PSYC 200
LECTURE 9
FEB 8TH 2016
STATES OF CONSCIOUSNESS

Consciousness and Information Processing

- **how do we define consciousness?**
  - awareness of ourselves in our environment, experiences are subjective, perceptions of colors can vary from individual to individual
- **what is phenomenology?**
  - this is the study of individual consciousness that addresses subjective experience

- **levels of consciousness**
  - **altered states of consciousness**
    - some occur spontaneous (daydreaming, drowsiness, dreaming)
    - some are physiologically induced (hallucination, orgasm, food or oxygen starvation)
    - some are psychologically induced (sensory deprivation, hypnosis, meditation)
  - **minimal consciousness**
    - partial consciousness, not aware about everything happening around you
  - **full consciousness**
    - meta cognition: thinking about your thoughts
  - **self consciousness**
    - most aware state, every time you look in the mirror you enter self consciousness, recognizing yourself in the mirror is a state of self consciousness

- **Non conscious, pre conscious, and unconscious information**
  - **non conscious activities:** examples like heartbeat, breathing, blood pressure, hormone production, protein synthesis
  - **pre conscious:** info that exists outside of your awareness but you have access to this info, you can take this info and bring it into consciousness on demand, example: remembering the name of grade 1 teacher (you weren't thinking about it but when asked/needed, you can provide the info)
  - **unconscious info:** sigmund freud, believed that our unconscious info was so threatening that we had to remove them from our conscious, example: something traumatic that occurred to you in the past/when we were young, physical abuse, abandonment, Freud believed that we take all this negative info and we bury it in our unconscious and this affects our behaviour without us realizing, we 'bury' this info through a process known as repression
  - **cognitive unconscious:** can be thought of as a collection of mental abilities/processes, affects how we act/think/feel, even though we are not aware of this stuff it still affects us throughout our daily activities, subliminal messages: example: messages are flashed on the movie screen so rapidly that we don't pick them up but our unconscious does, messages would implore audience to buy snacks and allow movie theatres to make more money

- **Survival advantages of consciousness**
  - **the restrictive function:** an aspect of consciousness that allows us to direct our attention, or conscious focus, on one stimulus or perception at a time
    - example: writing test, you try to keep focus on questions and their answers, you are not preoccupied by the feeling of your shirt on your skin or the contact of your chair with your butt
  - **selective storage:** an aspect of consciousness that allows us to selectively analyze, interpret and act on stimuli
    - selective attention, very similar to restrictive function, changes over time/with experience
    - example: as you get better with driving, certain behaviours become automatic (seatbelt, where we place our hands on the steering wheel)
  - **executive control function (Planning Function):** an aspect of consciousness that allows us to inhibit urges that are not moral, ethical or practical
    - analyze and evaluate your thoughts before you act on them, important aspect of human behaviour that allows us to act in a civilized manner, right from wrong, however it isn't the fastest of functions, happens in a very serial manner (A-->B-->C), found in pre-frontal cortex
    - example: given a list of things to buy in a mall, people with damage to pre-frontal cortex did not know to go to the hardware store to buy a hammer or to go to the grocery store to buy a banana

Sleep

- it is a readily reversible state of reduced responsiveness and interaction with your environment, it is a voluntary loss of consciousness, exists in all of the livings organisms because it is key to survival
- associated with very complex brain functions, it isn't the brain shutting down

- **Circadian Rhythm**
  - coordination of behaviour with this rhythm, the result of a biological clock that regulates your bodily functions on a daily cycle
  - most physiological processes have a particular rhythm
  - alertness is at the top, low in the morning and tends to peak around noon and begins to dip until nighttime
  - body temperature peaks just before you go to sleep, reaches lowest point just before you wake up
  - growth hormone production peaks at night when we sleep
  - cortisol release (hormone, ensures the availability of energy to the body) is at its lowest level just before you go to sleep and peaks in the morning
  - as we get older, our arousal peaks earlier throughout the day (9AM-10AM), for younger people, peak arousal happens around 1PM-2PM
  - circadian rhythm is affected by certain neurotransmitters in the brain like dopamine, changes in dopamine levels inside of the brain influence the synthesis of certain proteins that regulate your circadian rhythm

Suprachiasmatic Nucleus

- **Melatonin**
  - when we remove the daily cycles of daylight and darkness from someone's environment, the circadian rhythms continue more or less on a 24-hour cycle
  - the primary clocks for the circadian rhythm are not celestial (do not need the moon/sun) but they are biological
  - this clock is controlled by the suprachiasmatic nucleus which is a group of neurons found in the hypothalamus, it receives direct input from the retina, pineal gland, pituitary gland (to name a few)
  - when it is dark/your eyes are shut, the s. nucleus stimulates the pineal gland to produce melatonin
  - melatonin is a hormone that helps keep you asleep whereas the brainstem releases adrenalin (also stimulated by the s. nucleus) to keep you awake, more adrenalin increases cortical activity
  - adrenalin is light stimulated, melatonin is dark stimulated (REMEMBER)

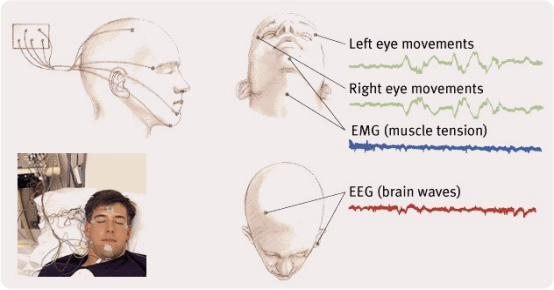
Sleep is an Active Process

several hours of wakefulness --> accumulation of adenosine (a sleep substance) --> sleep

- adenosine is produced by the hypothalamus
- neurotransmitter in the brainstem synthesize and release serotonin, which stimulates hypothalamus to produce adenosine
- when adenosine levels reach a critical level, you fall asleep
- when you sleep at night, the adenosine previously released is destroyed and returned to a base level and thats when you wake up
- reason why you can't fall asleep after drinking coffee is because caffeine blocks adenosine receptors
- turkey contains high content of serotonin (you feel sleepy after eating it)
- milk contains serotonin (drinking a glass before bedtime helps us fall asleep) however there is not enough of it in milk to actually put you to sleep, you would need 80 glasses of milk for it to have an effect on you

Measuring Sleep Activity (EEG Machine)

- **brain wave characteristic**
  - **amplitude:** size of the brainwave (microvolts)
  - **frequency:** number of oscillations over a given period (Hz, cycles/second)
  - **morphology:** the shape of the wave/how they look, combo of both amplitude and frequency



Traditional Classification of Brain Waves

- **Beta:** small amplitude/size, high frequency, produced when alert and working
  - amplitude --- frequency +++
- **Alpha:** medium amplitude and frequency, produced when you are relaxed and reflective
  - amplitude +- frequency +-
- **Theta:** higher amplitude, smaller frequency, produced in shallow stages of sleep (drowsy, meditative)
  - amplitude ++ frequency -
- **Delta:** higher amplitude, really small frequency (inverse relationship between magnitude and frequency), produced in deep stages of sleep (not dreaming, dreaming is a combo of beta and alpha waves)
  - amplitude +++ frequency ---

Functionally Distinct Brain States

- **wakefulness**
  - **EEG:** small amplitude, high frequency
  - **sensation:** vivid, external origin
  - **thoughts:** parasympathetic/sympathetic activity, logical, progressive
  - **movement:** continuos, voluntary
  - **rapid ocular movement:** frequent
- **slow-wave sleep**
  - **EEG:** large amplitude, low frequency
  - **sensation:** absent or very attenuated
  - **thoughts:** parasympathetic activity, logical and repetitive
  - **movement:** occasional, involuntary
  - **rapid ocular movement:** rare
- **paradoxical sleep**
  - **EEG:** small amplitude, high frequency
  - **sensation:** vivid, generated internally
  - **thoughts:** sympathetic activity, vivid and illogical/strange
  - **movement:** muscular atony, movements ordered by the brain are not realized (paralyzed)
  - **rapid ocular movement:** frequent (one theory is that you're following images/sequences that are going on in dream)

Sleep Stages

- **stage 1:** light sleep, mostly theta and a few alpha waves
  - associated with hypnagogia which is the transition between wakefulness and sleep
  - this period is characterized by several things:
    - 1) hypnagogic jerk: involuntary muscle movements before sleeping
    - 2) feelings of floating weightlessly
    - 3) exploding head syndrome (RARE): when the person hears a loud bang just when they fall asleep
- **stage 2:** light sleep, mostly theta
  - associated with sleep spindles which is a sudden burst of brain activity (characterized by increased brainwave frequency/magnitude), its function is unknown, according to some, these spindles represent a period where the brain is inhibiting the processing of outside stimuli so as to keep you asleep, happen very early on in the night
  - also associated with K complexes, they occur spontaneously, function is the same as sleep spindle, surpasses brain activity in response to outside stimulation, happen very early on in the night
- **stage 3**: mostly delta and a little bit of theta (deep stage of sleep)
- **stage 4:** delta waves (deep stage of sleep)
- **REM/Dreaming stage:** mix of beta and alpha, paradoxical sleep

Sleep Stages (important slide #15)
sleep cycle consists of stages 1, 2, 3, 4 and REM
sleep cycle is known as ultra radiant rhythms because they take less than 24 hours to complete
sleep: 75% slow wave and 25% REM
an entire night's sleep is a succession of different sleep stages (REMEMBER)
cycle repeats itself every 90 minutes
important things to remember:

- 1) first half: we spend most of our time in stages 3 and 4 and less time in 1 and 2 and REM sleep
- 2) second half: we spend most of our time in stages 1 and 2 and REM sleep and less time in stages 3 and 4, this happens because it is really hard to wake up from stages 3 and 4 (deep sleep)

sleep walking becomes less and less frequent as we get older because we spend less time in sleeping and we spend less time in stages of deep sleep
there has to be a 30 min break between dream stages, 25% REM sleep represents 2 hours of dreaming in a 8-hour sleep cycle
the inner ear is always active, it allows us to detect any sort of danger, we are much more sensitive to relevant stimuli (whisper name into sleeping person's ear and their eyes will instantly open)

Variations in Sleep Pattern
as we get older, we spend less and less time sleeping - less time in REM sleep
infancy (1 day old to 2 years old): there is a marked drop in REM during this period, 16 h asleep to 12 h asleep
example: grandparents always call you asking you how to use their cellphones even when you already explained it to them because the information is not properly stored/integrated due to lack of REM sleep
sleep patterns of identical twins were much more similar than those of fraternal twins (twin studies)
if you're allowed to sleep for as long as you want to, chances are that you will sleep 9 hours a day (if you have a