the dawning of *karuṇā*. (This, of course, is central to the synoptic consideration of the *Tevijja Sutta*, as read by Gombrich, and the traditional story of the Noble Truths.) And on this account, the post-enlightenment person is (by definition, as it were) a compassionate being, someone motivated towards acting for the wellbeing of all. The account, nonetheless, does not *identify* being in nirvana with being a compassionate being. On the present understanding, divine living need not be thought of *only* as having come to have the nature of *karuṇā*; other alterations may accompany this transformation.<sup>5</sup>

Traditionally, the Buddha is viewed as changed by his enlightenment in many ways. Some of these are undoubtedly hagiographic developments that arose as the evolving legend moved towards his deification; others may at least plausibly be considered as historical fact—becoming more dispassionate or calm, for instance, or more reflective—and effective—in practical reasoning of means to ends.<sup>6</sup> How we may sort out these two categories and how we may understand how it is that various items in the second could naturally arise as a result of enlightenment may be interesting topics for those who have a taste for plausible biographical reflection. However, they lie beyond the scope of this paper.

Whatever the details, on this reading of the *Tevijja Sutta* it belongs to the Buddha's view of nirvana that it is possible to alter the *tanhā* in our nature so as to live a human life without enmity, and this would be to live in such a way that human life is no longer inherently unsatisfactory. In the cultural context of the time, this would have been a truly radical idea.

### A model of meditation

All of this assumes, however, that there is some humanly accessible process or procedure by which bounded karma can be expanded into unbounded karma. And what might this be? The *Tevijja Sutta*'s talk of pervading the world with thoughts of kindness and compassion bespeaks some type of meditation practice, and (I shall suggest) the current Dalai Lama's writings offer a clue as to what such a compassion meditation might involve. To develop "genuine compassion," he tells us, requires "a warm and kind heart that is forceful, stable and firm." (Mehrota 97) And this involves something "more powerful" than "just a wish that sentient beings be free from suffering." (101) Nor is it enough "to have an affectionate

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<sup>5</sup>I have benefitted from the comments of one of the journal's reviewers, who understood an earlier draft to be identifying a way to nirvana with nirvana itself.

<sup>6</sup>See Walters, p. 127.

attitude toward sentient beings, regarding them as precious and dear.” (97) It requires, more demandingly, the “taking upon your shoulders the responsibility of working for the benefit of other sentient beings.” (113)

In order to develop such an altruistic orientation, he recommends that we begin with the easiest case, thinking of someone with whom we have—or once had—the strongest affective bond. What would we do to protect her, if need be? What would we do to enhance her wellbeing, if the opportunity presented itself? Let this person and such thoughts be the focus of our meditation so that our willingness to act for her sake soaks deeply into us. Then begin to widen the circle. “Meditate on your own parents, friends and relatives,” he advises, cultivating an attitude of compassion toward individuals in each of these categories in turn. Next, “shift that attention to neutral persons and eventually to your enemies, so that eventually all sentient beings you encounter will be part of your meditation.” (101)

As we do this, he tells us, our regard for others increasingly becomes “that they are ‘mine.’” (186) They become “mine” not in a possessive sense, as if we were asserting dominion over them. Rather they are “mine” in that we have expanded our self-regarding inclinations to include all others within ourselves.<sup>7</sup> If we can enlarge our self to include “all sentient beings, then they all become like members of our own family.” (186) And, the Dalai Lama concludes, when “you are able to extend your meditation to all sentient beings, your compassion and love will become so pervasive that the moment you see suffering, compassion will spontaneously arise.” (101)

Circling back to Gombrich’s reading of the *Tevijja Sutta*, we may understand the condition the Dalai Lama describes as what it is for someone to eliminate bounded karma and so be without ill will towards anyone. But then, we might ask, is it humanly possible for someone to so alter their conative nature, through some such meditative regimen as the Dalai Lama recommends, that they come to be living the divine life?

### What Does Neuroscience Have to Say?

The ongoing plasticity revolution in cognitive neuroscience may have reached a state of development at which it becomes relevant to such a question as whether it

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<sup>7</sup>Richard Gombrich has brought to my attention that “the Dalai Lama’s advice about meditating on kindness shares quite a bit, unsurprisingly, with chapter 9 of Buddhaghosa’s *Visuddhi-magga* (‘The Path to Purity’).”

is empirically possible—in the terms of our preceding discussion—for someone to be able to reorient his *tanhā* to the boundless heart of *karuṇā*.

### Accepted wisdom

Anyone entering the fields of experimental psychology or neurophysiology in the first couple of decades after World War II “knew”—without necessarily being taught it—that the structures, functions and capacities of the central nervous system were firmly fixed rather early in life. The brain is biologically programmed to perform certain functions—vision, hearing, language, etc.—in certain identifiable areas. When these capacities have developed in the normal maturational process, the process ceases. The fact that you *can* teach an old dog new tricks is just an incidental phenomenon, peripheral to an understanding of the fundamental way the brain works. So accepted wisdom went.

Thus, for instance, even such an insightful little book as Richard Gregory’s *Eye and Brain* (1st ed. 1966) could speak of *the* visual system or *the* visual brain without hesitation or qualification. This type of understanding had been powerfully reinforced by the work of David Hubel and Torsten Wiesel in the 1950’s showing that localization of function in the brain extends all the way down to individual nerve cells. They demonstrated, for instance, that when a bar of light was shown “some cells [in the visual area] were only active when [it] was presented . . . at a certain angle. . . . Others cells responded only to movement, and movement in only a single direction” (69). Gregory described this work as “of the greatest importance” (69), and Hubel and Wiesel later received the Nobel Prize for it. It was assumed that if there was no input to a certain brain area—if, for instance, someone was congenitally unable to send signals from the eyes to the visual cortex of the brain—then that area would have nothing to do and would just sit by quiescent. Or if an area responsible for some function were damaged, then that function would be irretrievably lost. This was the accepted view. And it was wrong.

### A change in perspective

By the early 1980s, research was turning up results that would undercut and eventually overthrow earlier dogma. Beginning in the 1970s, Jon Kass and Michael Merzenich, for instance, asked whether mammalian brains can reorganize as a result of experience (Begley 37-38). Working with monkeys, they made extensive

recordings of electrical activity in the somatosensory cortex to map what areas were activated by stimulation of various parts of the monkeys' bodies. They next surgically severed the medial nerve in one hand; after a month, they repeated the mapping process. Received wisdom predicted that the cortical area whose sensory input had been eliminated by the surgery would now be silent. As Mriganke Sur, then a graduate student of Kass, later stated: "The standard view was that when you deprive the brain of sensory input, there should be like a black hole in the cortex where it used to receive that signal" (Begley 38, personal communication). But this was not so. The surgery had silenced any signals from the affected hand; however the area that had previously received those inputs was now registering signals from other, nearby portions of the hand.

This was astounding. As Merzenich later recalled, it was accepted at the time that Hubel and Wiesel "had shown just the opposite: that after a critical period early in life, the brain does not change as a result of changes in sensory input" (Begley 40, personal communication).

In an ingenious experiment a few years later, Merzenich, working with William Jenkins, demonstrated that it did not take a traumatic event to induce the brain to reorganize the sensory cortex. They trained monkeys to reach through the bars of a cage and lightly touch the top of a spinning disc. A deft touch was required to keep contact with the disc and yet not stop it from spinning. This exercise was repeated hundreds of times over several weeks; then they remapped the somatosensory cortex. They found that as a result of the new sensitivity of touch, the cortex corresponding to the sensitized fingers had increased considerably, as much as fourfold (Begley 40-42; Jenkins 82).

These results conflicted with received wisdom. But accepting them, Merzenich later said, "required a different mind-set, one that did not view the brain as a machine with fixed parts and defined capacities, but instead as an organ with the capacity to change throughout life" (Begley 43, personal communication). So the new findings were written off as small-scale and local in character.

Mriganke Sur, who had been part of the team that did the experiment with the monkey hands, set out to investigate the more global question of whether an area of the brain that ordinarily performs one function, such as hearing, could be induced to perform a different function, such as seeing (Begley 54-57; Gazzaniga *Human* 363-364; von Melcher 871-876). For this he used ferrets. Their sensory systems closely resemble those of humans, with one key difference. During brain development in both species the optic and auditory nerves grow from the eyes and

ears, respectively, to eventually arrive at the visual cortex at the back of the head, in the one case, and the auditory cortices on the sides of the head, in the other. In doing so, the optic nerve from the left eye, in both species, crosses over and connects to the right visual cortex—and vice versa. The auditory nerves, however, take a direct route and connect the left ear with the left side of the head, and the right with the right. The key difference that Sur was to exploit is that, although this developmental process is completed by birth in humans, in ferrets these sensory nerves do not reach their intended destinations until somewhat after birth.

Sur surgically intervened and prevented the auditory nerve of the right ear—just the right ear—of his ferrets from extending all the way into the right auditory cortex. As a consequence, the optic nerve for the left eye was induced to grow to the right auditory cortex. The left side of the brain, however, remained normal: right optic nerve to left visual cortex; left auditory nerve to left auditory cortex. The researchers allowed the ferrets to mature. They then trained them to respond to a flash of light by turning right and to respond to a sound by turning left. Now they were ready for the moment of truth. What would the ferrets do when a light was flashed to their left eye, the one that is now connected to the right ear? The answer: They turned to the right. As the researchers wrote, “[The] ‘rewired’ ferrets respond as though they perceive the stimulus to be visual rather than auditory” (von Melcher 872). Helen Neville later demonstrated much the same phenomenon in adult humans, working with deaf individuals. As she explained to the Dalai Lama at a meeting in Dharamsala in 2004, “The brain’s *auditory* region can be recruited to process at least two aspects of *vision*—peripheral vision and the perception of motion” (Begley 104, Neville’s emphasis).

These findings discredited the assumption that mammalian brains are genetically programmed to perform specific functions in certain specified areas of the brain. As Sur said: “An auditory cortex that grows up with visual input sees rather than hears” (Begley 57, personal communication). But arguably it did not disturb orthodoxy’s most basic contention, that once a developmental period closes, that’s it: an area that by design and development is dedicated to one function cannot take on a different one.

Paul Bach-y-Rita began the sensory substitution work for which he would become well known as far back as the 1960s, but it was much later before it received much recognition. He is best known for creating a device that can enable a blind person to see with his tongue. For the blind, whose eyes do not transmit their normal input to the brain, he discovered a way to provide substitute input through

a different channel. A blind person wears a small TV camera on the forehead. Visual images from the camera are carried to arrays of stimulators in a disc worn on the tongue. There coded signals create specific pressure patterns. The neural responses to these patterns travel to the brain along the sensory pathway of the tongue. Over time the wearer learns to use this input to begin to move herself in the world in ways that approximate those of a sighted individual (Gazzaniga *Human* 364-365). In his 2004 review paper, Bach-y-Rita described a “very recent trial” in which “within an hour of being introduced to the [sensory substitution device], a blind person was able to discern a ball rolling on the floor towards him; he was able to reach for a soft drink on a table; and he was able to play the old game of paper, scissors, rock. Later, he walked down a hallway, saw the door openings, examined a door and its frame, actually noting that there was a sign on the door” (56).

Apparently even in adults signals are signals, and cortex is cortex: send one sense’s signals to an area of the cortex that was not expecting them, and the new area will decode that input and enable at least some approximation of a normal person’s behavioral upshot. As Michael Gazzaniga recently put it, “It is the pattern of these signals that determines what you experience; it doesn’t matter where they come from” (*Human* 364).

By the turn of the century it is safe to say that something of a Gestalt shift had occurred in the field of neuroscience. Phenomena once peripheral had become paradigmatic. As the authors of a chapter in *The Cambridge Handbook of Consciousness* stated in 2007, the idea of neuroplasticity, “namely that experience changes the brain,” had “prompted an explosion of research” and had become a “well-accepted and well-documented theory” (Lutz, *Meditation* 522). The question was no longer whether neuroplasticity characterizes the brain, but rather with respect to what areas and what functions, and to what extent.

### **Mind matters**

It appears that the rule is: change the input, change the brain. But the process is not as simple or straightforward as this somewhat mechanical way of putting it might suggest. Consider another of Merzenich’s monkey experiments. His team set up a situation in which a device tapped the monkeys’ fingers one hundred minutes a day for six weeks, this while headphones piped various sounds to the monkeys’ ears. During this time some monkeys were taught to attend to their fingers and others were taught to attend to what they heard. But all monkeys re-

ceived the same tactile and auditory stimulation; each group got the same finger tapping and the same headphone sounds. At the end of six weeks, the researchers examined whether any changes had occurred in the somatosensory and auditory cortices of the monkeys. In those who had been rewarded for attending to the finger tapping, the amount of cortex devoted to their fingers had increased several fold, but there was no similar change in the auditory cortex. And vice versa, with the monkeys trained to attend to the sounds, the areas of the auditory cortex that process the sound frequencies the monkeys heard had increased, but the somatosensory cortex remained unchanged (Begley 196-197). This demonstrated that input alone does not change the brain; attention matters.

In October 2004, the Dalai Lama met for a week at his home in Dharamsala, India, with five prominent neuroscientists; each had one day to report on recent work in his or her area of research. Neville was one of the presenters. “It is a beautiful experiment,” she told the Dalai Lama, referring to this Merzenich study, “because it’s showing the pure effect of attention.” “It is showing,” she said, that “attention” is “necessary for neuroplasticity” (Begley 197-198).

Moreover as demonstrated by Alvaro Pascual-Leone, sometimes mindedness matters most. In the mid-90s, he set up a situation which he expected would show a change in cortical organization as a result of learned finger movements. He taught some volunteers a five-finger piano exercise, which they then practiced two hours a day for five days. Before and after the practice sessions, the investigators used a non-invasive technology (transcranial magnetic stimulation) to map the areas of the motor cortex devoted to the finger movements. Sure enough, this showed that those areas had expanded significantly into adjacent ones. But this was just a prelude. Pascual-Leone then repeated the experiment with another group, and this time the subjects were asked to just imagine they were moving their fingers to practice the piano exercise. Subsequent testing showed that this mental practice had resulted in a similar reorganization of the motor cortex (Begley 187-188; Pascual-Leone *Modulation* 1037-1045). Mental rehearsal apparently activated the same motor circuits as actually piano playing would and thereby brought about a similar cortical reorganization. As Pascual-Leone later wrote: “Mental practice alone may be sufficient to promote the plastic modulation of neural circuits” (Pascual-Leone *Plastic* 380).

The “plastic modulation of neural circuits” with which the neuroplasticity revolution began was largely in certain areas of the cortex. But we are not just cortical creatures. It is, for instance, widely accepted as biological fact that even rather

simple creatures are born with some type of neurological approach-avoidance system which biases the organism to move towards the source of some stimuli and away from the source of others. Some things have (or come to have) a positive valence or value for the organism; others, a negative one; and still others are neutral. We naturally seek to ingest or extend a hand to some things and shy away from or resist others. Indeed the “essence of . . . approach and avoidance,” Antonio Damasio tells us, is as “apparent in a creature as simple . . . as a sea anemone” as it is “in a child at play” (Damasio 78-79). And such an approach-avoidance center is undoubtedly located, at least substantially, in subcortical areas of the brain.

Furthermore, somewhere along the evolutionary line the approach-avoidance module of certain species, our own included, developed a species specific aspect. We are biologically set, it seems, to accord close kin (and others whom we may treat as kin) a highly positive value, and others of our kind a more neutral or to some degree negative value. The former we pre-consciously regard, certainly not as ingestible, but as being at least as important to us as food. Harking back to earlier discussion, we might say that we pre-consciously treat such favored others as within the ambit of our conative self, as part of “the who” for whose wellbeing we are disposed to act.

Accepting these ways of speaking, we may then ask, could it be possible that some form of “mental practice” could modify (“modulate”) the approach-avoidance system of human adults? Otherwise put, could meditation work to expand the range of our conative self? Is this empirically conceivable? And if so, how could it be investigated?

### **Meditation affects motivation**

Richard Davidson has been in the forefront of recent experimental investigation into the possible long-term effect of meditation on brain structure and function. He was another of the presenters at the Dharamsala meeting. In an early study, he and colleagues worked with eight Tibetan Buddhist monks, as well as a control group of non-meditating university students who received a week-long course in a particular meditation technique. The monks were all accomplished meditators, having logged thousands of hours over periods ranging from 15 to 40 years. They were participating in the study at Madison, Wisconsin at the urging of the Dalai Lama. The meditation technique was one in which the meditator attempted to generate “a state of ‘unconditioned loving-kindness and compassion,’” a state described as an “unrestricted readiness and availability to help living beings” (Lutz

*Long-term meditators* 16369). The subjects had their heads wired for electroencephalogram (EEG) recording. In each test session the subjects were asked to, on cue, to put their minds into a non-meditative state, begin meditation, release back to a neutral non-meditation, and so forth—as EEG recordings were made.

The results were striking, particularly in measurable gamma-wave activity. As Davidson reported in Dharamsala, after just a week's worth of training, "some of the controls . . . showed a slight increase in the gamma signal" (Begley 292). But with the monks it was marked. "Most of them showed very large increases, and some showed extremely large increases of the sort that have never been reported before in the neuroscience literature" (Begley 293). Potentially even more significant was what the recordings told about the monks in their non-meditating state. Even when not engaged in compassion meditation, Davidson reported, their brains "show a large increase in this gamma signal," which suggests long term changes in the brain (Begley 295-296).

Another finding, which Davidson called "novel and unexpected," was that during the test periods when the monks were asked to produce compassion meditation their brains displayed activity in areas associated with planned movement (Begley 296-297). Mathieu Ricard, a monk with a Ph.D. in genetics who participated in this research both as a member of the research team and as a subject, related this neural activity to a feeling of "total readiness to act, to help" (Begley 297). Davidson suggested to the Dalai Lama that what they were measuring "may reflect the generation of a disposition to act in the face of suffering." "It gives real meaning to the phrase 'moved by compassion,'" he added, and concluded: "Science has long held that emotional regulation and emotional response are static abilities that don't much change once you reach adulthood. But our findings clearly indicate that meditation can change the function of the brain in an enduring way" (Begley 297).

## Conclusion

Gombrich understands the Buddha to tell us that it is possible through meditation to become someone who will not regard anyone with ill will—and recent neuroscience supports the empirical plausibility of such a claim. More provocatively, Gombrich also understands that, according to the Buddha, attaining this condition *is* to be living the divine life. In this regard, earlier reflections in this paper may enable us to see that, for the Buddha, unbinding bounded karma so as

to become empty of enmity and eliminating *tanhā* so as to be free from *dukkha* are two ways of speaking of one and the same way to that divine life, nirvana.

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