First of all – thanks for useful feedback; some things were added on mycourses and more will be added ☺ We will also have a few breaks e.g. in the form of mini-group discussions. Lecture #1 materials were not covered entirely since we ran out of time, but this is ok, these 6 lecture sessions are all used as time to cover everything and there should be enough time for this ☺

Below some questions from your learning diaries along with short answers. Please note I reformulated / shortened some of the questions, and merged some together when two or more asking the same. Thanks for submitting such excellent questions ☺

Question: (On eye movements) I wonder what we look first when we see a whole human, instead of just a face?

If the person is close enough so that we can see his/her face, especially eyes and mouth region clearly, eye-movements tend to fixate on these, as they carry a lot of socially relevant information in the form of communicating emotional states and gaze direction (which tells about the intentions-attentional focus of another person; for example, angry-looking person looking directly us vs. fearful person looking to our left tell very different stories). When a person is in distance, attention could be paid to for example gait (walking style) as that holds information with which it is able to identify a person. Overall, our goals (looking for a friend in crowd vs. trying to be wary of potential muggers in a shadowy alley) very much influence our eye-movement patterns when scanning the environment. Also, personality features have been shown to predict patterns of eye-movements in natural environments, as studied with wearable eye-movement glasses.

Question: What are some current trends or directions that research on attention is taking?

There are many areas of development in attention research, perhaps the most interesting are some recent studies on how attention is deployed in natural(istic) stimulus environments, and how attentional resources are allocated over time. Also, selective-attention type of AI is being developed for robots including autonomous driving vehicles with insights and inspiration from human selective attention processes.

Question: What is the difference between involuntary- and unselective attention?

Involuntary attention refers mostly to processing of the unattended when we selectively attend; unselective attention is broadening of “spotlight” of attention to detect better stimuli in a wide variety of locations for example.

Question: What is the difference between shifting attention and divided attention?

Voluntary shifting of attention (attending first one and then another) is the basis for divided attention as one shifts attention back and forth between two or more to-be-attended inputs.

Question: Are most disturbances of attention a result of a disease/tumor/trauma or can one be born with an attention deficit, for example prosopagnosia or associative agnosia?

Yes, congenital prosopagnosia, agnosia ja visuospatial perceptual difficulties reminiscent of unilateral neglect have been described.

Question: I wonder if shifting of attention is also when we are mind wandering, like when practicing mindfulness?

Yes, attention is then shifting about internally, from one topic to another. Perhaps the closets to voluntary attention shifting in this case are instances when one decides to shift attention, as to perform a memory search when something relevant has popped to mind.

Question: if one of two concurrent tasks is automatic, is there divided attention?

In case of fully automatic task, one cannot speak of divided attention in the real sense of the word, however, even for fully learned tasks, when something goes wrong or there are some challenges introduced (e.g., walking on icy slippery surface), division of attention takes place.

Question: Covert and overt attention not opposite of each other?

This is true, covert attention simply means that deployment of attention is independent of concurrent fixation of eyes, i.e., we can look straight ahead, but attend an object in the area of visual field on the side.

Question: Neurotransmitters (DA, 5-HT, NE) and attention: do they work also via motivational factors?

Yes, this is a very good point. A person who has developed an addiction for example, is strongly guided in his goal-directed behaviors by those addictions, including attention. A gambling addict will definitely spot and remember where there are slot machines in the nearby store, whereas someone else would not even notice. Overall, our motivation guides our attention in daily life both to external stimuli and internal flow of thoughts. The neurotransmitters DA, 5-HT, and NE; especially DA (dopamine) play crucial roles in this.

Question: It seemed that many of the disturbances of attention in neurological patients had to due with inability to recognize objects, voices, faces etc. and I was wondering what it the difference between disturbances with attention and disturbances with memory since recognition has to with a memory of experiencing, seeing, hearing etc. the concerned target before (or are they basically just same thing).

Indeed attention and memory are coupled very intimately, but they are not the same. For example, lesions of fusiform face area can result in prosopagnosia (inability to recognize faces) and while it is not exactly understood how fusiform face area processes faces, there is evidence

indicating that this area holds face representations that are one form of memory. In this case, destruction of such representations can result in inability to recognize faces. The case of unilateral neglect is a good one demonstrating how attention can be independent of memory (representations).

Question: It was not completely clear to me why it is important to understand the parts of brain that are responsible of each of the disturbances, in other words, how does identifying the locations help?

Identifying the locations is one of the first tasks when trying to understand how the brain works. It is true that this in and by itself does not provide any ultimate answers, but can already give some important information. For example, based on the locations involved being different, we know that involuntary attention shift and voluntary attention shift are differential phenomena. Findings that help understand mechanisms constitute one step further, for example, studies showing how selective attention is associated with modulation of "filter settings" (modulated receptive fields) in primary sensory cortical neurons.

Question: I did not quite understand how the distinctive forms of attention can be applied to business, as the text and lecture mostly discussed the example of a cocktail party.

This is true, application of the information to different areas is very important and challenging too. Digital marketing cases might be something where attention research could be helpful, as well as when building smooth man-machine interfaces.

Question: Colour agnosia is very hard for me to imagine.

I looked this up in a bit more detail and I find descriptions of patients who cannot remember which color banana or tomato is, or provide lists of things/items that are red. Color vision would be intact (ability to match colors is ok). It is a good question whether the person can obey red traffic light, though on this it helps that the location of the red light or extra symbolism (walking man vs. man standing; or in US "don't walk" vs. "walk" texts) helps the patient.

Question: does internal and external attention stimuli look different in the brain? Like if my attention switches between two memories rather than two visual cues?

Yes, these do differ. Internal attention (e.g, mind wandering) seems to involve so-called default mode network (VMPFC and precuneous along with parahippocampal cortex) whereas attention shifts to external seem to involve posterior-lateral parietal cortical areas also referred to as "dorsal attention network".

Question: Could it be possible for a migraine to produce the same damage (as unilateral neglect) temporarily, or do migraines have some other method to produce similar effect?

Indeed, migraine results from short-lived often painful-throbbing (though pain not as commonly included as thought) constriction of blood vessels that bring oxygen-rich blood to brain tissue. Depending on the location of migraine attack in the brain, a variety of temporary effects can take place like scotomas (partial loss of visual field which is readily perceived as such) and visual auras in case of visual cortex, but a host of other effects when blood vessels in other areas of the brain are affected. Cases of unilateral neglect during migraine attack have been reported.

Question: How does attention to internal mental processes work as there are no stimuli in the same sense as external stimuli have?

As I will explain on next lecture on memory, we have an associative machine in default-mode network of the brain that draws materials from memory via associations and creates new memories, useful scripts then stored for potential future use. So mind-wandering when we "do nothing" is actually often useful in the future. To answer the question, attention is directed then to memory materials when directed internally, activating memory-retrieval processes.

Question: I wonder, how exactly the neuronal mechanisms are different depending on whether the person has ADHD? And in the case of ADD?

ADD diagnosis was described as inattentive, passive, and ADHD more hyperactive, reacting to the outside world with inability to focus attention. As I checked into this, today these both fall under the category of ADHD, though in psychiatry (or neuropsychiatry) where diagnoses are based on symptoms the diagnostic classes from time to time change. In ADHD, stimuli capture the attention of the person more easily than in healthy individuals, selective attention fails. Environments with less distractors help them, as well as amphetamine based drugs. Interestingly, there are some views according to which ADHD is more a developmental delay.

Question: I was wondering if the disturbances in attention can be treated or the symptoms mitigated?

Overall, rehabilitation, guided repetitive training of the lost function are in most cases effective, like in case of unilateral neglect in the video shown last time. Another alternative are e.g. electronic aids helping patients. Stem cell therapies are yet another, very interesting, new approach in certain conditions like Parkinson's disease.

Question: Regarding unilateral neglect: How do researchers practically differentiate this disorder and visual system defects, such as hemianopsia that also can be described as inability to interpret something taking place on the particular side?

In neglect, the patient is not aware that the left side is there, in hemianopia there is loss of visual field on one side; patient is aware that he cannot see things on the affected side.