COGNITIVE NEUROSCIENCE

Implicit vs. Explicit Learning Activity

Emile Bruneau

Knowledge of the psychological world of humans and other related species is far behind that of the brain-mind system –Cognitive psychology

This activity on cognitive learning could be quite relevant to educators

To be an effective teacher one must have good teaching strategies, and teaching styles. Those come in many different flavors. Conversely there are various leaning styles and learning strategies. By understanding how best a particular student can learn a course material a teacher can get better results.

Is all knowledge due to a conscious processes, or is some knowledge acquired by unconscious processes?

What is explicit/implicit learning?

Implicit learning: Passive process
people acquire knowledge of new information through exposure.

Explicit learning: Active process
people seek out the structure of any information that is presented to them.

*Implicit learning is acquisition of knowledge about the underlying structure of a complex stimulus environment by a process which takes place naturally, simply and without conscious operations. Explicit learning is a more conscious operation where the individual makes and tests hypotheses in a search for structure. Knowledge attainment can thus take place implicitly (a nonconscious and automatic abstraction of the structural nature of the material arrived at from experience of instances), explicitly through selective learning (*Nick C. Ellis)

Is implicit learning easier than explicit learning?

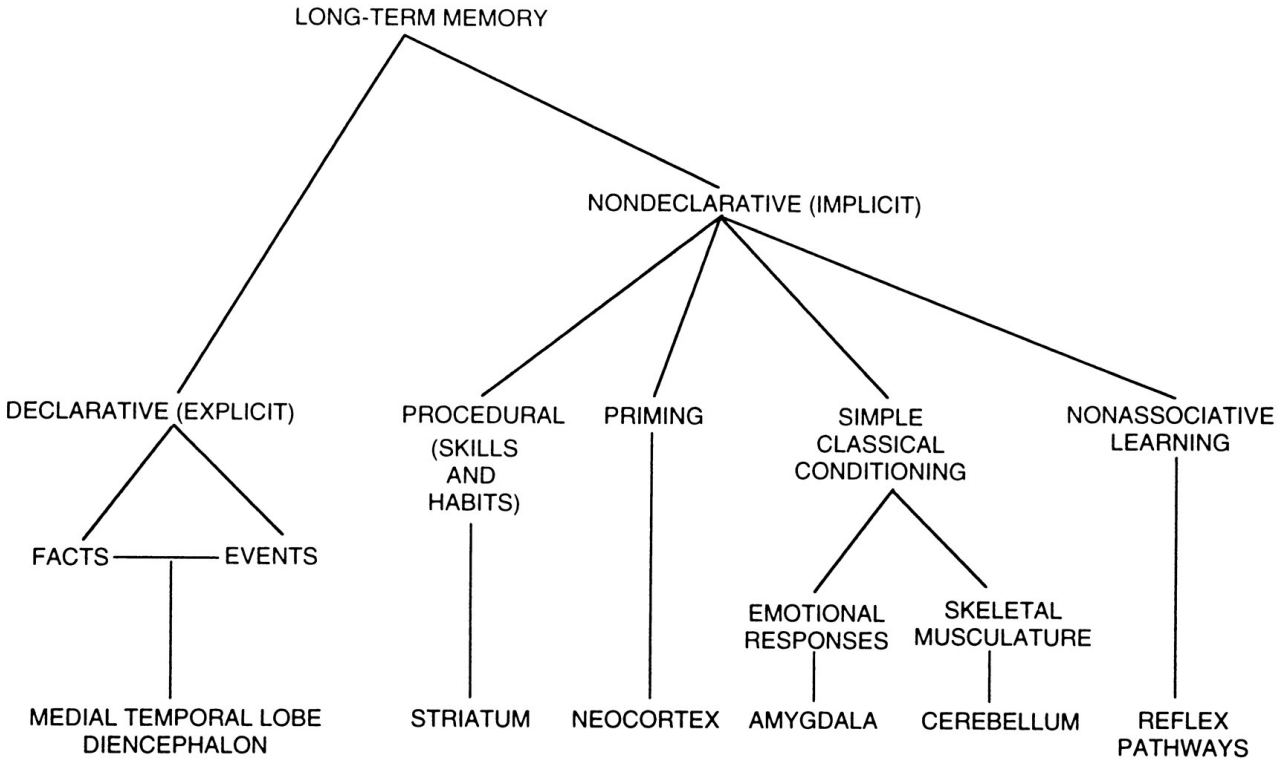
Can explicit and implicit learning be separated or are they interdependent with one being more prevalent that the other depending of the learning context?

Explicit learning and memory

Implicit learning (IL) is nonepisodic learning of complex information in an incidental manner, without awareness of what has been learned.

Does *explicit* learning lead to *implicit* knowledge?

Explicit vs. implicit learning chart



www.pnas.org/content/93/24/13515/F1.large.jpg

Specialists define **learning** as a process that will modify a subsequent behavior.

Memory, on the other hand, is the ability to remember past experiences.

You learn a new language by memorizing words. When you speak it you use your memory to retrieve the words that you have learned. Thus, Memory is essential to all learning, because it allow for storage and retrieval of information. But learning also depends on memory, since the knowledge stored in your memory provides the framework to which you link new knowledge, by association. The more extensive your framework of existing knowledge, the more easily you can link new knowledge to it.

Learning is a relatively permanent change in behavior that marks an increase in knowledge, skills, or understanding thanks to recorded memories.

Human memory is fundamentally **associative.** It is easier to remember new information if it is associated with previously acquired knowledge that is already firmly anchored in memory. The more meaningful the association, the more effectively it will help remember.

Implicit/explicit learning lab
Instructor: Emile Bruneau

Work in teams of 3: Emile Bruneau will first show you the activity. Each member of the group will then perform the activity while the other two members of the group record the results.

After each group has performed the activity we will reconvene to discuss how to make this activity a useful teaching tool in the classroom. We will discuss ways of making this a quantitative exercise and plotting results.

MATERIAL:

Goggles:

(get some cheap ones like this at your local hardware store)

Fresnel Prisms for goggles: (http://west-op.com/pressonprism.html)
(approximately 20D correction – 2 of the SAME DIOPTER per pair of goggles)

Target board or bucket

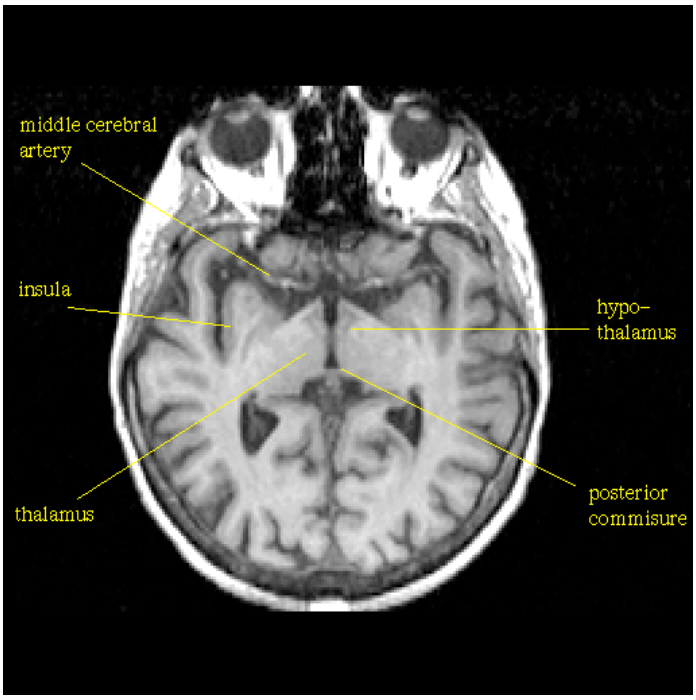
http://www.allthingscornhole.com/cornhole-boards?src=ggl&cmp=2&grp=1&ad=2&gclid=CILw8bmKv5oCFQyVFQod3SwWrg

Canvas Bean Bags:

http://www.centurynovelty.com/detail_56_163-404.html?mr:trackingCode=83E16236-0319-DE11-B0EA-001422107090&mr:referralID=NA

BRAIN IMAGING, BRAIN FUNCTION, and COGNITION

Functional MRI -fMRI and EEG



MRI pictures from http://www.med.harvard.edu/AANLIB/cases/caseB/tab10.html

functional MRI

Wednesday July 22 and Thursday July 23, Morning sessions

Brain tumors, injuries or psychiatric illness can affect the normal brain activity like reasoning, motor control and consciousness. Imaging techniques are used as a non-invasive method of visualizing the brain's structure, activity and function.

Magnetic Resonance Imaging (MRI) is the state-of-the art non-invasive imaging technique in clinical medicine and is an indispensable tool for clinicians for diagnosis of various diseases such as tumors, hemorrhage, spine abnormalities, etc. MRI produces a series of cross-sectional images of an organ in any desired plane at any angle. It uses no harmful radiations such as X-rays or radioactive nuclear isotopes. Functional MRI (fMRI) is a variant of the regular MRI for determining which parts of the brain are activated by different types of physical activity, such as visual perception, sound or finger movements.

Measuring blood flow

Two brain imaging techniques, PET and fMRI, measure blood flow through the brain. It is assumed that active areas of the brain have a higher metabolism and need a greater supply of oxygen and glucose and have increased blood irrigation. PET tracks blood flow by using a radioabeled chemicals, while fMRI monitors the oxygen content of the blood.

Functional MRI (fMRI) is cheaper, simpler and more sensitive than PET scanning, and does not use radioactivity. It is non-invasive, safe, and has relatively high spatial resolution but poor temporal resolution in relation to neuronal time scales.

Measuring brain activitiy

- PET
- fMRI

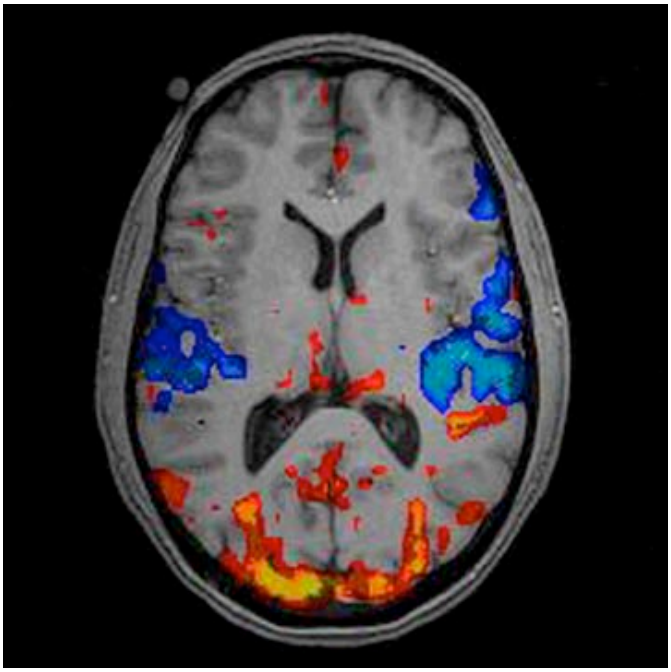
Spatial signal = WHERE it happens record every 2 sec

- EEG: electorencephalogram

real time measurements of brain activity

Temporal signal: WHEN it happens

During an fMRI scan, the human subject lies inside a huge magnet. fMRI allows to identify areas of the brain that have an increased oxygen supply because hemoglobin has different magnetic properties when bound to oxygen (oxyhemoglobin) compared to deoxyhemoglobin . Oxyhemoglobin is diamagnetic, and Deoxyhemoglobin is paramagnetic. This difference is sufficiently detectable to make fMRI useful in localizing brain activity. Thus, fMRI produces images of brain regions by detecting indirect effects of neural activity on local blood volume, flow, and oxygen saturation.



It is important to note that neuroanatomical variability in the human population is an issue that complicates the study of brain activation in a large sample population.

fMRI allows to isolate areas of brain activity and thus identify parts of the brain that are necessary for specific cognitive functions (such as face recognition, proper noun recognition, etc.)

fMRI investigation differs from regular diagnostic MRI scan in that it localizes brain activity rather than brain anatomy. It produces images of activated brain regions by detecting the indirect effects of the neural activity on local blood volume, flow, and oxygen saturation. An area of the brain, which has more oxygenated blood compared to another area of the brain, is believed to be relatively more active. When the brain is active, arterial oxygenated blood will redistribute and increase to this area. This is known as blood oxygen level dependent (BOLD) phenomenon. These changes in tissue blood volume have been directly correlated with brain activity. As fMRI images are acquired rapidly, one can get enough images to measure the relative differences between two mental states that differ in only one aspect. fMRI experiments are performed with several periods of stimulation (active) alternating with several periods of non-stimulation (rest). Images are then compared over

the entire activation to the rest periods. Active regions glow more brightly than inactive regions

fMRI uses an MRI scanner to detect the differences in magnetic signature of oxyhemoglobin and deoxyhemoglobin over and above the normal energy release of hydrogen atoms. But here is the most important point of fMRI: It is a statistical analysis. It is *not* a direct measurement of neural activity. In order to image an area where there is activity, a thought has to be made, and an image taken a couple of seconds afterward (because the oxygen conversion is not instantaneous). This process must be repeated a couple of times to be able to filter out false positives. **fMRI only indicates is *which parts of the brain are* more active *compared to other nearby regions* not why.** TMS A new technique, transcranial magnetic stimulation (TMS)