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# Where is Human Morality? Is it in Brain or Heart?

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Every of us have hard times in our lives. In those times we feel ourselves to make some tough decisions. Sometimes these decisions like one or another. But I always wonder how many of us ever faced a situation that Sophia had faced in the famous novel by William Styron's "Sophia's choice". In the movie version of the novel, Meryl Streep was playing Sophie; a Polish refugee immigrated to USA after the Second World War. Meryl Streep was highly successful with reflecting the unstable character of Sophie to silver screen. At the end of the movie, we all trembled with the dilemma that Sophie had faced at the concentration camp during war. Sophie allowed getting only one of her two children out of camp with her while she knew that the other little would die. And, she had her decision and her life after this event was a long misery.

Perhaps, Sophie had a very extreme dilemma but how our brains decide in such a dilemma? Do we do just lose or gain calculation? Or do we allow our emotions cloud our computation? These questions are not only for philosophers only but also for neuroscientists. How do we decide in case we faced with emotional engagement situations?

One such a situation is "Trolley Dilemma"; a runaway trolley is headed for five people who will be killed if it proceeds on its present course. The only way to save them is to hit a switch that will turn the trolley onto an alternative set of tracks where it will kill one person instead of five. Thus, the question is "will you turn the trolley in order to save five people at expense of one?" Ninety-one percent of people say "yes" to this question. If we consider another dilemma "footbridge dilemma", the answers of people change dramatically. In this dilemma, someone is standing next to a large stranger on a foot-bridge that crosses the track. Again a trolley threatens five people who

are on the track. And, again these five people are not aware of the trolley. The only way to save five people is to push this stranger off the bridge, onto tracks below. Surely, he will die, but if it is done, five will be rescued as the trolley will stop. Although gain is five in spite of losing one, 81% of people say "I can not push the stranger".

From the psychological point of view, pushing someone to his death as footbridge dilemma is more emotionally salient compared to trolley dilemma in which you are only editing the situation. Thus, it seems that when the emotions are involved in decision making process, "gain-lose" calculation changes as above. But, which parts of our brain decide this?

A group from Princeton University, Center for the Study of Brain, Mind and Behavior addressed this issue in an fMRI study. They found that emotional areas i.e. Brodman's Areas (BA) 9 and 10 (medial frontal gyrus), BA 31 (posterior cingulate gyrus), and BA 39 (angular gyrus, bilateral) were significantly more active in emotionally involved conditions like footbridge dilemma compared to less-emotional situations like trolley dilemma. Interestingly, in the later condition, areas associated with working memory become more active. It is known that working memory is mostly associated with BA 46 (middle frontal gyrus, right) and BA 7/40 (parietal lobe, bilateral).

People who responded appropriately (pushing the stranger onto tracks) decided later than those who responded inappropriately<sup>1</sup>. In non-emotional situations we do not see a delay between appropriate and non appropriate responses. Thus, emotions have some kind of stop effect on decision making processes and impede the right decision.

Basically we decide with our knowledge (parietal and prefrontal cortex mainly) but not without omitting

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<sup>1</sup> "Appropriate" is for more utilitarian

the emotions. Emotions are involved in more personally concerned situations with interference on knowledge related areas. Perhaps, why doctors or decision makers can not decide appropriately in situations in which their relatives are involved.

If our emotions impair our decision making processes in a non-utilitarian way, why humans kept their emotions through their evolution? The answer of this key question might be found in works of Damasio and Bechara. Their observations on patients with bilateral ventromedial prefrontal cortex led them to "somatic marker hypothesis". The hypothesis attributes these patients' inability to make advantageous decisions in real-life to a defect in an emotional mechanism that rapidly signals the prospective consequences of an action, accordingly assists in the selection of an advantageous response option. For Damasio, an emotion is defined as collection of changes in body and brain states triggered by a dedicated brain system that responds to specific contents of one's perceptions, actual or recalled, relative to a particular object or event. Responses range from changes in internal milieu and viscera that may not be perceptible to an external observer (heart rate changes or smooth muscle concretions) to changes in musculoskeletal system that may be obvious to an external observer (posture, facial expression etc.).

Somatic states which refer to the collection of body-related responses that hallmark of emotions induced from primary or secondary inducers. Simply, primary inducers are innate or learned stimuli that cause pleasurable or aversive states. Secondary inducers are entities generated by recall of a personal or a hypothetical event, like thoughts or memories of primary inducer, which when brought to working memory elicit a somatic state. For example, when faced with a spider, an emotion with its somatic states is aroused and coded for spider. That fear object plays role as a primary inducer. When faced with a spider some time later or just imagine it, the same emotion and body-related response are going to be felt again. The latter is secondary inducer. Anybody can wide these examples like facing with snake, had a punishment, or losing large amount of money.

Amigdala, an almond shape nucleus of limbic system plays an important role triggering emotional somatic state for primary inducers. Ventromedial pre-

frontal cortex is a critical substrate in the neural system necessary for triggering somatic states from secondary inducers. In healthy brains two systems can operate together. Insula and somatosensory areas work as if-state under secondary inducer.

The importance of this hypothesis is the way it explains our daily choices. When we go to a market to buy anything or make a chose, the objects under the selection would be secondary inducers. Thus, chooses are result of our previous or innate primary inducers and their later effect as secondary inducer. If an object, as a primary inducer created a pleasurable somatic state, the next time as a secondary inducer helps us to have a decision (for example seeing chocolate in market gives you the pleasure [similar to first time] as if you eat it and with its secondary inducer effect, you decide to buy it more easily with anticipation of having same pleasure). This is also same for aversive state.

Patients with ventromedial prefrontal lesions do not develop anticipatory autonomic responses (somatic emotional responses) and behave as they are insensitive to future consequences (having bad chocolate every time). As these people, do not code emotionally the aversive situations or situations resulted with punishment, they do same mistakes again and again, like addiction or antisocial behavior.

According to Damasio and Bechara, emotions are needed for having correct choices and they should be felt bodily, on the other hand we know that emotions impede the computation of brain during decision making especially personally involved situations. It is clear that we need both our brain and our body for having emotions to give a right (moral) decision for the survival of our society and ourselves.

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