

Review Article

How to Form the Human Brain

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Modern societies are challenged by a range of problems; most, if not all, are aggravated by the way people behave. Our minds are shaped by the combined effect of genes and environment. The only practical option for modifying behavior is to adjust the impact of the environment. All communities try to mold their members; thus, the question is not *whether* we should attempt to form the brains of future generations, but *how* to optimize the outcome. In this review, I discuss desirable features, brain plasticity, and strategies for enhancing society by tweaking the mindset, and thus the behavioral propensities, of the population.

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1. Introduction

Life in modern societies is troublesome. One problem is that we have moved away from the environment and lifestyle evolution designed us for, and the consequences include what is referred to as the diseases of civilization or diseases of modernity ^{[1][2]}. We also have other challenges such as overpopulation, pollution, dwindling resources, inequality, and violence. Although aggression has always been a part of human nature, the present arsenal of weapons exacerbates the consequences of conflicts. The question is how to ameliorate the situation.

The search for ways to improve society dates back to ancient times. The Greek philosophers, such as Plato and Aristotle, had their suggestions ^[3]; the later utopian movements came up with novel ideas ^[4], but the problems remain unsolved. I believe that today, with the help of science, we have a better chance of success.

The notion that the State should try to control how people think and feel can be construed as indoctrination or brainwashing. These concepts evoke images of dictators who force people to serve them, as warned about in Huxley's *Brave New World*. The present zeitgeist is strongly opposed to

indoctrination, but at the same time, every society tries to mold coming generations. If people are not educated and exposed to shared values, society will fall apart. We need a certain coherence in terms of moral thinking and cultural concord. The difference between brainwashing and desirable efforts is a question of to what end and by what means. I believe we should try to influence the minds of the people, and that science can help us both in terms of direction and means.

The quality of a society depends on many factors. Technology, resources, economy, infrastructure, and institutions are important, but the key element is, arguably, the human factor – the mentality of the population. The mentality, or the culture, has a considerable impact on how people behave, not least how they behave when relating to each other. Mental features, whether it is aggression, empathy, or social competence, are assumed to depend roughly 50/50 on the environment and the particular genetic constitution of an individual ^[5]. We are all born with the same compilation of qualities, so the ratio explains the observed variation in a population. Consider a society that has established an ideal effort to, for example, elevate empathy and reduce aggression. Both these qualities will still be universally present, and there will still be considerable variation between individuals. The important point is that in this case, the average mentality is moved in the direction of more empathy and less aggression. In short, we can improve how society functions by offering a setting that is more optimal regarding the formation of desirable qualities in the human brain.

Despite more than two thousand years of thinking and enormous advances in technology and science, we are still not where we ought to be. The key problem, how to “bring out the best” in human nature, has not been solved. I believe science has advanced to a stage where it can offer a substantially improved platform compared to what the Greek philosophers and the utopian movements had. Thanks to anthropology, biology, medicine, psychology, and the social sciences, we have substantial knowledge of the human brain, including its propensities in terms of feelings and behavior, and how to take advantage of its inherent plasticity.

Humans are genetically a highly homogenous species ^{[6][7]}; the enormous variations in ways of thinking and behaving are due to the plasticity of our brains. There are genetic variants that influence behavior, but most of them are probably present in all populations above a certain size. Thus, all societies face roughly the same challenges when it comes to forming the mind.

I shall start by looking at possible priorities as to what we might want to achieve. Four options are suggested: happiness, knowledge, social skills, and health. Subsequently, I review current insight into how the brain is molded by the environment and how we can have an impact on this process. What sort

of properties we would like to see in future generations and what strategies we ought to pursue should be publicly debated; the present text is meant to offer relevant background for that discussion.

2. Desirable Brain Properties

2.1. Happiness as a primary purpose

There has been a tendency to move from more tangible and quantifiable features – such as economy, health, and education – to quality of life or happiness when articulating the aim of society ^{[8][9]}. The terms happiness, well-being, and life satisfaction are in this context closely related. Unfortunately, happiness is neither easily measured nor a straightforward aim to pursue. The more tangible features are important because they offer a practical approach to improving society and, most likely, enhancing happiness. Scandinavian countries, including Norway where I live, tend to score high on happiness ^[8]; yet there seems to be plenty of room for improvement. The prevalence of mental disorders is high ^[10], people are lonely, and many struggle with sexual issues ^[11].

It seems reasonable to expand on the concept of happiness in the way promoted by the Happy Planet Index ^[12]. Their measure of well-being is based on multiplying happiness (or the experience of life satisfaction) by life expectancy and then dividing by the ecological footprint (pollution and exploitation of resources). It makes sense to consider happiness over a lifetime and to incorporate a measure that promotes the opportunity for happiness in the future. A similar concept, sustainable happiness, refers to a pursuit that does not exploit other people, the environment, or coming generations ^[13]. One may argue that a happiness index should also be corrected for inequality, as it seems likely that a society is better off if everyone has an equal chance of happiness rather than if this is primarily for the privileged ^[14].

If happiness is to be the main target, it is important to understand what happiness is about. I believe a biological approach, in the form of describing the relevant features added to the brain by evolution, offers important insight. This approach is described in more detail elsewhere ^{[15][16]}, but here I only present a brief account adapted to the present purpose.

The term "feelings" is used for any experience with a positive or negative valence. Feelings were presumably introduced by evolution some three hundred million years ago in the amniote (reptiles, birds, and mammals) lineage ^[16]. The evolutionary rationale was probably to improve complex behavioral decisions ^[17]. As behavior is basically about moving toward what is good for the genes and away from

anything detrimental, feelings tend to be, respectively, positive (pleasure/rewards) or negative (pain/punishment). The positive or negative effect, or “mood value”, is accounted for by distinct neuronal modules ^{[18][19]}. These “mood modules” can be distinguished from the modules that add the general content, or substance, of a feeling. For example, both a physical injury and being rejected by a friend use the same pain module but are clearly distinguished by content ^[20]. Based on this description of the brain, the level of happiness can be construed as the net output of the brain’s mood-related modules.

In research on happiness, it has been customary to distinguish between hedonism (the pursuit of pleasures) and eudemonia (positive experiences associated with, for example, friendship and having meaning in life). However, the two concepts likely reflect activity in the same mood modules, which means that the above account of happiness encompasses both eudemonic and hedonic forms of positive feelings. Another important point is that the default state of mind seems to be one of positive mood ^[21]. Consequently, the key to a good life is to avoid unnecessary negative feelings. This observation helps explain why meditation, avoiding worries, and being absorbed in a task (the feeling of flow ^[22]) are associated with happiness.

Based on the above description, it should be possible to improve the score of happiness by avoiding unwarranted activity in the pain module and/or enhancing the activity of the modules responsible for pleasure. The point of avoiding unnecessary negative feelings is closely associated with ameliorating mental agony and disease. Anxiety, depression, and chronic pain are the most common mental problems ^[10]. The three conditions can be described as hyperactivity in the fear function, the low mood function, and the physical pain function, respectively. All three functions activate the pain module. The burden of these conditions can presumably be reduced by adjusting lifestyle, particularly as to how we bring up children ^{[23][24]}.

There is a two-fold reason to pursue happiness when trying to form the minds of future generations: for one, the population scores better on what matters; and two, happy people are more likely to have a positive impact on society ^[9]. The following three attributes – knowledge, social skills, and general health – are particularly important when trying to progress.

2.2. Knowledge

There are obvious reasons why we should aim for educated citizens ^{[25][26]}. General knowledge is required to maintain a functional democracy and to make personal choices aimed at improving health

and happiness. We need specialized and diversified expertise to manage an industrialized society and to stimulate innovation in science and technology. These requirements are reasonably well cared for in developed countries. The K-12 (kindergarten to 12th grade) schooling engages most of the young, and university-level education offers specialization. There may be possible improvements as to the curriculum offered, but the overall system seems well-designed for the purpose.

In most countries, the educational system creates an attitude favoring achievements. We see the result in that many people want to work, or engage in various tasks, even in the absence of monetary encouragement. The driving force is presumably the small (and not necessarily recognized) “drops of pleasure” associated with doing something deemed useful.

For society to move forward, it is important not only to educate people but to foster ambitions and a desire for innovative thinking. However, in present societies, ambitions tend to be driven by monetary gain; the drops of pleasure are more easily harvested if the achievement can be converted to money. The situation is not ideal as it may lead to more pollution and less equality. It would be desirable to change present ways of thinking in the direction of having ambitions fueled by the notion of “doing something good” or “working for the benefit of all”. To achieve that, we need to inform people that the most important factor for improving happiness is not riches but social relations ^{[27][28]}. Overall happiness is likely to improve if we reduce material inequality ^[29], and a reduction in consumption seems necessary to avoid global warming.

2.3. Social skills

Our innate predispositions that drive interactions with others seem to be an Achilles heel of the modern world. In the Stone Age tribe, people presumably behaved well towards those defined as the in-group but not necessarily to others; as humans are designed by evolution to selectively collaborate and care for comrades ^[30]. In large-scale societies, we interact with a lot of people we do not know. World peace and prosperity depend on a mindset of global solidarity and collaboration. We all stand to suffer when conflicts escalate. In short, less discriminatory compassion and a capacity to cooperate with strangers are key factors when it comes to improving society.

Altruistic or genial behavior is not always to the advantage of the genes. Evolution therefore balanced our gregariousness with features such as egoism and aggression. Hostility is a core feature of the mind and is easily activated when confronted with a potential adversary. The idea of global solidarity is a high demand considering our innate behavioral tendencies. It is not sufficient to simply tell people to behave

nicely and back the statement with laws and threats of punishment; we need to find ways to make the most of our inherent genial capacity.

The task can be compared to moving and holding a pendulum out to one side. On the opposite side are our innate tendencies for egoism and aggression, as well as the propensity to label people we do not know as adversaries. These tendencies are presumably at least as strong as our prosocial dispositions. In a mind shaped by a random environment, the pendulum points to the ground; that is, behavior reflecting both amiability and violence is common. Fortunately, all these features of the brain are meant to develop in interaction with other human beings. It means that by creating an environment optimal for fostering geniality, we pull the pendulum in the desired direction. In short, we need to create a mindset where empathy and gregariousness dominate, while aggressive tendencies are subdued. The difficult part is finding the right grip on the pendulum.

Aggression is strongly engrained in the human brain as it likely was important for survival and procreation in the formative period of mammalian evolution. Fortunately, gregariousness seems to be a better option for personal happiness ^[30]. It feels better to hug someone than to hit someone. Altruistic behavior helps others, and thereby society, but there is also evidence that being helpful enhances the happiness of the helper; and that improving happiness makes people more altruistic ^[8]. In other words, there is a win-win situation in molding brains in the direction of empathy.

Feelings evolved to serve the genes – not world peace or happiness. The notion that genes may be best served by aggression while happiness is best served by geniality is therefore a paradox. A possible evolutionary explanation is that geniality evolved recently, over the last 6-7 million years, while aggression dates much further back. In the more recent period of human evolution, the installment of novel brain function probably relied to a larger extent on the incentive of positive feelings as opposed to instinctive tendencies. That is, aggressive behavior may be more like pushing a button, while our gregarious capacity is to a larger extent coupled with rewards. Society would likely gain if this information had a stronger impact on the mindset of the inhabitants.

The concept of active citizenship is related to the idea of enhancing social skills ^[31]. It implies that the state should promote an engagement in community affairs. Active citizenship can be learned, and it benefits both the community and the individual. People who live in communities with engaged and dedicated people seem to be happier ^[27].

The educational system has traditionally focused on fostering knowledge of the type associated with the sciences. As discussed elsewhere ^[32], fostering social skills should receive higher priority in the K-12 system. In Section 3, I discuss other strategies for moving a culture in this direction.

2.4. Health

Health is a major factor for both happiness and the capacity to contribute to society. Its effect on the lifetime happiness score is twofold in that most forms of morbidity both activate the pain module and tend to reduce lifespan. In addition, there are the indirect effects of having a fraction of the population that is unproductive. Creating a mindset that encourages healthy behavior should therefore be a priority.

If we were to compare health and life expectancy today with the presumed conditions in the Stone Age, the diseases of modernity are more than compensated for by present medical care. Yet, it should be possible to further improve health, for example, by adjusting the present lifestyle to better fit with the nature of being human. Even if top-quality medical care were universally available, we would be far from having a population with optimal health.

As in the case of gregariousness, healthy behavior is largely a question of mindset. People need to learn what constitutes favorable behavior, but they also need to develop an inclination to follow relevant advice. Thus, both education and the promotion of advantageous habits are required to reduce the toll of morbidity. We have the best medical system ever, and it is continuously improving, but people should be aware that the responsibility for maintaining health rests primarily with themselves, not their doctor. It seems reasonable to focus on nutrition and physical activity, as these factors are particularly important in relation to the diseases of modernity, but it is also possible to promote behavior that improves mental health. For example, meditative techniques can be taught in school as a strategy to ameliorate the consequences of stress ^[33]. Sexual behavior is another problematic issue regarding mental health and happiness in modern societies ^[11]. It is desirable to create a culture that is more open and less condemning regarding nudity and sex.

3. How to Mold the Brain

3.1. Brain plasticity

Brain (or neural) plasticity implies the ability of nervous systems to change their activity in response to internally or externally generated stimuli ^[34]. It can be described as modifying the connectome; that is,

the “masterplan” of the neuronal network [35]. There is considerable knowledge regarding the processes responsible for neural plasticity [36]. Most of the focus is on the synaptic transfer of signals between neurons. Synapses can be added or removed, and their strength and efficacy are malleable. Brain functions can also be altered by modifying the support cells. Most of the cells associated with human nervous tissue are glial cells that help neuronal function without being directly involved in signaling. Changes in axon myelination can, for example, alter the speed of the electric signal that moves down the axon. The brain has an arsenal of molecules, referred to as neurotrophic factors, that help orchestrate development [37].

The human brain is presumably the most advanced and complex neural structure in nature, which probably means it is also the most flexible. We are born with a highly unfinished brain, partly due to restrictions on head size because of the female birth canal, and partly because the brain is designed to learn and develop to fulfill its intended functions. We need a capacity to adapt to a variable environment [38].

There are various physical and chemical ways in which we can enhance neuroplasticity, for example, by electrical stimulation of the vagus nerve and the use of substances referred to as psychoplastogens [39][40][41][42]. Using tools to increase plasticity is particularly relevant in the case of mental disorders, as any form of therapy implies an attempt to mold the brain [24]. The effect of psychedelics such as ketamine and psilocybin in the treatment of mental disorders may be associated with their role as psychoplastogens [43].

In the future, it could be possible to harness the processes of neural plasticity in more specific ways. For the time being, the task of molding the brains of individuals without mental disorders depends primarily on more traditional methods such as education. I shall discuss three aspects of neural plasticity that are relevant for the success of this pursuit: brain exercise, critical periods, and habit formation.

3.1.1. Brain exercise

The brain responds to stimuli by both direct action and by subtly changing its structure. The latter response, which reflects the plasticity described above, can be compared to exercising muscles. If a particular neuronal network is repeatedly activated, it will tend to strengthen, while if it is left unused, it will degenerate [44][45]. If the relevant nerve circuits have a distinct locality, the effect can be measured as an increase or decrease in brain tissue [46]. The activation does not necessarily rely on external stimuli or

experiences; the power of the mind is sufficient, as exemplified by the use of mental imagery in sports ^[47]. Electric stimulation of circuits also works; for example, stimulation of the dorsal genital nerve (in the clitoris) is reported to enhance libido in women ^[48].

The term “brain exercise” is commonly used for attempts to either improve specific skills or to slow down cognitive aging, but the principles apply to any desired change. We exercise the brain by strengthening circuits when we learn and remember physical tasks or scholarly facts ^[49]. The important point is that humans have sufficient power of mind to purposefully activate, and thus exercise, a vast range of circuits that influence how we experience daily life and how we behave. We can, for example, use this form of exercise to reduce anxiety ^[50] or induce kindness ^[51]. The difficult part is finding practical workout regimes – ways to activate desired circuits. The task is particularly challenging when the circuits are primarily controlled by nonconscious processes, which is the case for feelings. Feelings were installed by evolution to manipulate your behavior, not for you to turn on or off at will. Consequently, you have limited access to the neuronal switches that turn off fear, low mood, and physical pain. This means it is difficult, but not impossible, to treat anxiety, depression, and chronic pain by exercising their off buttons.

Meditation can be described as a brain exercise where the purpose is to enhance the capacity to relax. This form of relaxation typically implies turning off negative feelings such as worries, thereby entering the positive default state of mind. A meditative exercise may also include an attempt to specifically enhance modules such as those required for compassion or to turn off a negative mood ^[24].

3.1.2. Timing of learning

Although the brain is malleable throughout the lifespan, it tends to become more set as we age. The brain’s capacity to change and adapt decreases, so the early years are therefore particularly important. Some people associate learning with attending school, but long before the child can respond to formal education, there is a considerable effect of the environment on brain properties ^[52]. In short, strategies aimed at molding the brain should have a focus on infants and youth. It seems more difficult to cure or change an adult brain compared to directing brain development in a desirable direction in children. Specific skills are best learned in mature individuals as they tend to require general knowledge, but inclinations related to feelings and behavior should be catered to early in life.

The significance of childhood as a time of learning is reflected in the observation that play behavior is primarily associated with that age ^[53]. Play is meant to help infants, of either humans or other animals, develop skills required for adult life. Learning to control and coordinate muscles is an important part, but, particularly in the case of humans, it is also a question of learning mental skills. Play is enjoyable, which means the behavior is driven by brain rewards designed to promote this form of learning. If one can design ways to mold the brain by engaging these rewards, the chance of success should increase.

The brain's capacity to learn and adapt does not diminish linearly. For one, there are sensitive periods, or learning windows, designed to acquire particular skills in childhood; and two, the capacity tends to level off in adults but drop more rapidly in old age ^[54]. The concept of sensitive periods is most widely studied in the case of language ^[55], but most likely it also applies to social competence ^[56]. These windows of opportunity seem to last through childhood and, particularly in the case of social skills, through adolescence. Feral children display the consequences of a lack of linguistic and social experience, but the negative effect is also seen in individuals with less extreme forms of social deprivation ^[57]. On the other hand, having siblings (or playmates) to interact with appears to support mental health ^[58]. We should make sure children and youth are offered conditions aimed at optimizing their linguistic and social skills.

3.1.3. *Habits*

The brain's propensity to form habits is another important aspect of how evolution prepared us for brain development and adaptation ^{[59][60]}. Habits presumably evolved because they offer a faster and less demanding (in terms of brain resources) way of making appropriate behavioral decisions. Behavior that has previously proven successful becomes more hardwired and more easily elicited. The relevant neural circuits are strengthened so that they can be rapidly engaged next time the opportunity arises.

The problem is that habits are based on the reward system of the brain, which means that success is defined by the capacity of a given situation to bring out positive feelings ^[16]. If something causes pleasure, we are prone to want more and therefore repeat the action. Our habit-forming propensity was probably appropriate in the Stone Age. Modern societies have invented and made easily available all sorts of products that activate the reward system, from sweet food to narcotics. The craving for these products results in bad habits. If the habit is sufficiently detrimental, we refer to it as an addiction. Substances like heroin and cocaine form the strongest form of addiction. The nonconscious brain follows the advice based on previous positive experiences, even if your consciousness objects. That is, the heroin addict continues to set shots even if he knows very well that he ought not to.

We are all under the influence of habits. The underlying rewards are not necessarily as obvious as in the case of heroin; small drops of pleasure suffice. These can drive the computer game player, the social media chatter, or the bird watcher to spend more time engaged in these activities than what might seem appropriate. Habits with an obvious detrimental effect on health, such as junk food and alcohol, are more problematic but perhaps less common.

Humans are designed to rely largely on cognitive assessments when it comes to complex behavioral decisions ^[17]. As this manner of evaluating a situation is slow and resource-demanding, evolution presumably increased the reliance on habits in our lineage. The notion may explain why we are so prone to develop not only addictions but all sorts of compulsory behavior. The neurobiology associated with obsessive-compulsive disorder is related to that associated with habits and addiction ^[61].

The important point is that one should be aware of our proneness for habits when setting up regimes for molding the brain. Habits can serve us well, but they also cause severe problems. Ideally, brain molding should imply coaching people in the direction of positive habits.

3.2. Strategies for improvement

In Section 3.1, I looked at the processes associated with brain plasticity on which any attempt to form our brains depends. In the present section, I shall discuss strategies for how we can pursue the desired molding. It is a question of means and platforms in society that are suitable for causing the required impact on the mind.

Three of the four brain properties singled out in Section 2, knowledge, social skills, and a proper attitude to health, can be approached directly by educational means, that is, by repeatedly exposing people to relevant input adapted to age and situation. Happiness is more difficult. Those engaged in implementing happiness as an aim for governance – such as the network behind The World Happiness Report ^[8] and Bhutan's Gross National Happiness Centre ^[62] – focus on more tangible factors. The list typically includes education, health services, good governance, environmental sustainability, economy/living standards, well-functioning communities, freedom, equality, and security. Most countries take these factors seriously.

Below, I focus on opportunities for molding the brain. I discuss four relevant platforms: government, mass media, religion, and art. The question is how these platforms can be used to create a culture where a positive mindset flourishes.

3.2.1. Governmental options

Only the authorities can reach the entire population. However, for governments to take the right action, they need the required knowledge, the will to act, and the support of the people. Ideally, the inhabitants should be close allies, as reflected in the concept of active citizenship ^[63]. It is a question of coaching people to act voluntarily as co-producers of cultural sustainability.

The most important arena is the educational system. The government can set up curriculum and guidelines for teaching. Even in countries where most kindergartens and schools are privately operated, education tends to comply with official guidelines. The authorities also decide on general laws, rules, and regulations. These impact people's minds by enforcing certain behaviors and creating a way of thinking. Another option is to launch attitude campaigns, for example, related to healthy behaviors such as eating habits and the use of alcohol. Physical exercise is important not only for general health but also for brain health ^[64]. The government can encourage and facilitate physical activity in all ages, through campaigns, by including it in the educational system, and by supporting sports clubs.

Cultures evolve in a process somewhat akin to biological evolution ^[65]. Although the government is a core driver of cultural evolution, and thus the mindset of the inhabitants, the process is not always predictable. Certain people – whether in their capacity as influencers or their status in sports, music, and art – make a larger-than-average impression. They can have a considerable effect on how people feel and think; but if the government has reasonable support in the population, they are unlikely to foster change unless they operate within vague boundaries of what is considered acceptable and appropriate.

Another relevant issue is how the authorities can help people find a suitable “meaning in life” ^[66]. A sense of meaning or purpose is an important factor when it comes to happiness ^{[27][67]}. Presumably, the positive feelings stem from harvesting brain rewards associated with an internal drive to do something “useful”. The evolutionary rationale for the rewards (and thus the correlation with happiness) is that the usefulness, and concomitant achievements, will promote the genes. However, as discussed elsewhere ^[16], the associated positive feeling can be harvested regardless of whether the behavior is useful for the genes. Consequently, the authorities can accomplish a lot if they enhance the desire for meaning and at the same time guide the behavior in a way that helps society and stimulates cooperation. Collecting butterflies may be sufficient for obtaining the brain rewards, but engaging in charity work offers a better yield for the community.

A more controversial option is to promote a constructive use of psychedelics. The psychedelic MDMA (also known as ecstasy) is known to increase emotional connectedness ^[68]. A wide range of psychedelics, including LSD, psilocybin, ketamine, and ibogaine, also appear to stimulate socializing. The effect is well documented in controlled experiments with mice ^[69], but also reflected in correlational studies on humans where the long-term use of psychedelics is associated with positive mental health and prosocial outcomes ^{[70][71]}. In the case of adult mice, these substances appear to open a window of social learning that would otherwise be restricted to puppies ^[72]. I suggested that social life is an Achilles heel of modern societies; the effect of these chemicals seems to offer an opportunity that ought to be further investigated.

The government also has the option to support private initiatives, including those associated with mass media, religion, and art. The role of these platforms is discussed below.

3.2.2. Mass media

Mass media, such as newspapers and TV channels, have considerable power over the way we think ^[73]. The power vested in the media should preferably contribute to the aim of forming a culture that improves society and enhances the happiness of its citizens.

In the Western world, mass media operate largely independently of the government. The situation implies that they may counteract measures deemed constructive; however, the importance of having a possible corrective if the government is not acting in the interest of the citizens ought to weigh more. In the long run, one would expect that mass media taking a detrimental stance will lose followers and thus impact.

Many countries have broadcasting media that are sponsored or operated by the authorities. These channels can be forged to pursue the desired molding of the brain, but an independent and diversified press ought to be an additional asset.

3.2.3. Religion

Religions have been a vital force in shaping cultures for millennia. Even people who do not adhere to a faith are under the spell of our religious inheritance, as witnessed, for example, by current views on sexual behavior ^[74]. Religiousness, or spirituality, seems to build on innate characteristics of the human mind ^[75]. As such, religious faiths are not likely to disappear and are expected to retain considerable

influence on human thinking in the foreseeable future. The question is how to harness this force for the benefit of society ^[76].

Although ethical rules, or moral thinking, can exist in the absence of religion – as witnessed by the observation of apparent moral behavior in animals ^[77] – spirituality is a powerful tool when it comes to having people comply with rules. The idea that “God can see you” (even when nobody else can) appears in many creeds. Thus, if religion is tutored to comply with what one decides are desirable brain properties, there is hope for a substantial benefit.

3.2.4. Art

Art, or symbolic displays, has a universal presence and a long history in human culture ^[78]. The prominent forms in present society are literature, visual art (including paintings, photography, and film), and music. They all have a considerable potential for influencing the human mind. Although the primary power of art is to elicit various forms of rewards in the brain ^{[79][80]}, it can deliver a forceful message.

Literature represents the more direct way of influencing how people think, but visual art and music may capture more attention. Governments can sponsor or support art in various ways; however, in most countries, art is relatively independent and free to pursue any content and form of expression. Art can proceed where other forms of communication are likely to be banned, as exemplified by political caricatures and the display of nude children. As in the case of mass media, this freedom of expression may benefit society. Art tends to be at the forefront of social reforms and novel ways of thinking. Ideally, art should contribute to forming desirable brain properties. If nothing else, art contributes to happiness by the joy offered to spectators.

3. Discussion

Some people worry that AI should take command and make decisions to the detriment of humans. I believe that to be a minor worry compared to having humans make destructive decisions – as when starting meaningless wars. It is more important to be careful when “programming” our brains than our computers.

Most people accept the present version of brain molding because it reflects the culture they are a part of. The cultural restrictions regarding dress codes offer a suitable example. The codes of Western nations are considered obvious by the people living there, while they dislike both the nudity of tribal people and the

strict dress codes of certain Islamic countries. Is it obvious that the present code is optimal? To improve society, it is important to question and evaluate all aspects of a culture. I believe society should be proactive when it comes to forming future brains. If one agrees that such an attitude is desirable, the choice of strategy is, arguably, primarily a question of what is practical and efficient.

I suggest that the overarching priority should be to improve happiness. The level of happiness is determined by the output of rewards and punishments from the mood modules ^[17]. Their output varies on a scale ranging from excruciating pain to ecstatic joy. Most of the time, you experience no obvious pleasures or sorrows; still, the modules are presumably active in that they: for one, generate a background, or set point, of mood ^[71]; and two, add drops of pleasure or pain that are not necessarily recognized but that can impact behavior ^[81]. The level of the set point depends on life events and on how the relevant brain modules are primed, but it tends to stay on the positive side as long as the person is not troubled by maladies such as anxiety or depression ^[82]. It seems likely that the brain can be molded in a way that enhances mood ^[16], but we need more proximate targets such as health and compassion.

As discussed elsewhere, present societies do not seem to make the most of our social propensities ^{[30][83]}. Humans are well equipped with innate qualities such as altruism, empathy, and sociability, but we also have less desirable features such as anger, egoism, and aggression. Global happiness depends on enhancing the former and subduing the latter. A pertinent strategy is to promote the right feedback loops: If I am kind, you are kind; if I hit you, you hit me. And if the government is good, we support it; if it is bad, we work against it. To secure positive feedback loops, we need to take a stance on how to mold the brain. Happy people are likely to make kind and good citizens, while dissatisfied people may not.

In this paper, I suggest a framework for improving society. The core issue is how to shape the minds of people. Questions related to the molding of the brain should be publicly debated, but for the debate to have a successful outcome, people need to be informed. For that purpose, I try to outline a way of thinking concerning the qualities we would like to see in humans and a strategy for getting there. More research is desirable, but our present understanding of the mind is sufficient to move forward.

References

1. [^]Williams, G.C. and R.M. Nesse, *The dawn of Darwinian medicine. The Quarterly Review of Biology*, 1991. 66(1): p. 1-22.

2. [△]Carrera-Bastos, P., et al., *The Western diet and lifestyle and diseases of civilization*. Research Reports in Clinical Cardiology, 2011. 2: p. 15–35.
3. [△]Lane, M., Ancient political philosophy, in *The Stanford Encyclopedia of Philosophy*, N.Z. Edward and U. No delman, Editors. 2023, The Metaphysics Research Lab: Stanford.
4. [△]Badaan, V., et al., *Imagining better societies: A social psychological framework for the study of utopian thinking and collective action*. Social and Personality Psychology Compass, 2020. 14(4): p. e12525.
5. [△]Plomin, R., *Blueprint*. 2019, Boston: MIT Press.
6. [△]Pennisi, E., *Primate genomes offer new view of human health and our past*. Science, 2023. 380(6648): p. 881–882.
7. [△]Lewis, R., *Human Genetics: The Basics*. 2016, New York: Taylor & Francis.
8. [△][♂][♀][♂][♀]Helliwell, J.F., et al., *World Happiness Report 2023*. 2023, New York: Sustainable Development Solutions Network.
9. [△][♂][♀]Grinde, B., *Role of happiness when evaluating society*. Encyclopedia, 2022. 2(1): p. 230–236.
10. [△][♂][♀][♂][♀]Wittchen, H.U., et al., *The size and burden of mental disorders and other disorders of the brain in Europe 2010*. European Neuropsychopharmacology, 2011. 21(9): p. 655–679.
11. [△][♂][♀]Grinde, B., *The contribution of sex to quality of life in modern societies*. Applied Research in Quality of Life, 2022. 17(1): p. 449–465.
12. [△]Abdallah, S., et al., *The Happy Planet Index 2.0*. 2009, London: New Economic Foundation.
13. [△]O'Brien, C., *Sustainable happiness: How happiness studies can contribute to a more sustainable future*. Canadian Psychology, 2008. 49(4): p. 289–295.
14. [△]Pickett, K. and R. Wilkinson, *The Spirit Level: Why Equality Is Better for Everyone*. 2010: Penguin UK.
15. [△]Grinde, B., *Can the evolutionary perspective on well-being help us improve society?* World Futures, 2004. 60: p. 317–329.
16. [△][♂][♀][♂][♀]Grinde, B., *The Evolution of Consciousness: Implications for Mental Health and Quality of Life*. 2016, Switzerland: Springer.
17. [△][♂][♀]Grinde, B., *Consciousness: A strategy for behavioral decisions*. Encyclopedia, 2023. 3(1): p. 60–76.
18. [△]Leknes, S. and I. Tracey, *A common neurobiology for pain and pleasure*. Nature Reviews Neuroscience, 2008. 9(4): p. 314–320.
19. [△]Berridge, K.C. and M.L. Kringelbach, *Pleasure systems in the brain*. Neuron, 2015. 86(3): p. 646–664.

20. [△]Lieberman, M.D. and N.I. Eisenberger, Neuroscience pains and pleasures of social life. *Science*, 2009. 323(5916): p. 890-891.
21. [△]Grinde, B., Why negative feelings are important when assessing well-being. *Journal of Happiness Studies*, 2016. 17(4): p. 1741-1752.
22. [△]Csikszentmihalyi, M., *Flow: The psychology of optimal experience*. 1990, New York: Harper and Row.
23. [△]Grinde, B., Can the concept of discords help us find the causes of mental diseases? *Medical Hypotheses*, 2009. 73(1): p. 106-109.
24. ^{a, b, c}Grinde, B., Evolutionary perspective on improving mental health. *Encyclopedia*, 2022. 2(3): p. 1464-1482.
25. [△]Reimers, F., Education for improvement. *Harvard International Review*, 2013. 35(1): p. 56-61.
26. [△]Archer, M.S., *Social Origins of Educational Systems*. 2013, New York: Routledge.
27. ^{a, b, c}Grinde, B., et al., Quality of life in intentional communities. *Social Indicators Research*, 2017. 137: p. 625-640.
28. [△]Diener, E., et al., Wealth and happiness across the world: material prosperity predicts life evaluation, whereas psychosocial prosperity predicts positive feeling. *J Pers.Soc Psychol*, 2010. 99(1): p. 52-61.
29. [△]Oishi, S., S. Kesebir, and E. Diener, Income inequality and happiness. *Psychological Science*, 2011. 22(9): p. 1095-1100.
30. ^{a, b, c}Grinde, B., An evolutionary perspective on the importance of community relations for quality of life. *ScientificWorldJournal*, 2009. 9: p. 588-605.
31. [△]Crick, B., *Active Citizenship: What Could It Achieve and How?* 2010, Edinburgh: Edinburgh University Press.
32. [△]Bush, S., et al., Humanistic STE (A) M instruction through empathy: leveraging design thinking to improve society. *Pedagogies: An International Journal*, 2022: p. 1-20.
33. [△]Goyal, M., et al., Meditation programs for psychological stress and well-being: a systematic review and meta-analysis. *JAMA Internal Medicine*, 2014. 174(3): p. 357-368.
34. [△]Mateos-Aparicio, P. and A. Rodríguez-Moreno, The impact of studying brain plasticity. *Frontiers in Cellular Neuroscience*, 2019. 13: p. 66.
35. [△]Axer, M. and K. Amunts, Scale matters: The nested human connectome. *Science*, 2022. 378(6619): p. 500-504.

36. [△]Hogan, M.K., G.F. Hamilton, and P.J. Horner, Neural stimulation and molecular mechanisms of plasticity and regeneration: a review. *Frontiers in Cellular Neuroscience*, 2020. 14: p. 271.
37. [△]Skaper, S.D., Neurotrophic factors: an overview. *Neurotrophic Factors: Methods and Protocols*, 2018. 1727: p. 1-17.
38. [△]Lindenberger, U. and M. Lövdén, Brain plasticity in human lifespan development: the exploration–selection–refinement model. *Annual Review of Developmental Psychology*, 2019. 1: p. 197-222.
39. [△]Hays, S.A., R.L. Rennaker, and M.P. Kilgard, Targeting plasticity with vagus nerve stimulation to treat neurological disease. *Progress in Brain Research*, 2013. 207: p. 275-299.
40. [△]Sweatt, J.D., Neural plasticity and behavior—sixty years of conceptual advances. *Journal of Neurochemistry*, 2016. 139: p. 179-199.
41. [△]Sagi, Y., et al., Learning in the fast lane: new insights into neuroplasticity. *Neuron*, 2012. 73(6): p. 1195-1203.
42. [△]Sasmita, A.O., J. Kuruvilla, and A.P.K. Ling, Harnessing neuroplasticity: modern approaches and clinical future. *International Journal of Neuroscience*, 2018. 128(11): p. 1061-1077.
43. [△]Vargas, M.V., et al., Psychedelics and other psychoplastogens for treating mental illness. *Frontiers in Psychiatry*, 2021: p. 1691.
44. [△]Pascual-Leone, A., et al., The plastic human brain cortex. *Annual Review of Neuroscience*, 2005. 28: p. 377-401.
45. [△]Slagter, H.A., R.J. Davidson, and A. Lutz, Mental training as a tool in the neuroscientific study of brain and cognitive plasticity. *Front Hum Neurosci.*, 2011. 5: p. 17.
46. [△]Hensch, T.K., Whisking away space in the brain. *Neuron*, 1999. 24(3): p. 492-493.
47. [△]Simonsmeier, B.A., et al., The effects of imagery interventions in sports: A meta-analysis. *International Review of Sport and Exercise Psychology*, 2021. 14(1): p. 186-207.
48. [△]Bottorff, E.C., et al., Acute dorsal genital nerve stimulation increases subjective arousal in women with and without spinal cord injury. *medRxiv*, 2023: p. doi.org/10.1101/2023.04.24.23288935.
49. [△]Mansvelder, H.D., M.B. Verhoog, and N.A. Goriounova, Synaptic plasticity in human cortical circuits: cellular mechanisms of learning and memory in the human brain? *Current Opinion in Neurobiology*, 2019. 54: p. 186-193.
50. [△]Botella, C., et al., Recent progress in virtual reality exposure therapy for phobias: a systematic review. *Current Psychiatry Reports*, 2017. 19(7): p. 1-13.

51. [△]Gilbert, P., *The origins and nature of compassion focused therapy*. *British Journal of Clinical Psychology*, 2014. 53(1): p. 6–41.
52. [△]Nolvi, S., et al., *Prenatal stress and the developing brain: Postnatal environments promoting resilience*. *Biological Psychiatry*, 2023. 93(10): p. 942–952.
53. [△]Barnett, L.A., *Developmental benefits of play for children*. *Journal of Leisure Research*, 1990. 22(2): p. 138–153.
54. [△]Bettio, L.E., L. Rajendran, and J. Gil-Mohapel, *The effects of aging in the hippocampus and cognitive decline*. *Neuroscience & Biobehavioral Reviews*, 2017. 79: p. 66–86.
55. [△]Hartshorne, J.K., J.B. Tenenbaum, and S. Pinker, *A critical period for second language acquisition: Evidence from 2/3 million English speakers*. *Cognition*, 2018. 177: p. 263–277.
56. [△]Berk, L., *Child Development*. 2015, Sidney: Pearson Higher Education.
57. [△]Dombrowski, S.C., et al., *Feral children*, in *Assessing and Treating Low Incidence/High Severity Psychological Disorders of Childhood*. 2011, Springer: New York. p. 81–93.
58. [△]Grinde, B. and K. Tambs, *Effect of household size on mental problems in children: results from the Norwegian Mother and Child Cohort study*. *BMC Psychology*, 2016. 4(1): p. 1–11.
59. [△]Amaya, K.A. and K.S. Smith, *Neurobiology of habit formation*. *Current Opinion in Behavioral Sciences*, 2018. 20: p. 145–152.
60. [△]Wood, W. and D. Rünger, *Psychology of habit*. *Annual Review of Psychology*, 2016. 67: p. 289–314.
61. [△]Burguiere, E., et al., *Striatal circuits, habits, and implications for obsessive–compulsive disorder*. *Current Opinion in Neurobiology*, 2015. 30: p. 59–65.
62. [△]Ura, K., S. Alkire, and T. Zangmo, *Bhutan: Gross National Happiness and the GNH Index*. 2012, Bhutan: the Centre for Bhutan Studies.
63. [△]Moulaert, F., et al., *The International Handbook on Social Innovation*. 2013, New York: Edward Elgar Publ.
64. [△]De Lange, C., *Brain Power: Everything You Need to Know for a Healthy, Happy Brain*. 2022, London: Michael O'Mara Books.
65. [△]Brewer, J., et al., *Grand challenges for the study of cultural evolution*. *Nature Ecology & Evolution*, 2017. 1(3): p. 0070.
66. [△]King, L.A. and J.A. Hicks, *The science of meaning in life*. *Annual Review of Psychology*, 2021. 72: p. 561–584.
67. [△]Wong, P., *The Human Quest for Meaning: Theories, Research, and Applications*. 2013, New York: Routledge.

68. ^ΔLyubomirsky, S., *Toward a new science of psychedelic social psychology: The effects of MDMA (ecstasy) on social connection. Perspectives on Psychological Science*, 2022. 17(5): p. 1234-1257.
69. ^ΔNardou, R., et al., *Oxytocin-dependent reopening of a social reward learning critical period with MDMA. Nature*, 2019. 569(7754): p. 116-120.
70. ^ΔJohnson, M.W., et al., *Classic Psychedelics: An integrative review of epidemiology, mystical experience, brain network function, and therapeutics. Pharmacology & Therapeutics*, 2019. 197: p. 83-102.
71. ^ΔJones, G.M. and M.K. Nock, *Lifetime use of MDMA/ecstasy and psilocybin is associated with reduced odds of major depressive episodes. Journal of Psychopharmacology*, 2022. 36(1): p. 57-65.
72. ^ΔNardou, R., et al., *Psychedelics reopen the social reward learning critical period. Nature*, 2023. 618: p. 790-798.
73. ^ΔMcCombs, M. and S. Valenzuela, *Setting the Agenda: Mass Media and Public Opinion*. 2020, New York: John Wiley & Sons.
74. ^ΔGrinde, B., *Sexual behavior in modern societies: An interdisciplinary analysis. Sexuality & Culture*, 2021. 25(6): p. 2075-2091.
75. ^ΔGrinde, B., *God: A Scientific Update*. 2011, Princeton: Darwin Press.
76. ^ΔGrinde, B., *How can science help religion toward optimal benefit for society? Zygon*, 2005. 40(2): p. 277-288.
77. ^Δde Waal, F. and S.A. Sherblom, *Bottom-up morality: The basis of human morality in our primate nature. Journal of Moral Education*, 2018. 47(2): p. 248-258.
78. ^ΔBenton, J.R. and R. DiYanni, *Arts and Culture: An Introduction to the Humanities*. 2012, New Jersey: Prentice Hall.
79. ^ΔGrinde, B. and T.-A. Husselman, *An attempt to explain visual aesthetic appreciation. Integrative Psychological and Behavioral Science*, 2022. 18: p. 1-16.
80. ^ΔGrinde, B., *The human passion for music. Encyclopedia*, 2022. 2(2): p. 1119-1127.
81. ^ΔÖhman, A. and S. Wiens, *To think and to feel: nonconscious emotional activation and consciousness. Emotions, Qualia, and Consciousness*, 2001. 10: p. 363-385.
82. ^ΔLucas, R.E., *Adaptation and the set-point model of subjective well-being: Does happiness change after major life events? Current Directions in Psychological Science*, 2007. 16(2): p. 75-79.
83. ^ΔGrinde, B., *Social behavior: Making the best of the human condition. Mankind Quarterly*, 2000. 41(2): p. 193-210.

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