

Neuropsychology of Happiness

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Abstract

The empirical exploration of the construct of happiness has offered several conceptual inputs regarding its operationalization, nomological network and its process nature. It has also provided a number of theoretical explanations of happiness and techniques of fostering happiness. While recognizing such contributions, the present article goes beyond these parameters and identifies neural correlates of human happiness. Drawing on the contemporary brain imaging studies, the article delineates the role of middle prefrontal cortex, the left and right middle frontal gyri (LMFG and rMFG). It is accentuated that the ratio of left to right activity in the MFG marks a brain signature for happiness. In this context, the role of amygdala and hippocampus is also discussed. Finally, a number of lifestyle changes are recommended for promoting sustainable happiness.

Keywords: happiness, left-frontal activity, neuroplasticity, right-frontal activity

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Health and happiness have become major concerns in contemporary life. Previously these topics had been dominated in the practitioner-oriented magazines. Recently, such topics are getting attention by different scholarly journals. The construct of happiness has undergone a number of evolutionary changes. In olden times, behavioral scientists were speaking in the languages of *mental health*. It primarily referred to the absence of negative conditions such as stress, anxiety and depression. The World Health Organization (WHO) defined health in a positivistic manner: health is not merely the absence of diseases and infirmities, it is the presence of physical, psychological and social well-being (WHO, 1948). The scope of well-being was broadened to include multi-faceted aspects of human existence. This broadened view of well-being was also facilitated by corresponding developments in psychology. Psychologists launched very promising journals such as *Behavioral Medicine* and *Health Psychology*.

The paradigm shift from mental health to psychological well-being brought a change in perspective. Since many psychologists believed in the seminal role of the individual in experiencing well-being, they preferred to term it *subjective well-being (SWB)*. The efforts were geared towards operationalizing the construct and identifying its components.

An Overview of Field Studies

Behavioural scientists have focused on three aspects of the definition of subjective well-being, at the operational level (Diener, 2000). First, well-being is defined as the overall life satisfaction which includes a complete assessment of an individual's subjective well-being. Second, well-being indicates "feeling good". Positive psychologists are of the view that consistent experience of mild to moderate positive emotions is a reliable predictor of well-being in comparison to the occasional experience of strong positive emotions. For example, the participants about feelings of life as a whole, which include the positive and negative emotions can be measured used the PANAS (Positive and Negative Affect Scale),(Watson, Clark, & Tellegen, 1988).The difference between positive and negative affect experience rating indicates either wellness or illness.

The third component refers to satisfaction in numerous critical domains of life (such as family, work, and social relationships). Thus, Diener's (2000) three factor model of well-being (life satisfaction, frequency of moderate positive affect, and domain-specific satisfaction) provided an impetus for furthering empirical studies of well-being and happiness.

Subsequent developments in the field of happiness reoriented efforts to look into the dimension of meaningfulness. Drawing on Aristotle's concept of eudaimonia, many positive psychologists stressed values and self-realization in the process of happiness (Seligman, 2002). Accordingly, a broader framework was proposed. Specifically, Ryff and Keyes (1995) proposed a six-component happiness model and found that this multi-dimensional model was a superior fit over a three-component model. The components include "self-acceptance, personal growth, purpose in life, environmental mastery, autonomy, and positive relations with others".

Theoretically, well-being or happiness is constituted of two components: hedonia and eudaimonia which explain positive affect or pleasure and a sense of meaningfulness and engagement in life respectively. Prior to identifying brain functions in individuals experiencing pleasure and meaningfulness, it may be important to look into the external referents that explain the why of happiness. These explanatory concepts are important because these ideas can be appropriately used for wellness enhancement programs.

It is believed that there are mainly three factors that affect well-being and happiness, such as the individual, life circumstances, and the set point. Till date, literature suggests that around 50% of the variance in happiness is accounted by genetics and 10% by circumstances. Other factors explain 40% of the variance.

Now the fundamental question concerns as to the source of this 40%. A number of viable explanatory solutions have been offered.

Lyubomirsky, Sheldon, and Schkade (2005) offer evidence suggesting that volitional or intentional effort offer a way to longitudinal upsurges in happiness. Intentional activities are ways that people act on the emerging circumstances and necessitate some degree of strength to enact. The intentional activity influences happiness. For example, some types of behavioural activity, such as regular exercise and kindness to others, are associated with happiness. Similarly, some types of cognitive activities, such as framing again the situations in a more positive way or counting one's blessings are good examples.

Telic or end-point theories maintained that happiness is gained, when a goal is achieved. It is explained that satisfaction of needs or goals leads to happiness and unfulfilled needs generate unhappiness.

According to *Bottom-up theories*, well-being is the sum total of several small pleasures. These theories explain that individuals use some mental computation to total the momentary joys and pain. On that basis they judge whether they are happy or not. Hence a happy life denotes addition of several small pleasures. In contrast, the *top-down approach* assumes that one enjoys pleasure when they are happy, and not vice-versa and this is because of a universal predisposition towards positive experiences.

Further, *associationistic models* comprise of certain theories which explains happiness in terms of associative networks in memory. These theories apply the associative and cognitive principles. People generally recall memories that match their present affective state. Previous investigations regarding associative memory networks point out that people tend to build a strong network of positive associations and a restricted network of negative associations. Thus, an individual with a positive memory network will be likely to respond to most events in a positive manner.

The theory related to classical conditioned elicitation of affect shows that there is resistance to extinction in case of affective conditioning. Hence, happy persons have very

positive affective experiences related with a great number of frequent every-day stimuli.

There is some evidence that individuals give conscious directions to the affective association in their life and reduce negative thoughts. This in turn can increase happiness. For example, remembering positive moments in the morning leads to a happy day.

It has been observed that certain individuals build a strong positive affect network and consistently react in a positive way. These individuals possess a happy temperament. A person who finds positive associations or reacts positively to events in the world, may be said to have a Pollyanna approach to life. Previous literature has shown an association between happiness, positive associations and high scores on Pollyanna personality.

A group of explanatory concepts termed as *judgment theories* maintain that happiness is derived from a comparison between some standard and actual conditions. Such comparisons may be conscious for satisfaction and unconscious for affect.

Judgment theories are classified on the basis of the standard that is used. Social comparison theory explains that a person would be satisfied or happy if he/she is better off than others. Here other people are taken as a standard. Sometimes the past life of a person is also used as a standard and if the present life surpasses this standard, the individual would experience happiness.

In the context of social comparison, proximal others are usually weighed high because of their prominence. Some studies have indicated happiness increases when the downward comparison with less fortunate is used. For example, considering that others live in poor circumstances can enhance one's satisfaction towards life. Sometimes people are satisfied with their income taking others income in the society into account.

On the basis of an individual's own experiences, a standard may be derived. Current events are compared with past events and the person feels happy if present events are better than the past ones. If positive events continue occurring, *adaptation* would take place. According to the principle of adaptation, as and when new events occur, the individual escalates his/her standards, and starts looking for newer events for comparison. The

happiness or unhappiness now would depend on the new events. It has been found that there is no difference between the happiness levels of lottery winners and quadriplegics compared to normal controls. Slowly, people adapt to all events. Research shows that spinal cord injury patients are enormously unhappy after their accidents. Nevertheless, their unhappiness decreases and quickly begins moving back towards happiness, indicating that adaptation is taking place quickly even to this dangerous misfortune.

A provocative theory of happiness (Parducci, 1968) is based on some tested models of human judgment. The models in this theory predict a precise standard against which incoming events are judged. The implications of the model are mainly for individuals who have a skewed distribution of life events. According to this model, the utmost happiness will be experienced by those with a negatively skewed distribution of events. A distribution of events which is positively skewed would result in unhappiness.

The judgment theory which is popular is the aspiration levels. It explains that happiness in an individual's life is a resultant of the difference between actual conditions and aspirations. Happiness is calculated as the ratio of unfulfilled desires to total desires. The theory also postulates that, high aspirations can be as much hazardous to happiness as bad conditions. An individual's level of aspiration is likely to come from previous life experiences, ambitions, etc. Although research supports the idea that the difference between actual conditions and the aspiration level is correlated with happiness, the association is not strong.

Thus, the exploration of the process nature of well-being has identified a number of causal routes. Researchers have attempted to substantiate their own viewpoints in terms of supportive empirical evidence. Yet, a crucial examination of their relative standings is a challenging research gap. In such a critical juncture of scientific explorations, neuroscientific studies of happiness serve as a navigator's compass to move forward in the direction of investigating the happiness experience.

Studies of Brain Mechanisms

Studies of brain mechanisms represent the frontiers of happiness research. Considering the proposition that happiness essentially consists of two major ingredients of *hedonia* (a psychological state of pleasure) and *eudaimonia* (meaningfulness), contemporary brain research has been directed to identify neural correlates of these two ingredients.

Fortunately, recent advances in neuropsychology have identified the neural correlates of hedonia or pleasure components. In contrast, it is relatively more difficult to comprehend brain activity linked with eudaimonia.

As discussed earlier, Eudaimonia refers to the valuably meaningful and engaging life experiences. The objective has been to find out how these experiences are reproduced in patterns of brain function.

Though hedonia processing and eudaimonic meaningfulness appear to be different at the conceptual level, yet empirically they are connected. There is a convergence of high scores on hedonic and eudemonic in happiness in individuals. It is found that 80 percent of people reporting their lives as meaningful also report their life satisfaction as "pretty to very happy". Similarly, 80 percent of people reporting higher levels of total life satisfaction view their lives as meaningful (Diener, Kesebir, & Lucas, 2008). The tendency of pleasure and meaningfulness ratings to cohere together creates an opportunity for studies related to the neuroscience of both aspects of happiness. If pleasure and meaningfulness occur simultaneously in the same individual, by recognizing one neural markers the information about the other can be easily established.

The pleasure aspect is most tractable. Happy people are those who feel more pleasure in life. The simple and best method to measure happiness may be to ask people how they feel at the moment again and again in order to assess their pleasure accumulation (Kahneman, 1999). This self-reports could be used for identifying stable neurobiological brain *traits* that dispose the individual towards happiness.

In the context of identifying the happy brain, the pioneering research of Richard Davidson stands out (Davidson & Begley, 2012; Goleman, 2003). The above research showed that certain areas of the prefrontal cortex (PC) are linked to happy and unhappy states (Figure 1).

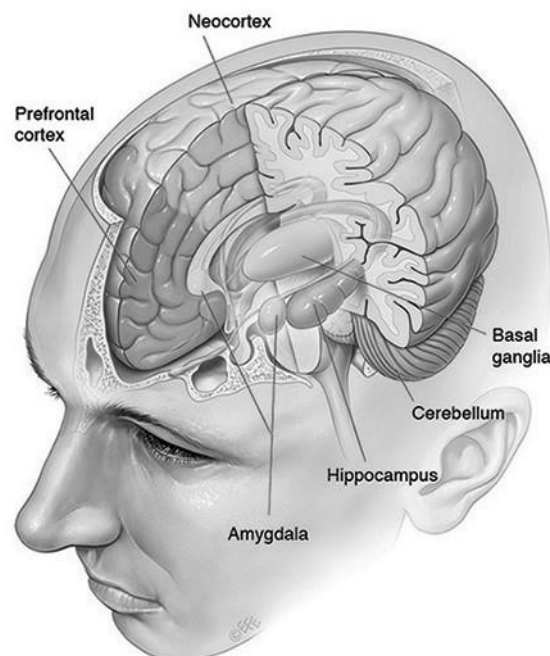


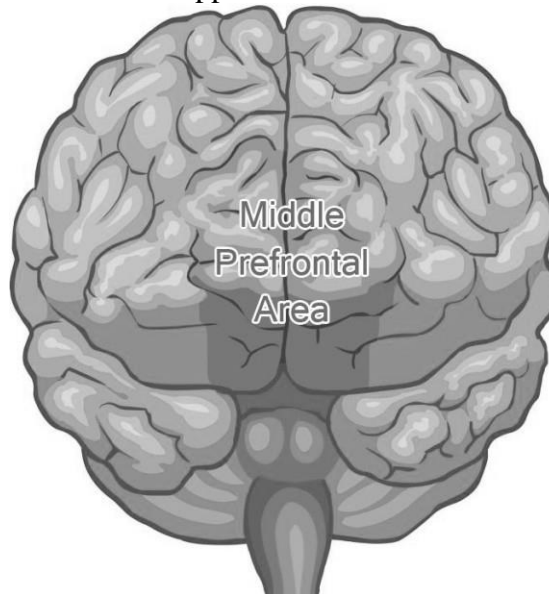
Figure 1. Key regions of the brain
Source. Siegel (2007)

The outermost layer of the brain is called the cortex, and it is larger in mammals, particularly in humans, compared to other animals. The middle prefrontal cortex is identified as the happy brain.

(Figure 2), the left and right middle frontal gyruses (LMFG and rMFG). According to Goleman, (2003), when electrical activity in the LMFG is high it accounts for happiness and when it is high in the rMFG it accounts for unhappiness. While individual's having high levels of electrical activity in the left prefrontal region are able to experience positive states and are able to create a happy life, individuals with high electrical activity in the rMFG report experiences of negative states.

The ratio of left to right activity in the MFG is used as a ratio of brain equation for happiness (Davidson, 2012) and this ratio is found to be fairly constant for any individual. Change in the circumstances, events affects the MFG ratio to some extent and again goes back to the baseline. Thus, people do have happiness set point. It is in consonance with the suggestion that happiness is determined at least 50% hereditary factors.

Figure 2. The key region linked with happiness



Source. Siegel (2007)

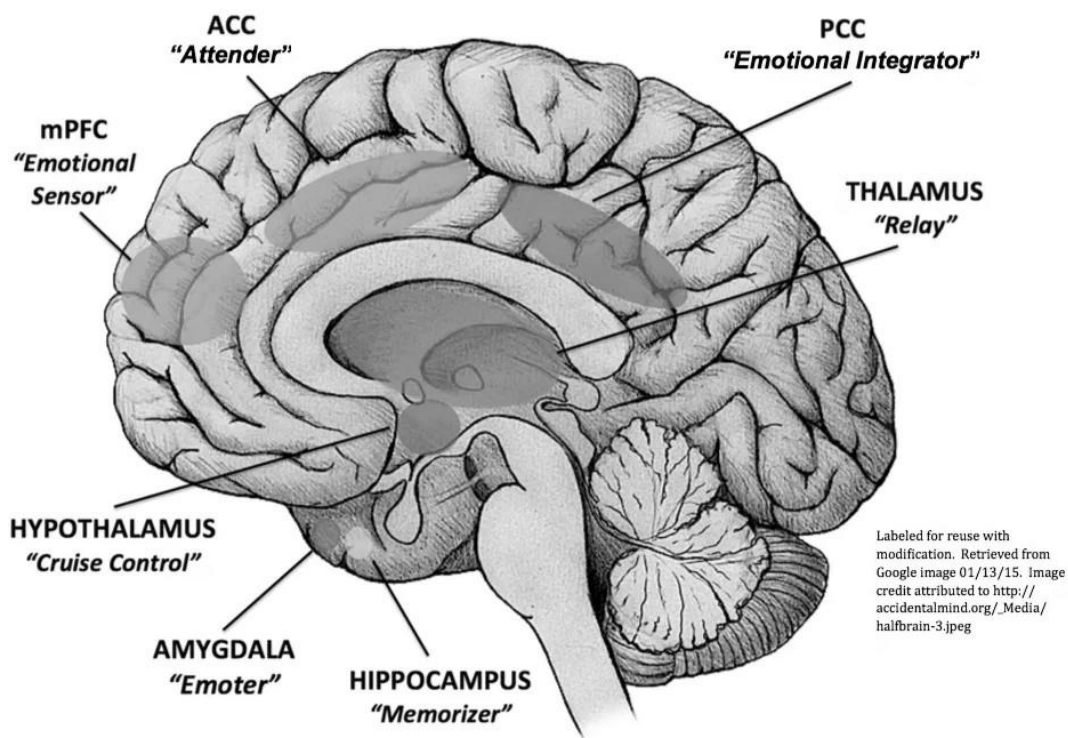
Goleman (2003) reports a number of studies where senior practitioners in the Tibetan Buddhist tradition indicated greater left prefrontal activities. According to Davidson MFG ratio is more reactive to inner conditions than the outer one. This is in line with the Buddhist belief that happiness is successfully maintained through inner discipline.

In continuation to the above research, Davidson conducted research on mindfulness-

based stress reduction (MBSR) program. A Pre and post intervention (daily meditation practice of 45 minutes for 8-weeks) MFG ratio was measured. Results showed that the MFG ratios increased significantly. Participants also reported greater happiness and decreased anxiety. Numerous studies indicate that meditation can result in a significant leftward shift in MFG ratios. Mindfulness training appears to enhance attentional monitoring systems in the brain, supported by the anterior cingulate and lateral prefrontal cortices.

Research suggests that the anterior cingulate cortex (ACC) is centrally involved with attention along the dorsolateral and orbitofrontal regions of the prefrontal cortex (Figure 3). Mindfulness is found to enhance the attention systems in these areas and along with regulation of mood.

Figure 3. The ACC region and other relevant areas



Source. Goleman (2003)

Siegel (2007) evaluated the pertinent literature and concluded that mindfulness uses the same brain circuitry as our social engagement system. We activate the anterior cingulate cortex region (ACC) of the medial prefrontal cortex (MPC) to empathize with others. It appears that mindfulness is a method of internal attunement. The type of attachment infant has with the caregiver, helps in an internal attunement to the brain. Research reveals that brains of adults who had secure attachment as infants, exhibit the same functions as do brains of those who have practiced mindfulness. It is indicative of the higher integration of body, emotion, and thought.

In addition to the significant role of mindfulness and other forms of meditations, another feature of the brain, which is related to pleasure or happiness is *neuroplasticity*. The brain can change throughout life. Learning a new item or playing an instrument is found to enlarge the related areas of the brain, regardless of the age of the individual. The key element is paying attention to the task, which in turn gets mapped into our brain. It is reproduced in the principle: "Neurons that fire together wire together".

A happy brain is found to be to be more flexible. Recent research shows contraction of the dentate gyrus of the hippocampus in individuals with depression, which is the part of the brain that handles novelty (Figure 3). While the brain is ready to receive new stimuli, depressed people do not recognize the novelty. The amygdale and the hippocampus emphasize the old, the painful, and the negative. The changes in the dentate gyrus are observed in all people, because the freshness of the present moment experience improves anyone's mood. Individuals who meditate learn to be happy even in the middle of difficulty. In this sense, meditation is preventive against all forms of depression and unhappiness.

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