2013

Using Neurotechnologies to Develop Virtues: A Buddhist Approach to Cognitive Enhancement [pre-print]

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To cite this article: James Hughes Ph.D. (2013): Using Neurotechnologies to Develop Virtues: A Buddhist Approach to Cognitive Enhancement, *Accountability in Research: Policies and Quality Assurance*, 20:1, 27-41

To link to this article: http://dx.doi.org/10.1080/08989621.2013.749744

Abstract

Recently Fenton (2009) has argued that Buddhist ethics can accommodate the use of attention-enhancing drugs and Walker (2006, 2009) has argued that future neurotechnologies may be used to enhance happiness and virtue. This paper uses a Western Buddhist perspective, drawing on many Buddhist traditions, to explore how emerging neurotechnologies may be used to suppress vices and enhance happiness and virtue. A Buddhist approach to the authenticity of technologically-mediated spiritual progress is discussed. The potential utility and dangers of mood manipulation for a Buddhist understanding of liberation are outlined. Then the ten *paramitas* of Theravadan Buddhism are explored to frame an exploration of the potential genes, neurochemicals and brain structures that could be targeted as part of a program of neurotechnological moral enhancement.

Introduction: Buddhism, Virtue and Moral Enhancement

In "Buddhism and Neuroethics" Andrew Fenton (2009) argues that the use of methylphenidate (Ritalin) as an aid to daily mindfulness could be consistent with Buddhist ethics. Fenton notes that Mahayana Buddhism is especially open to the utilitarian rationale that something like a drug might be a "skillful means" to greater concentration and attentiveness to one's life. In this essay I will expand Fenton's argument to argue that Buddhists may use a variety of future neurotechnologies to enhance not just mindfulness but also happiness and virtue. The essay attempts to offer a specifically Buddhist perspective on arguments for moral enhancement or "virtue engineering" recently offered by a number of philosophers (principally Walker, 2009; as well as to Spence, 2008; Faust, 2008; Douglas, 2008; Persson and Savulescu, 2008; Savulescu and Persson, 2012).

The arguments made here are also specifically a modern, Western interpretation of Buddhism which borrows freely from the Theravadan, Mahayana, Tantric and Zen traditions, as do many Western Buddhist teachers and communities. The key ideas presented are consistent with most Buddhist traditions, with minor adjustments of terminology, but I will also attempt to acknowledge where there are relevant significant differences between Buddhist traditions.

The cultivation of virtuous thoughts, sentiments and action is central to all Buddhist traditions. But there is a lively ongoing debate about whether the Buddhist emphasis on

the importance of cultivating virtue means that Buddhist ethics are a form of virtue ethics. Damien Keown (1992) and James Whitehill (1994) have argued that, among the moral theories of the West, Buddhist ethics most closely resembles Aristotleian virtue ethics. Siderits (2003) and Goodman (2008,2009) have argued, on the other hand, that Buddhist ethics is a form of consequentialism (Siderits, 2003; Goodman, 2008, 2009), since the enlightened being is supposed to have transcended individual identity and be motivated solely by the needs of all sentient beings.

In my view the Buddhist tradition embodies both of these forms of ethics in a developmental trajectory of spiritual development. The ethics enjoined for most lay Buddhists in Asian societies, householders who do not have the opportunity to pursue enlightenment, is focused on the cultivation of virtue in order to ensure a good rebirth. The core of lay virtue is the observance of the *pancasila* or five ethical observances: not to kill, lie, steal, take intoxicants or practice sexual misconduct. If these virtuous practices are observed laypeople may be reborn in heavenly realms instead of as ghosts or in hells. This has been called *kammic* ethics to distinguish it from the *nibbanic* ethics practiced by monks, nuns and the extraordinary laity who are trying to achieve Enlightenment (King, 1964; Spiro, 1972). Although inconsistent with canonical Buddhist teachings, many Buddhist laity also believe that the good karma or merit accrued by monastics in their cultivation of virtue can be dedicated or transferred to lay people when they support monastics, or give *dana*.

The second stage of virtuous practice applies to the aspirants after Enlightenment. So long as an individual suffers under the illusion of self, with its attendant greed, hatred and ignorance, then all Buddhist traditions advise that the cultivation of virtue is necessary for spiritual progress. The canonical formula is found in the Four Noble Truths articulated in what Theravadans say was the Buddhas first sermon, the "Turning of the Wheel of the Dharma" Sutra. (1) Life is full of unease and dissatisfaction because (2) we are constantly grasping and craving. (3) In order to stop grasping and craving we need to (4) develop a skillful, virtuous life based on the Eightfold Path: right views, right intentions, right speech, right action, right livelihood, right effort, right mindfulness and right concentration.

The Pali canon's *Buddhavamsa*, part of the *Khuddaka Nikaya Sutta* (Dhammapala, 1978) offers a different list of virtues, the "perfections" or *paramis* of the Buddhas which I will use to structure this essay :

Dana - generosity
Sila - proper conduct
Nekkhamma - renunciation
Prajna - transcendental wisdom, insight
Virya - energy, diligence, vigor, effort
Kshanti - patience, tolerance, forbearance, acceptance, endurance
Sacca - truthfulness, honesty
Adhitthana - determination, resolution
Metta - loving-kindness
Upekkha - equanimity, serenity

This formulation of the virtues was presented in the Theravada texts as the perfections of the *bodhisattva* who would later become the Buddha. The paramitas provide a bridge between the Theravadan tradition, in which the soteriological goal is to become an *arhat*,

and stop reincarnating, and most Mahayana traditions in which the soteriological goal is become a *bodhisattva* and stay in world after Enlightenment to help all sentient beings. While the *paramitas* were part of the hagiography of the Buddha in the Theravadan text, they became (in varying forms) the central list of virtues to practice for Mahayanists.

Once Enlightenment is achieved, in both the Theravadan and Mahayana accounts, the cultivation of virtue becomes irrelevant. The enlightened person has no vices to avoid, no cravings or bad habits to suppress. They act out of selfless compassion for all beings as pure consequentialists. Until that point, for the vast majority of Buddhists however, the cultivation of mental and behavioral virtue is central.

Moral Enhancement

The Buddhist tradition recognizes that we are not all born with equal propensities to wisdom or moral behavior, and that Enlightenment is only possible for the very few. In "Cognitive Enhancement, Virtue Ethics and the Good Life," Barbro Fröding (2011) concludes that a fully virtuous life is biologically impossible for most people. But, given the rapid advance of neurotechnologies, "if these cognitive shortcomings could be compensated for, or balanced, through the use of safe and voluntary enhancement techniques, then it would be morally desirable to do so. Indeed, it could well be the case that a combination of cognitive enhancement and virtue could make virtue ethics more convincing." If specific, consistent moral behavioral orientations – truthfulness, compassion and so on – can be identified, and our likelihood of manifesting them is strongly influenced by inherited genetic predispositions or persistent neurochemistry, then it might be possible to use future neurotechnologies to systematically make ourselves more truthful or compassionate. The use of neurotechnologies to consistently avoid vices and practice virtues would be useful in cleansing the mind of *klesas* or mental impurities.

The widely held belief that people have moral character - consistently good or bad moral predilections across diverse situations - has recently been called into question by the “situationist” school of social psychologists (Doris, 2002; Harman, 1999). While personality psychologists can point to some consistency of moral behavior across time and between situations, the situationists can point to people being compassionate in some circumstances but greedy, selfish and cruel in others.

Fortunately the project of technologically enhancing virtue does not really require a strong theory of “moral character” or even the existence of virtuous moral traits. Even if individuals are strongly primed to be compassionate by specific environmental cues, and less so in other situations their compassion is still neurochemically mediated and could still be neurochemically enhanced. In other words, even if someone was only compassionate while taking a compassion drug, like a diabetic’s dependence on insulin, it would still be possible to systematically enhance their compassion.

A second question that is sometimes raised about the use of neurotechnology to achieve “spiritual” ends is whether the result would be “authentic.” Sometimes a distinction is made between praise-worthy “natural” methods of self-

transformation, and "unnatural" methods. But which is more natural, gossiping around the fire or sitting silently for hours, having visions in a sweat lodge, and taking peyote? In other words taking a drug to control one's cravings or sharpen one's mind is no more or less natural for homo sapiens than many spiritual practices.

A concern with authenticity is also inconsistent with the central Buddhist insight of *annatta,* that there is no "authentic self," no enduring, consistent soul or self-essence. Since there is no self the medicated person is no more or less authentic. The only question is whether they are better able to deal with the demands of their life and make spiritual progress.

The concern with authenticity also reflects a concern with how similar the results would be from spiritual exercises as opposed to neurotechnologies. If chemically enhancing compassion, persistence or discernment only lasts for the drug's half life, while participation in religious community and meditation effect lasting behavioral and cognitive changes, then the former would be at best be an adjunct to the latter. In that case moral enhancement drugs might speed the development of virtues as an adjunct to a program of self-reform, and act as a stopgap to prevent backsliding in especially trying circumstances.

So long as the neurotechnologies are drugs they may be restricted to being a temporary adjunct rather than the principal method of self-improvement. But eventually we will have the capacity to change genes that affect the brain permanently, and install neurodevices that constantly monitor and direct our thoughts and behavior. At that point the distinction between traditional methods of self-change and neurotechnology may become moot. In fact, eventually it is quite likely that the changes of thought and behavior that neurotechnology will enable will be much quicker, far surer, longer-lasting and more targeted than traditional religious practices.

Chemical Happiness

Buddhist psychology advises that the practice of these virtues will replace predilections to do wrong with a joy in doing and being good, similar to Aristotle's theory of *eudaemonic* happiness achieved though virtuous behavior. If the soteriological goal of Buddhism is to alleviate one's own suffering, and the perfection of virtue is merely a tool to that end, is it possible to skip the enhancement of virtue and just use neurotechnology to eliminate suffering?

Both lay and monastic Buddhist precepts include a vow to abstain from intoxicants. In ancient India the principal concern would have been with alcohol. This is not an absolute prohibition since the medicinal use of intoxicants are explicitly permitted for monks in the *Vinaya,* the code of monastic conduct. Whether other substances, such as caffeine, tobacco and psychedelics, should be considered intoxicants by Buddhists has also been debated (Redmond, 2004). The key question is whether the drug intoxicates, creating stupefaction and chemical pleasure that delays efforts to eliminate *dukkha*, the unease that is starting point for realizing the unsatisfactory nature of grasping self-centered existence. While alcohol, opiates and cannabis certainly could not create a permanent state chemical happiness, much less facilitate spiritual insight, the neurotechnologies of

this century might create permanent changes of mood. Therefore a Buddhist approach to cognitive enhancement would first distinguish between the use of neurotechnologies that is intoxicating, use that is temporarily therapeutic, and use that enables long-term spiritual progress.

Traditional Buddhist cosmology provides some context for such distinctions. Buddhists traditionally divide the world of beings into three realms, the realm of desire (*kamadhatu*), a more elevated realm of godly states (*rupadhatu*), and a realm of bodiless absorption states (*arupadhatu*). Each of these are still part of *samsara*. Embodied beings in the realm of desire include those suffering in hells, hungry ghosts, animals, humans, demi-gods and the gods. These different planes correspond to mental states (Trungpa, 2002): hell represents suffering, hungry ghosts unsatisfied craving, animals are the embodiment of ignorance, demigods embody envy, and the gods are pleasure junkies. Humans, by contrast, have a mixture of all these mental states which makes a human mind the ideal form for spiritual development. Below the human realm beings are too distracted by torments, cravings and ignorance to develop morally and psychologically. Above the human realm the demigods and gods are too distracted by their striving and amusements. Even the use of neurotechnologies to generate sublime, spiritual states of mind can be a trap. Advanced meditators are counseled to recognize experiences of absorption into oneness with all things or emptiness (*arupa jhanas*), as signs of meditative progress, but not as experiences to linger in.

A distinctively Buddhist approach to the use of neurotechnologies would therefore seek to avoid being stuck in any one set of moods or mental states. Using a drug or nano-neural device that created an addiction to a blessed out state of pleasure would be as unwholesome as making oneself as stupid as an animal, or as consumed with greed as a hungry ghost (e.g. addicted). Buddhist psychology counsels that there is a difference between a dynamic *eudaemonic* happiness grounded in self-awareness and the constant stimulation of dopamine on a hedonic treadmill.

This nuanced approach can be seen in the Western Buddhist discussion of psychedelics. Some Western Buddhists credit their experimentation with psychedelics with catalyzing their interest in meditation (Badiner, 2002), and providing an initial glimpse of their inner lives that they would not otherwise have had. There is even some evidence that psychedelics may have been incorporated into medieval Tantric Buddhist practice (Hajicek-Dobberstein, 1995), although they are certainly not used today. Few former psychedelic-using Buddhists believe that psychedelics changed their personality in the long-term however, and they recognize that habitual use of psychedelics would be very unhealthy (Redmond, 2004).

Western Buddhists have also debated the use of antidepressants (Epstein, 1993; Hooper, 1999) . Antidepressants are not true *soma* or happy pills, creating superior moods for everyone who takes them. At best they alleviate symptoms of depression for the severely depressed. The general conclusion is that clinical depression is very different from *dukkha,* the ubiquitous unsatisfactoriness of existence. Antidepressants are precisely the opposite of narcotics: they facilitate having sufficient energy and mental health to actually get on with life and a meditation practice (Bitner et al, 2003).

Following this lead, Buddhists will likely be very concerned about the possibility that mood-modification may dull the mind and engender a static passivity towards oneself and others. But Buddhists will also be open to the possibility that safer, more powerful and

targeted mood-altering drugs and brain implants – "wire-heading" - may be useful in generating a positive, dynamic engagement with life. Evidence that our day-to-day level of subjective well-being, our "happiness set-point," is about relatively stable across the life course and across situations, and about half genetically determined (Lykken, 1999; Weiss, 2008), suggests instead that mood could be boosted with only positive effects on our dynamic engagement.

Happier people are more successful in achieving social, work and life goals. Happier people are more likely to get and stay married, have more friends, belong to more groups, and are more likely to volunteer. Happier people are more highly rated by their supervisors and they make more money. Happier people are also healthier and live longer (Lyubomirsky, King, and Diener, 2005; Oishi, Diener and Lucas, 2007; Walker, 2006). A gene therapy or drug which successful changed the happiness set-point to the setting that the happiest 1% of people thrive at, without tipping over into addiction or stupefaction, would presumably facilitate moral behavior and spiritual practice.

Generosity and Loving-Kindness (*Dana* and *Metta*)

The virtue of generosity is narrowly the willingness to share with others. Generosity requires overcoming greed and material attachment. But more broadly generosity is an exercise of empathy, compassion and loving-kindness, *metta,* the capacity to imagine others' suffering as ones' own and the active desire to help them. In this broader sense the exercise of *dana* and *metta are* the overcoming of self-absorption and neuroticism.

The generation of compassion for all beings is one of the oldest meditation techniques in the Buddhist tradition, in which it is presented in several different forms. Research on people practicing a form of compassion visualization meditation has found it reduces stress hormones (Pace et al., 2008), and boosts positive emotions and well-being (Fredrickson et al., 2008; Pace et al., 2008) and feelings of social connectedness (Hutcherson et al., 2008).

Many lines of research are suggesting that neurotechnologies to enhance generosity and compassion may also soon be possible. First, there is a strong genetic component to our innate predisposition for compassion and generosity. The dominant model for the components of personality is the five factor model. The five factors are Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (OCEAN). The five factors have been statistically distilled from personality tests and appear to be stable over the life course. Each is about half genetically determined (Jang, Livesley and Vernon, 1996; Bouchard and McGue, 2003), which suggests that drugs and gene therapies could be developed to change their personality attributes. Luo et al. (2007) has, for instance, found a number of genes correlated to these underlying personality dimensions.

The factor of agreeableness appears to be particularly relevant to the virtues of generosity and compassion. People who score high on agreeableness are more compassionate, trusting and helpful throughout their lives while people low in agreeableness will find it hard not to be uncooperative, unsympathetic and easily irritated regardless of how much they meditate and think loving thoughts. Agreeableness has been found to be correlated with empathy (del Barrio et al., 2004) and volunteering (Carlo et al., 2005).

Agreeableness is also related to several other personality constructs that have moral valence. Michael Ashton and colleagues (2005) have found that agreeableness is related to Honesty-Humility and Greed-Avoidance scales, which include personality descriptors such as sincere, fair, and unassuming as opposed to sly, greedy, and pretentious. Agreeableness and Honesty-Humility are in turn negatively associated with the ‘‘Dark Triad’’ traits of Machiavellianism, Narcissism, and Primary Psychopathy (Lee & Ashton, 2005).

Two examples of drugs that appear to boost agreeableness are oxytocin and MDMA. Oxytocin is a hormone released during romance, love making, child birth and breast-feeding which induces feelings of trust and bonding. Its use is now being explored to overcome social phobia (shyness) and facilitate the social integration of people with autism (Baumgartner et al., 2008). Variations in oxytocin receptor genes are correlated with the ability to empathize with others' feelings (Rodrigues et al., 2010), and oxytocin supplementation improves the ability to read social cues (Domes, 2007), trust in others (Kosfeld et al., 2005) and generosity in social games (Zak et al., 2007). MDMA or "ecstasy" is another drug whose users report feeling more love and compassion. Among other effects MDMA stimulates the release of oxytocin (Thompson et al., 2007).

Self-Control, Renunciation and Honesty (*Sila, Nekkhamma* and *Sacca*)

Self-discipline in Buddhism begins with the ability to keep the five ethical precepts, to refrain from killing, stealing, lying, intoxicants and sexual misconduct. But more generally *sila* and *nekkhamma* are the capacity to refrain from self-gratification, to be temperate in speech and deed.

Here again we find that there is a substantial body of research suggesting that our capacity for self-discipline is genetically determined, and chemically malleable. The personality factor of conscientiousness is associated with carefulness, self-discipline, and thinking carefully before acting. Low conscientiousness is associated with substance abuse and criminality (Ozer & Benet-Martinez, 2006). Conscientiousness appears to be associated in turn with genetic variations of the dopamine receptor (Blasi, 2009). Dopamine is the neurochemical that mediates the pleasure we receive from novel and risky activities such as gambling, drugs, alcohol and sex (Zald et al., 2008). Ben Zion et al. (2006) found that variations in the dopamine receptor gene is linked to lower or higher amounts of sexual desire. About 30% of humans have a variant that boosts sexual desire. Zietsch (2010) found a strong heritability of “risky sexual behavior” in a study of 5000 twins.

Another line of research has looked at the role of glucose availability in the brain and having the energy to resist temptation. Baumeister et al. (2007) found that the exercise of self-control depletes brain glucose, and with it the energy for self-control. Therapies that increase the brain’s supply of glucose would therefore boost self-discipline.

Specific forms of compulsive behavior may be open to more targeted neurotechnological control. Sexual compulsion for instance is strongly influenced by testosterone, and the recidivism rate of sex offenders has been successfully reduced via chemical suppression of testosterone (Grubin, 2010). Although not a standard therapy, some clinicians are using testosterone suppression, antidepressants and other psychiatric drugs for “sex

addiction" or compulsive hypersexuality (Goodman, 2009). The neurochemical vasopressin has also been found to play an important role in sexual fidelity, facilitating the binding of the memory of sexual pleasure to a specific partner. Lim et al. (2004) found that modifying a vasopressin gene in prairie voles made males of a non-monogamous species monogamous. Savulescu and Sandberg (2008) have suggested that the administration of oxytocin, vasopressin and testosterone might be useful as an adjunct to marital therapy in the future, rekindling sexual desire, deepening feelings of trust and mentally bonding partners to one another.

As to the vice of gluttony, hundreds of thousands of people have undergone lap-band procedures to shrink the size of the stomach, and for most, their appetite for food. Patients are having electrical "pacemakers" implanted in their stomachs to tell the nervous system the stomach is full. Dozens of drugs are being researched to safely control appetite through the manipulation of the hormones involved in satiety, such as ghrelin and leptin (Hameed et al., 2008). Sibutramine, a drug which blocks the uptake of norepinephrine and serotonin, is in wide use as an appetite suppressant (although it has been removed from the market in Europe because of safety concerns.) Lorcaserin, which acts on the brain's cannabinoid receptors, is another appetite-suppressing drug close to approval in the United States.

Patience and Equanimity (*Kshanti* and *Upekkha*)

Our capacities for patience and equanimity appear to be similarly genetically and neurochemically determined. For instance a variety of mental health disorders have been found to be heritable. Tambs et al. (2009) studied twins and found that vulnerability to anxiety disorders was about 50% heritable.
Our propensity towards anger and aggression appears to be affected by variations in the monoamine oxidase A gene (MAOA). A third of people have a form of the MAOA gene which predisposes them to aggression in response to provocation (McDermott, 2009).

The ability to rebound from traumatic life events without lasting effects on mental health is known as "resilience," and research has also found resilience to be strongly heritable. Multiple studies have found genetic inheritability for risks of stress, depression and schizophrenia. Beaver et al. (2010) found psychological resilience from victimization to be related to variations of genes that determine dopamine and serotonin. Variations in the corticosteroid regulating genes are linked to our susceptibility to stress (DeRijka, 2008). The OCEAN personality trait of Neuroticism is also highly heritable, a major risk factor for clinical depression (Kendler, 2010).

Effort, Perseverance, and Concentration (*Virya, Adhitthana* and *Dhyana*)

One piece of evidence for the neurobiological basis of our capacity for diligence and concentration is found in attention deficit disorder. Twin studies and studies of parents and children show that ADHD is strongly heritable, and appears to linked to variations of the dopamine and serotonin regulating genes (Faraone et al., 2010). While clinical ADHD is only present in 5-10% of the population, the underlying attentional mechanisms

presumably vary across the population, with outliers at the other end exhibiting very high capacities for focus, persistence and self-control. Andrew Fenton's (2009) essay on a Buddhist approach to the use of methylphenidate has already advanced the argument that drugs could facilitate meditative practice and general mindfulness in daily life. A goal of Buddhist moral enhancement in general would be to develop means for the average person bring their full attention to every situation. An even stronger case could be made for the drug modafanil, which, unlikely methylphenidate, improves wakefulness and task performance in most subjects, and without the stimulants side effects and risks of dependency. Greeley et al. (2008) and others have begun to argue that these cognitive enhancement drugs are so safe and beneficial that they should be deregulated.

The ability to keep returning to task is likewise a desirable virtue, and one that appears to have a neurogenetic component. In a study of twins Tony Vernon and his team at the University Western Ontario (Horsburgh et al., 2009) found that half of the variation in the capacities for commitment, confidence and the ability to face new challenges were genetically determined. More disturbingly Vialou et al. (2010) subjected rats to days of electrical shocks from the wire mesh whenever they attempted to leave their cages. They found that rats that had been engineered to overexpress the chemical ΔFosB in their reward circuits of the nucleus accumbens were more likely to continue trying to escape, while rats engineered with low levels of ΔFosB gave up. They speculate that supplementing this brain chemical in humans might increase resilience to stress and determination in the face of challenges.

Wisdom (*Prajna Paramita*)

Meditation-oriented Buddhism has tended to downplay the discursive, intellectual aspect of the concept of *prajna*, and to emphasize non-discursive awareness. But the Buddhist canon is clear that *prajna* is a combination of discursive, intellectual analysis with the mental clarity of a concentrated and spacious mind. *Prajna* is the capacity to see the true nature of things, their causal connections, and how things constantly change. *Prajna* requires an openness to new ideas and experiences, and the ability to recognize and avoid cognitive biases, habits of mind that lead us to false conclusions. *Prajna* requires general intelligence, and the more the better.

Again there is substantial evidence for genes that influence our cognitive abilities. For instance, Haworth et al. (2009) found 50% of the variation of intelligence ("g") to be genetic in a study of in 11,000 twins in Australia, the Netherlands, the United Kingdom and the United States. Many neuro-geneticists believe that genetic enhancement for intelligence is unlikely because of the number of genes involved. But if half a dozen of the most potent intelligence genes, or their neurochemistries, were targeted for enhancement that would presumably have a dramatic effect.

Drugs are now being investigated to enhance a number of cognitive abilities, largely as therapies for neurological conditions such as Alzheimers and Downs syndrome. A great deal of attention has focused on the ability of the brain to generate neural stem cells to repair brain damage, and to find drugs and gene therapies which can enhance the plastic and reparative capacity of the brain. Sugiyama et al. (2009) have found for instance that neural plasticity is controlled by the Otx2 protein, which may be a potential therapy for ramping up brain repair. Two other intriguingly futuristic avenues of this research are the

electrical stimulation of neural tissue, and the use of nanomaterials are scaffolds for the regeneration of neural connections.

Conclusion

Future neurotechnologies will include drugs, implanted devices and gene therapies that target specific moods, cognitions, impulses and behaviors. From a Buddhist perspective the growing ability to control our behavior will be an opportunity to suppress unskillful impulses and behaviors, and enhance our practice of the virtues. Mental illness and more routine emotional lability can be smoothed out, and mood ramped up to an optimal level of high, dynamic well-being. Neurotechnologies will at first be relied on as temporary spiritual training wheels, helping to create a solid foundation of moral behavior, concentration and mental clarity as part of the practice of self-reflection and meditation. As the technologies develop they may be used as the principal means of self-transformation. The Buddhist rejection of the idea of an essential core self and emphasis on self-transformation will likely become more attractive as personalities become more malleable.

At the same time the growing ability to modify mood and induce states of blissful absorption will pose a growing risk of addiction and stasis. The Buddhist goal of a more engaged, compassionate, form of eudaemonic happiness will become increasingly relevant as a alternative to the growing temptation of wireheading and chemical bliss. Buddhism can offer a model of cognitive enhancement that points past the tarpits to liberation.

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