

Q1: When using physiological data in order to determine emotional response, how are these measurements grounded to a specific emotion without using self-reporting? For example, how can we determine that the person is feeling happy when a certain area in the brain is activated in response to a stimulus? Is the solution to simply map the measurements to self-reported feelings? And does this mean that any issues characteristic to self-reported tests are then also propagated to physiological tests?

This is a very good question. In short the answer is yes, self-reports of emotions, whether the emotions were induced by some stimulus such as a movie clip, or self-induced as via imagery, we take the self-reported emotions as the golden standard based on which the classification algorithms are taught. Certainly, for some aspects, such as extent of activation of the autonomous nervous system, self-reports do not play any role, but the connection to experienced emotions (that are always subjective) is ambiguous. It is however an interesting question to what extent persons can consciously access or verbalize their emotional experiences. In this, perhaps some day reading the brain might help.

Q2: (I did not understand) The perspective taking approach and the way it is used

This is fairly simple so I think I failed to explain it in simple terms, and I am glad that this is then asked about so I get a chance to clarify. In this type of experiment, the subjects are instructed to watch a movie clip from a specific perspective. For example, “in the following movie clip, one of the protagonists is guilty of having committed a murder. Your task is to try to determine who this is” vs. “In the following movie clip, your task is to try to think of ways in which the interiors and exteriors could be made more attractive with decorations”. The subjects will then pay attention to different aspects in the movie clip, depending on which perspective they have been asked to assume. Another variation of this is to ask subjects to put themselves into shoes of one or another protagonist, to look at unfolding of events from the perspective of either.

Q3: In the psychological constructionist view on emotions the idea regards how emotions are based on which parts of the brain are activated, and subsequently prior experiences are the basis for emerging emotions. How does this fact relate to prehistorical fears that we carry because of our genetics? If the response works in the same way, then where is the database that links e.g., visual images to brain responses, if such image has never been seen?

In the constructionist view on emotions, the prehistorical stimuli result in core arousal that is then (more slowly) appraised-interpreted cognitively and labeled with an emotion label (conceptualization) depending on context (for example, a tarantella spider in an exhibition behind a glass vs. one in one’s bed at the time of getting to sleep when traveling in some distant country). I had difficulty understanding the next question, but I doubt that there are any databases linking specific images to specific brain responses, like I could imagine in case of teaching of deep networks for example. Also in case of humans, we are more contextually

modulated than for example non-human primates who are more driven by bottom-up (responses are better explained by what there is in the picture with less top-down or contextual modulation).

Q4: I was left wondering how these tests are designed. For example, how was the WCST test conceived, and how are the results guaranteed to be representative of a certain dysfunction?

This is a very interesting question that led me to do some browsing of literature. The roots of this test are more than a 100 years old it seems, with many phases in the development of the final implementation (see: 10.1016/j.bandc.2008.01.006). Clinical validation of a test involves collection of large normative (healthy) data sample and sufficiently large patient sample, based on which one can then determine what is in the limits of normal variation and what can be considered a sign of pathology. This approach is similar to determination of normal variation in other clinical tests such as blood tests. Also similarly to the use of such clinical tests, the clinical neuropsychologist is needed to assess the pathology, based on overall set of findings, which often includes also interviews of relatives.

Q5: Are there any studies focusing on resisting temptations and how this kind of feeling of control can also be rewarding. For example maybe in context of anorexia or such.

A concept that comes to mind when reading this question is *delay of gratification*, which is a classical concept in developmental studies. This means whether a child is ready to wait for some time for a bigger reward (more tasty ice cream) rather than taking the immediate smaller reward (some candy). This concept is related to impulse control. In anorexia, a big issue is distorted body image, the person sees him/herself as obese, even when close to dying from malnutrition.

Q6: I would really love to see data on dopamine and serotonin levels coupled with, for example, natural testosterone / epitestosterone in men and/or their correlation (rise in other levels gains rise in the other and not only the initial releasing concentrations). Has this been studied?

This is a very good question. There is a wealth of literature, especially in animal models, linking testosterone levels with both DA levels and 5-HT levels, with some studies finding stronger couplings between these systems in males than females. DA and T links have been studied for example as relevant for novelty seeking, while T and 5-HT interactions have been linked to aggression.

Q7: Do some emotions cause stronger response in studies than others or is the response only dependent from the strength of the stimuli?

This really depends on the stimuli, for example movies and narratives give more robust emotions than pictures, and some emotions are more difficult to elicit (also) with movies and narratives than others. For example, anger has been challenging (though not impossible) to

elicit in the scanner. Success in this can be accomplished by for example showing politically heated videos to subjects who hold politically opposing views. Typically, disgust is easiest to tell apart from other emotions based on brain activity patterns.

Q8: have there been any studies of the correlation between “personality tests” (like maybe Myers-Briggs) and cognitive/executive functions?

Personality and executive functions in some ways overlap as concepts, for example, if someone is extrovert or sensation seeker, then he/she might show up as having less impulse control on tests (though certainly below clinical threshold) than someone who is for example neurotic. Certainly this also depends on the type of executive function test that is administered. I found a study from 2016 that reported some connections between personality and self-reported executive function challenges, however, the same study failed to find correlations between personality features and performance in a number of executive tests, so while there is a connection, it is not a strong one it seems (<https://psycnet.apa.org/fulltext/2015-31819-001.html>)

Q9: I once read a long time ago, that the parts of the brain that handle cuteness and anger are located closely or somehow connected to each other, which is why we can sometimes feel like a thing is so cute we want to punch or squeeze something. Is that true, and if it is, are there other similar “weird” emotional connections in the brain that don’t necessarily make sense?

This is an interesting hypothesis along the lines of semantic priming – semantically close-by concepts facilitate each other, so if one is presented a picture of an animal as opposed to that of a bucket, there are faster reaction times to e.g. determine whether the word “cat” is a real or a pseudoword. As was shown earlier in this course, semantically close concepts are located nearby each other in the brain too, and there could be spread of activation to nearby concept representations that facilitate their processing. This makes also sense in case of language since what we face in this world is often semantically related, i.e., if a conversation runs on dogs, what comes up in that conversation semantically often relates to dogs. It is interesting to think that similar could take place in case of emotions. Classically, it is often said that fear leads to anger, but this is a bit different as it is a way to control fear to become angry.

Q10: Why is it that when sometimes I set to do a certain simple short task with a clear goal, I can completely forget what I was doing and a few moments later remember this task again? eg. I want to check the weather from my phone, but when I open the weather app, I forget to check the weather and just close the app and start to do something else and a few moments later I remember that I wanted to check the weather and do it again. (Or maybe it’s just me)

I think this is so very common, at least during times when my own schedules are the most hectic, this happens so often. It could be a sign of stress that when acute is quite ok, but if prolonged can lead to even severe problems with brain health. It is very important to have some more restful periods every now and then in order to maintain good brain health.

Q11: Based on the amygdala's part in personality and decision making, I was wondering if changes in one's behavior, for example a person going to anger management or a conservative person gaining a more liberal view has anything to do with the amygdala directly? Does the size of it change, are some emotional regulation networks changed? Or is the underlying mechanism more rooted into some behavioral or emotional change, since the amygdala appears to play a larger role in emotions – as presented later in the lecture?

I am not aware of findings describing size changes in amygdala with therapy such as anger management training, but I would anticipate such to take place, given findings of structural changes in the brain following exposure/training etc. For example in a study that received a lot of publicity at the time, London cab drivers were noted to have larger hippocampi than control subjects, this was hypothesized to be due to London cab drivers being prohibited to use navigators (at least at that time) and having to find their way in a fairly complex environment.

Q12: Empathy was divided into two sub-classes: cognitive and emotional empathy. How are these defined or what is the difference between them?

Cognitive empathy is often equated with Theory of Mind, putting ourselves into the shoes of others to understand their thinking and feels (taking perspective of the other), emotional empathy means feeling the same emotion as the other person is feeling.

Q13: Do diseases other than Parkinson's effect the basal ganglia? If so, how? What other diseases effect executive functions?

Yes, for example, in Huntington's disease basal ganglia are gradually destroyed. There are many diseases; strokes and dementias to name the most common, that affect executive functions. Korsakoff's syndrome is caused by chronic alcoholism resulting in brain damage.

Q14: How does eye movements and personality correlate? What "criteria" is there to fit some eye movement into a certain personality trait etc.?

This was not readily or in any straightforward manner disclosed by the results in the article. Often machine learning finds from complex data ways to predict into which class a given dataset belongs, and then there is the problem of black box – what actually caused this remains obscure. This is something to figure out in future studies and will be very interesting to see.

Q15: In the case of emotional regulation, I was wondering what the prefrontal cortical mechanisms used in fear repressions are specifically.

It is thought that prefrontal areas inhibit the response of the amygdala (that would otherwise set forth cascade of effects) in cases of sudden fear-evoking stimuli.

Q16: If person's personality will change after an injury, is it possible that it will change back to what it was while recovering? Or can this change happen only in one way?

Certainly this is possible, for example, a person who became more impulsive, once recovering might become again more reserved.

Q17: Are there examples of patients with failure in executive functions that do not have damage due to an accident?

Yes, definitely, strokes (arrest in blood supply resulting in death of neurons due to lack of oxygen in the tissue locally) are by far more common causes than accidents. Nowadays, if a stroke patient can get to proper treatment within 3 hours of the occurrence of the stroke, the prognosis is rather good as the blockade in the artery can be removed quickly (for example in Helsinki University Central Hospital).

Q18: Related to receptive fields...What happens when the neurons that have been a part of a network that processes a specific stimulus are destroyed? Naturally we get disturbances in that function and processing but what actually happens on the neural level? And how much is there actually to do about it?

When damage occurs, glia cells clean the dead neurons away and there is then of course the loss of function, but the exact problems can be surprising since one has to appreciate that what happens is that a specialized node is lost in the network, a node that is used for many different purposes (kinds of "computations") also other than sensory processing (e.g., also in imagery) as part of a larger network of nodes.

Q19: As for Stroop test I would think normal people also make mistakes in it, unless told to be particularly precise and not get anything wrong. But of course the amount of mistakes would presumably be notably higher for people with deficits in executive functions?

The patients with problems would be quite slow and/or do many errors. Patients with executive function problems often would have difficulties in detecting their errors.

Q20: if 'internal speech' is considered part of executive functions, then can we already based on this predict that people with aphasia will have problems with executive functions? Of course internal speech is not always maybe strictly language based?...And how to tell these apart (language problems and executive functions) in diagnosis?

This is a very interesting question, it seems that internal speech (or some aspects of it) is preserved in some aphasia patients (doi:10.1001/archneur.1986.00520060053017). Indeed internal speech is not always strictly language based. Diagnostics is often challenging, but overall doing worse on language tests vs. executive function tests forms the basis in clinical practice.

Q21: my question is about conscientiousness as I think that this personality trait is directly connected to the ability of a person to execute certain task properly, for example, people who are high in conscientiousness tend to succeed in self-organization, planning, time management. Are there any non-questionnaire methods to assess person's level of conscientiousness and methods of even improvement one's level of conscientiousness, because conscientiousness tends to be a key factor in university studies' success? Also, is it possible to predict openness to experience by analyzing eye movement of a person or brain images during a certain task? Do you think it is even possible to assess person's personality without questionnaire and self-assessment? And last question: why we can quite reliably and objectively assess human intelligence, but not personality traits?

On conscientiousness: observation of behavior is of course an even more valid way to assess this personality feature, as questionnaires depend on persons reflecting the questions and recollecting instances of their own past behavior, also prone to shortcomings in self-perception. The same applies to assessing of openness – I would say the questionnaires are highly useful and also to some extent reliable and valid. Assessing of personality based on eye-movements is not at least yet a standard practice, more initial exciting and interesting results. Assessing intelligence is actually also quite challenging. We have standard IQ tests but it is contested whether they measure intelligence and what is intelligence.

Q22: The study revealing that e.g., politically conservative subjects had larger amygdalae – did the researchers provide evidence to infer causation and not just correlation? What would be underlying mechanisms causing these anatomical changes? Or (causation the other way around) would a larger amygdala make people more prone to being politically conservative, thus reluctant to change?

As far as I am aware, the findings of amygdala size variation with political conservatism-liberalism (in the US system) is a correlational one. The basic idea is that conservative people tend to have larger amygdala structures and thus better able to detect dangers in the environment, and thus more reluctant to accept changes, as such bring potential problems with them. Whether this is caused by up-bringing or other early experiences cautioning against dangers and leading to larger amygdalae or genetic influences resulting in larger amygdalae that then predisposes persons to conservatism is an open question.

Q23: What is the current consensus on the psychological constructionist view? Apparently, in "everyday psychology", the locationist view seems to prevail.

This is hotly debated. I think the truth lies somewhere in the middle ground. For example, we know that by stimulation of certain receptors in the brain, we can induce euphoria (beta opioid receptor agonists), dysphoria (kappa opioid receptor agonists) and fear (cholecystokinin receptor agonists), and some structures are more important for some emotions than others. However, I would say that the reconstructionist theory is much better at explaining experienced emotions than strictly localizationistic theories.

Q24: As we talked about the working memory and its location in the brain I was wondering if it was still mainly located in the hippocampus as we learned in a previous lecture? And the processing of new and old information just involves a lot of other brain areas?

Working memory is a function not easily localized to any single structure

Q25: Would a patient with prefrontal cortical brain damage be aware of the interference errors they are making when they are performing, for example, the stroop test? Do they, based in the interference, unconsciously change the assignment for themselves?

Not being aware of errors (“lack of insight”) is often part of the problem in these patients.

Q26: In the Wisconsin card test: how do they patients respond? I can only imagine becoming very frustrated as you keep getting negative feedback. However, since for those patients have problems with the working memory and the pathways that process positive and negative feedback, would they feel/respond the same way? Is it a matter of not making the connection that the pattern has changed?

The patients, depending on the type of damage, can have a variety of responses, some might become frustrated, some not care at all.

Q27: Thanks to the plasticity, is it possible to recover the executive functions even though the prefrontal cortex is damaged?

This is possible though executive functions such lack of inhibition or lack of insight are often the most difficult ones to rehabilitate. Feedback signals (“that behavior is inappropriate”) can over time help the patient.

Q28: Is it possible to lose the ability of feeling an emotion because of a brain damage?

This is possible, for example, there are interesting cases with amygdala lesions who lost their ability to be afraid/wary of dangerous situations and ended up in dangerous situations due to that.