The mental processes used in obtaining and comprehending information from the external world are complex. In order to explain the overall process, we must first explain pattern recognition, imagery, attention, and concepts. Although each process is unique, they are interconnected in that the individual’s previous experience, particularly sensory experience, plays a greater or lesser role in each.

Introduction

For my self-observation project, I chose to relearn how to play the keyboard. I had a rudimentary knowledge of the skill before starting the project (I could play simple vocal lines— the written notes indicating a specific singer’s melody--only). I decided this skill would be beneficial for me since I am a vocalist & performer. I felt this skill would help me extend my musical theatre performance career after my knee injury hampered it a few years ago. Initially, I hypothesized that this former, related experience with vocal music technique would assist me (that it, could be used as positive transference) in learning the keyboard. While there has been some evidence that this is the case, I have found that there is also reason to question its application to all areas of the new skill. An example of its benefit is:

I met with Brian (one of my mentors) this afternoon. He recommended that I try to sing along with and play some of the simplified songs that I have learned in the first book. I tried the Singing in the Rain and another one I’m less familiar with called Super Trouper, both with Brian and later on my own... to my surprise I found that the “problem measure” I mentioned yesterday that I had finally solved with Singing in the Rain posed no problem at all when I sang through it and accompanied myself. I found myself concentrating on the vocal line and the emotion and phrasing of it and my hands just did what they needed to do. This is a marked change from when I first started at the beginning of last week when the rhythms took so much concentration. It also goes against my previous belief that attending to the vocal line was distracting for this section of the piece (journal entry dated 2/9/02).

I have not found any specific evidence yet of a detrimental effect of concurrent vocal performance, only that it has not helped significantly in some instances.

Method

Initially, I started by teaching myself simple songs in the order they are presented in The Complete Piano Player: Omnibus Edition by Kenneth Baker. This book contains five smaller books as he divided them, & I have chosen to measure my progress in part by my progression through these books. So far, the only situations I have observed have been my own solitary practice, playing for each of my tutors, & performing for a couple friends at a time. Other issues observed & contemplated include: 1) the effect of the type of music on acquiring the skill (whether previous knowledge of a musical style is beneficial to learning a piece in that style), 2) whether I will be able to accomplish secondary tasks while playing, especially being able to accompany myself singing a piece, performance effects, 3) the effect of different methods of learning the skill (two different “tutor/ experts” as well as an instruction book), & finally, 4) patterns in mistakes or effective
learning techniques as I recognize them. The dependent variables include my own subjective rating of my success in progressing in each practice (which I have called optimism for accomplishment), & the number of pieces that can be played a) with music & b) without music.

Pattern Recognition

My theory of pattern recognition consists of a simultaneous, two-way process comprised of both “bottom-up” & “top-down” processing. The “bottom-up” process involves using external stimuli comparisons to currently existent categories we have “in mind” (although we may not be able to designate one specific region of the brain where this knowledge exists). This process is similar to the feature theory of pattern recognition.

Pattern recognition for the “bottom-up” process begins with the physical stimulation of the sense receptors (eyes, ears, etc.) by some stimulus external to the individual. At that point, the incoming sensory information is compared to the basic characteristics or features which are stored in memory. These features are stored as a type of table of essential features which distinguish each pattern from any other.

While this is similar to the feature theory proposed in my first draft, I need to add an important difference. There is a basic flaw with feature theory; it does not specify relationships between features in an object. However, structural theory, which essentially clarifies & adds to feature theory, makes this distinction. A typical example of the superiority of structural theory over feature theory involves the distinction between a coffee mug & a pail. Both have the same features: curved handle, opening, cylindrical shape; therefore, a simple feature theory would not be able to distinguish between the two because the same features would be identified for both. The difference between them involves the relationship between the individual features that make up the mug or pail: for example, the placement of the handle in relation to the opening of the cylinder. In addition, I am partially biased toward structural theory from my modest involvement with Dr. Eric Cooper & his research at Iowa State University. For those of you who are unfamiliar with the relevance of Cooper’s research here, he has done research in this area regarding structural theory as it related to different structures perceived on the retina’s effect on pattern recognition.

The second, “top-down” process involved in pattern recognition would be a modified form of Yates’ OTT (Object Template Theory) in that our expectations would direct the information we search for in the environmental stimuli. There is a difference between this process & mental object theory as theorized by Yates because in my theory mental objects do not act as the fundamental object “language” used for pattern recognition & imagery. I must modify OTT to fit my theory because there has to be more to pattern recognition in my view than mere guesses & hunches as to what is out there; there are some features coming in from the world which help us narrow our expected objects before we project our first alternative. In
addition, OTT needs some assistance because I find fault with the view that 99% of the time we would have very strong expectations of what to expect an object to be. When I traveled to Spain, I had absolutely no expectations of how it would be different from the United States, except perhaps the fact that I did not know the local language & so I would probably experience difficulties because of this. While these expectations did come true, and granting that not everyone will have had such an extreme experience, I would argue some minor occurrence of this type happens to almost every person at least once a year (for example, a new class with new norms & standards for grading or testing procedures, etc).

Interaction of “Bottom-Up” & “Top-Down” Processes

The internal to external approach specified by OTT coexists with the external to internal approach of feature theories, & the two approaches would work cooperatively on the same function although they are separate processes. Both would work together to eliminate possibilities & confirm others, thereby narrowing the possible number of possible patterns until one is recognized or the person realizes a new pattern or concept must be established. Feature theories serve the function of narrowing the possibilities at the same time OTT attempts to guess the pattern & confirm or eliminate these guesses. Feature theories meet the OTT-like process in the “middle.” It is like the feature theories attempt to climb the stairs to recognition from the bottom floor of a building & the OTT-like process descends & meets it. This “middle” meeting landing area is our conscious experience of pattern recognition. The “bottom-up” process is the “image-free” process & the “top-down” process incorporates & uses images as recognition aids. The interaction of these processes can be seen in a seemingly commonplace, irrelevant example. As people identify puzzles in the game show “Wheel of Fortune,” two things are occurring. They are eliminating possible words based on the letter already present (features) & determining new letters to try by projecting possible solutions on the as-yet unknown puzzle (OTT).

Justification of Theory

The necessity of such a “top-down” process is shown by the “Jack & Jill” example used in class. Two hand-written sentences were presented: “Jack and Jill went up the hill” & “The pole vault was the last event” (emphasis added). The words “went” & “event” had exactly the same features. Semantic context, determined by “top-down”, OTT-like processing, ascertains the difference after (or concurrently during) the structural feature “bottom-up” processes narrow the possibilities. The “bottom-up” processes can select the category within which to find the stimuli, even if it cannot identify the stimulus by itself. For example, “bottom-up” processes determine the word ends with the features that form a “t.” My dual-process model also helps with deciding which features are relevant & fundamental & therefore should be focused on in processing.
The results of the haptic perception exercise (in which the data show that active techniques were more useful & common objects were more readily identified) indicate the need for a combination approach to pattern recognition theory, because no one theory seems to adequately explain reality. “Bottom-up” processes do not work alone for haptic perception because feature theory would predict that recognition would be easier with the passive method because each distinct feature would be presented separately & compared to our catalog of features, & the data clearly indicate that this is not the case. The “bottom-up” processes only look at the stimuli on the retina & the relationships between them, which stay constant in all of these examples. By combining these theories, my theory is similar to Ryan’s, or at least the revision ideas Ryan mentioned in his e-mail on March 11. I agree with his view that he does “not believe that we could use the OTT theory if we did not first make use of the feature theory,” with the exception that I would argue that they occur simultaneously (as opposed to the implied serial order in Ryan’s e-mail).

In order to decide upon this combined feature & OTT theory, I discarded the first theory of pattern recognition we discussed: template theory. According to template theory, unanalyzed templates are laid over stimuli like a stencil & the template with the most shared overlap is used to recognize the pattern. There are numerous problems with template theory, allowing me to discard it in my theory without any hesitation. A few of these include the number of templates that would have to exist & be accessible for recognition; it cannot specify how patterns differ, only that they do; & the stimuli would need to have the same position, orientation & size as one’s template to be identified. Template theories have too many flaws & not enough benefits to be retained in my theory.

Counterevidence

In her e-mail on January 24, Jenn wrote, “I believe that pattern recognition is much more of a core process that does not require any prior experiences to use as a comparison”. Similarly, in class she stated “if there has been no previous experience, pattern recognition still occurs.” Contrary to Jenn’s view regarding pattern recognition, I do not think pattern recognition can occur the first time that something is perceived. Even with her example of a baby crawling from a tile floor to a carpeted floor for the first time, it seems unlikely that the baby can recognize a pattern between the two textures of floor the first time the baby crawls onto each. In order for a pattern to be established in consciousness, repetition is crucial. Within this framework, it could be that, by my theory, the baby would notice the pattern between the two textures of the different spatial locations as early as the second or third experience. However, without a prior experience with which to compare the current one, the baby would merely be receiving a difference in sensory input and not recognizing a pattern. The difference in sensory input would not immediately be transformed into a recognizable pattern; however, this could be accomplished upon the first repetition of the experience.
I admit that further research is needed to fully support this conclusion, & the lack of such empirical research may weaken my theory. The only other related evidence I have comes from a conversation I had with one of my mentors, Sara, for my self-observation project. While she does not work with babies, she is a preschool & elementary age piano teacher. She stated: “I don’t think it is possible for kids that age (8 & under) to grasp the pattern of the notes the first time they play it. Sometimes they don’t get it for a few weeks, especially younger kids. I’m lucky if I can convince them right means higher & left means lower” (journal entry dated 3/27/02). This does not mean that everyone is unable to recognize novel objects. It just indicates that repetition is needed for a pattern to be recognized & established. First processing via the combined “bottom-up” & “top-down” processes is used to recognize a novel object & if these do not identify it, a new pattern is created. This process is similar to identification of new concepts.

Imagery

Prior to explaining my theory of imagery, it is important to note briefly that historically images were considered no more than epiphenomenon, floating around in consciousness with no causal role— the neurons were the causal elements, not images. Likewise, it is important to note that imagery exists for all senses, & different senses can be present in one complex image. Simple proof of this phenomena is provided by the common experiences of having a song “stuck” in one’s head, or a recalled memory image which brings back sights, sounds, smells, even tastes & feelings (in the tactile sense). I have experienced non-visual images countless times in my life, as we all have. A few examples should suffice here: 1) when asked to recall a past experience involving people, I created a vivid moving visual image complete with sounds, smells, & taste; 2) during the discussion of my self-observation project on February 15, I stated that I did not have images related to my playing. However, both Ryan & Dr. Yates pointed out that images do not have to be visual, at which point I realized I have a kinesthetic image of how the keys & the distances between them feel on the keyboard when playing something correctly. Despite this, my discussion here will focus almost exclusively on visual images, simply because that is the area where the majority of research has been done.

My Imagery Theory

Imagery used in recall is similar to an internal movie projector & camera crew. Therefore, the word “imagine” to me implies “turning on” one’s internal movie projector & rolling the film. This film can be literally created from past experience, or created as one goes, or some combination of the two, whatever is appropriate to the nature of the current image being formed. This film crew would be rather sophisticated, however. Some experiences coded in imagery, such as smell, taste, & even affective responses, come more from the experience on the set than the crew’s perspective. When I recall the Bird & Fish movie, I see a moving sequence of images, almost like an old silent movie with color added. There are individual
differences in this process; for example, not everyone's conscious image would be exactly like an old silent movie with added color & sound. Some may have a more modern movie projector than others, & therefore their image may have less "jumps" in sequence than others may. Beyond individual differences, this may also be due to the amount of detail initially perceived. I am more likely to have "jumps" or "filled-in" sequences when forming an image of a relatively unfamiliar object or routine than something I do every day.

All of the detail in the original is not stored, but rather enough detail is stored that the mind can recreate the sequence and major details and fill in the minor details on its own. Some support for this idea comes from my journal entry on March 19:

As I attempted to play from memory, I find myself relying heavily on visual images for the first time. I picture the bars of music & follow a 'bouncing ball'—like the ones used in karaoke or children's sing-a-longs which moves with me as I play. However, I have noticed that, like the penny & Far Side cartoon demonstration in class today, I do not have all the details of the music in my image... The guitar chords above each measure are not there as they are irrelevant to my keyboard playing.

The cultural conception of an “image” as a static snapshot-like picture has biased past research in this area in ways that are difficult to define simply. By suggesting in the instructions that a participant form an “image,” the participant’s preconception of what an image is may at least in part affect the research findings that indicate images are motionless pictures. We experienced this possibility in our class exercise when we were asked to create an image of a person & subsequently asked to recall a past occurrence that involved other people. The majority of the class created a photograph-like picture for the “image” portion, & a richer visual image, sometimes including several other sensory experiences, motion, & point of view, when asked to recall an experience. Our modal class experience with this exercise supports the cultural bias view on image research which I must concede as a limitation to our current knowledge, even though my own idiosyncratic experience with that exercise was not like my classmates.

The Major Imagery Theories

There are three proposed theories for explaining how imagery works. Kosslyn proposed the first of these, & the simplest. Kosslyn’s theory states that visual images are mirror, point-by-point copies of the faint sensations we receive on the retina as we perceive an object. Essentially, an image to Kosslyn is a mere copy of visual perception as we recreate it internally. Kosslyn makes use of the spatial analogue or cognitive map proposed by Shepard in his rotation experiment. A spatial analogue is a mental space that is isomorphic with real space. This can serve as a type of cognitive map of a room or other location.

The second theory is proposed by the computer scientist Pylyshyn, whose theory suggests that our images are constructed out of a type of “mental-ese,” a language unique to our image-making process that works similarly to our spoken & written language. We are not conscious of this language, but rather of an
image, although the image to Pylyshyn is a mere epiphenomenon. For Pylyshyn, an image is simply a concatenation of discrete symbols for the objects & the relation between them. There are rules for combining these symbols, just as there is grammar regulating the structure of our language & rules necessary for any computer programming language. The brain runs a computer program using “mental-ese” which creates abstract, unambiguous images devoid of any spatial medium.

Finally, Yates proposes that his OTT/mental object theory can be used for imagery as well as for pattern recognition. To recap this theory, mental objects containing everything about the “real” object. We determine each mental object by querying our database of possible mental objects. Mental object theory is similar to the concept of resonance— one’s mind resonates with the world in the form of mental objects. These mental objects are what we bring into consciousness when we “imagine” an object; it contains every aspect of the object because it is the object.

Although I am cautious to merely adopt another’s view on imagery, especially since I have not chosen to do so for pattern recognition, I find that my views coincide with Yates’ OTT theory’s explanation of images. I agree that there needs to be a middle-ground view between Kosslyn & Pylyshyn— both have rather extreme elements. It seems unrealistic to say that imagery can be simplified to a point-to-point “mirror” picture of external stimuli & the sensations we receive from them as Kosslyn suggests. Kosslyn’s map experiment did provide evidence that some images can be like static pictures, but demand characteristics flaw the ultimate usefulness of this experiment. By asking the participants to “get an image,” Kosslyn unintentionally created a bias in his experiment which may have led to his results. As for Pylyshyn, he is over-complicating the matter. Allowing that the vague quality of most people’s images could be due to lack of program code for the details (according to Pylyshyn), there is still an innate characteristic of human imagery processes that cannot be simulated in a computer (for example, their malleability & individual differences in images created by different people).

However, I find it difficult to accept that the exact same processes are used for both pattern recognition & imagery since the functional use & the conscious experience of these processes are quite different. Mental object theory (OTT) is useful & valid for imagery— indeed, it seems most applicable here than for pattern recognition (since my view is that we use some sort of feature theory for each sense to narrow the possibilities prior to allowing our expectations to project information on the incoming stimuli). OTT is also supported by enactment, such as how we determined in class what side of the door the doorknob was on on the front door of our prior home. Beyond all of this, imagery also appears to be used in expectation assumptions. For example, as I was watching the Bird & Fish video the first time, I would get
vivid images of what I thought was going to occur next, such as picturing the fish caught in the bird’s beak the first time I saw it dive downward.

I realize by holding to OTT for one process (imagery) & not so much for another (pattern recognition) it may seem that I myself am guilty of complicating matters as much as I accuse Pylyshyn of doing with imagery. I have little prepared in defense against this claim; it may be there is some as yet unknown method of simplifying my view without eliminating the specific factors I consider necessary to each process. However, while I cannot find fault with OTT when applied to imagery, I can find too many for it (in my view) when applied to pattern recognition processes, so for the moment this complexity seems necessary. Ultimately, I feel it is necessary to combine the three theories, although I place the most value & emphasis on OTT. For example, I feel Yates view that images are not based on sensations at all is too strong; this is an area where it can benefit from being combined with another (Kosslyn’s) view.

Limitations of Images

Images are based on VIP—values, interests, & purposes. Therefore, we only store what we need & do not store “minor” details. A “minor” detail is one that is irrelevant to the person. A few examples of image limitations from class are the penny exercise in which people had difficulty selecting the correct head-side drawing of a penny even though they interact with it quite often, & the Far Side cartoon recall in which people could not remember “minor” details such as the top of the wall, the clothing of the man, etc.

Visual Imagery for the Blind

A blind person can create images if the video is carefully described to them, it just may not exactly match a sighted person’s (but not all sighted people have the same subjective imagery experience as well). The blind from birth do in fact have visual imagery in terms of a cognitive map (or spatial analogue, to borrow a term from Shepard) that can be spatially created from tactile experiences. I base this view on my conversation with my friend who was born without eyes & upon the single-subject design discussed in class in which the little girl created paths between areas in a room even though she had not previously traveled them. During my “research” interview with her, my friend that was born without eyes said that she does not have “visual” images, at least not in the way that she defines visual. She has no concept of different colors. She did say that she has “tactile” images (to borrow her wording), such as how wide or long a hallway is. Melissa & I thought this might best be described as spatial imagery, because even though she may base the image on tactile sensations initially, the actual images seem to describe specific spatial locations or spatial qualities of an object (example: “the lamp by the door is two steps away & a little wider than my thumb”).

Further, based on the research discussed in class, the blind can create visual images even without having had a tactile experience of an object. One piece of empirical evidence supporting the notion that blind
individuals have “images” was a single subject design involving a 2 ½ year old girl that was blind from birth. The girl was led by the hand from her mother to each of 4 specific locations one at a time. Then the girl was asked to go from one place to another. The hypothesis was if the girl could create an internal spatial layout of the room (an image of it), she would be able to successfully journey paths she had not experienced (for example, from the table to the pillows). If she did not have an image of the layout of the room, she would not be able to travel any of these new paths, only the ones she had experienced directly (the ones starting at her mother). The girl was successful at all six possible paths in the room, even though she had only experienced half of them, thus providing support for the view that blind individuals have images.

Attention

The Metaphor

Attention, like imagery, works like an internal movie camera crew. Differences in the number of things that are “paid attention to” or the amount of concentration or detail paid to a specific object can be explained by widening the shot to a greater distance (from short to medium to long to extreme long) to include more objects or zooming-in to focus specifically on one object. Selective lens use can in this way be used as a metaphor for attention. It makes sense that more than one thing can be included in the frame & focused on at the same time. For the attention exercise we did as homework for class on April 8, I noticed that when I “switch” attention between objects, I did not really take attention away from the first object as I attended to the other; I just placed less emphasis on it. This occurred even when I tried not to attend to the first object, until I would literally block the object from sight to avoid attending to it. Similarly, when I observed what I had previously not been attending to, I noticed that all of the stimuli that I observed had always been within my perception. They did not just suddenly “pop” into consciousness, rather I “panned” the camera over to them or widened the shot (or changed the camera angle completely) to include them.

The Specifics

Attention is, at least to a certain extent, a choice. As Ryan pointed out in class discussion, you can hurt yourself but, after the initial attention is drawn to the injury, choose to ignore the pain (he used the example of a basketball injury). Attention is an active, even if not fully conscious, process of selecting what external input will be allowed through this sieve into our internal world. However, some aspects of attention are involuntary, as some of the major theories of attention take into account. Even Broadbent, with his simple, early selection filter model, allows for loud noises or other physical stimuli attracting attention. Beyond this simple level, both the Deutsch-Norman & Treisman theories of late selection allow for certain words causing a change in attention. Personally, Treisman’s theory seems to offer the best explanation of distracting phenomenon. According to Treisman’s attenuation theory, unattended channels are not excluded
from conscious attention, rather the volume is turned down (to use a music metaphor) or, to use my own attention metaphor, the unattended channel is merely out of focus or not in the frame. This means you still get part of an unattended channel or message in consciousness. Both her own & the class’ shadowing research provide support for her theory. Most of the class heard their name on the unattended channel at least once (of three mentions) with a mean of 1.67. However, very few individuals heard specific phrases (Maranda & Ryan being the exceptions) or understood the overall semantic content of the unattended channel, which Deutsch-Norman would expect to occur. With any of these theories of selective attention (& therefore possible distracting stimuli from attention), it is necessary to point out that attention is always present in my view. Objects that are newly or suddenly attended to did not magically appear in consciousness; they were always there, assuming of course they were not recently introduced into the environment of the observer. Awareness or attention merely varies in degrees of focus— zoom-in shots versus wide-angle lens views.

People have the capacity to allow several stimuli into consciousness by merely changing the frame, but each of these must necessarily be given a ranked amount of conscious consideration to keep the system from being overwhelmed with too much conscious input. This system cannot be simplified to the extent that you merely add x amount of attention paid to one thing with y amount paid to another, until you reach 100 percent, as Kahneman would claim. My theory details that tasks take less & less capacity until the amount is minimal—at which point the task appears routine & automated the more a task is practiced & performed.

While Kahneman’s theory does not necessitate selectivity to attention (he proposed it as a supplement to other selectivity or bottleneck theories of attention rather than a replacement), my theory incorporates both a capacity component similar to (but not identical to) Kahneman’s & a selection process (with associated distracting variables) like Treisman’s. Without a selective process like Treisman’s, how would attention ever be switched from x channel to y channel if we had no concept of anything occurring semantically on unattended channels? I agree with Treisman’s threshold view of the significance of possible distracting stimuli. It makes sense that some highly important things (one’s name, warnings of danger, etc.) would have permanently lowered thresholds, while other words’ thresholds would be lowered or raised dependent upon the context of the situation. Within this framework, it is possible to choose not to split attention & devote 100% capacity to any given stimuli or channel, or to choose to switch 100% capacity back & forth between channels instead of splitting attention. However, this ability does not preclude the ability to split attention, rather it merely expands upon it. Once you run out of capacity, you can no longer split attention to additional stimuli & perhaps may even need to stop attending to currently attended channels, as
BreAnne mentioned in her example of driving & giving a tour & watching the time & listening to her passengers' conversation all at the same time causing her to run out of capacity & stop.

Returning to the movie metaphor, the possible frame for the shot (of attention) can only be widened to a certain amount in a wide angle shot, beyond that, things necessarily fall outside of the frame of attention. However, one can always narrow the lens & zoom focus on a “tight spot.” Certain things take more of this overall attention capacity to attend to than others do. For example, if I am studying material that is relatively easy for me to comprehend, I have the capacity to attend to music at the same time without adversely affecting my comprehension of the material. However, if the material is considerably more difficult for me to understand, I cannot attend to anything else and be able to comprehend and recall the material later.

Some may counter that “split” attention does not really exist; it is merely an illusion created by extremely fast switching of attention between multiple channels (Chad & Dr. Yates would be two individuals with this view). They feel the shadowing exercise merely shows the “conservation of attention” & that “switching does not help much & splitting hurts or doesn’t help.” However, based on the shadowing exercise as well as personal experiences of my classmates & myself, split attention still seems quite real. Maria stated it most simply within our small group in the shadowing exercise, even “when you are switching attention, you really end up splitting between them both.” Everyone in my small group found it easier to split attention than to switch. The shadowing data itself supports split attention similar to Kahneman’s theory. At least half of the class (9 of 15) could split efficiently & effectively, when splitting is defined as ratings for split attention (phase 4) ≥ ratings for switching attention (phase 3). While this evidence is far from providing an unquestioned superiority for split attention, it does indicate that this phenomenon is more common than proponents of “switched” attention would seem to indicate. In addition, the totals of each phase being approximately equal (from 8.93-10.07) supports Kahneman’s & my theory of total attention capacity. Thus the shadowing data supports Kahneman’s theory as well as Treisman’s & my own, although the data did not quite match the predicted values for all of these theories.

None of the theories mentioned to this point deal explicitly & solely with routine or automated tasks, as does automation theory & Yates’ theory of attention. According to Yates’ theory, only some tasks can be automated (after sufficient practice), others will always require conscious attention. If only some tasks can even be “automated,” why believe that we “automate” any into unconscious planning? Or at the very least, what is the distinction between “automatable” & “non-automatable” tasks? Unlike Yates’ theory of attention as a planning function only & the automation theory, my theory proposes that attention is used for some problem-solving functions, such as focus (which goes along with the movie metaphor). Likewise, according to my theory even routine & seemingly automated tasks still require capacity (they are not completely
unconscious mental objects or plans as Yates theorizes). I grant that the amount of capacity devoted to such
tasks may be so minimal as to seem almost negligible, but that is not the reality. The capacity of seemingly
routine/automated tasks may be so minimal that it does not require conscious processes, however, if another,
greatly complex &/or life-threatening situation arises & draws attention, people stop doing even routine,
“automated” tasks such as listening, talking, etc. This provides some evidence for minimal capacity allocated
to these routine processes in these situations, which can easily be generalized to all situations. In my theory,
the “camera crew” behind the scenes carries out automated & routine tasks. This means that these processes,
as well as peripheral or objects outside of the frame can be brought into focus in the frame easily if there is a
problem or something unusual occurs. Therefore, what is actually in focus is what is attended to; what is
merely in frame or performed by the crew can be brought into focus/attended to if necessary.

Expectations also play a minor role in attention as well as pattern recognition & imagery. An
element of this from class discussion was when Chad noted that you observe more pregnant women because
you expect to see more, not because there are more in reality. Your expectations merely make you more
prone to focus your attention on them. The same is true of other objects, such as the common experience of
noticing everyone who has “your” car (same make, color, etc) shortly after you purchase your car.

Limitations on Attention

Based on the class’ self-observation projects, I place some restrictions upon the ability to split
attention. While I still argue it is feasible (unlike some of my classmates), a level of skill or experience with at
least one of the tasks &/or the use of different sensory modalities for different simultaneously attended tasks
seems necessary. More knowledge of a task facilitates both split attention & switching attention between
channels. Despite the evidence presented by the conscious experiences of Maranda & Chad who each hold
similar views regarding the inability for attention to be split, I will attempt to show that it can be. First, the
opposition: Maranda stated in response to Maria’s project discussion that split attention does not seem
possible, citing the example that she cannot play basketball & “think about” something else at the same time.
Chad holds the view that split attention is not really split, but rather lightning fast “flipping” between two
tasks. Maria’s view is closer to mine. She stated about her project that you have to acquire expertise before
you can split attention, at which point it may be coalescing into a concept. When questioned, however, she
stated that perhaps attention is not split but “fragmented,” a view similar to Chad’s. Despite all of this, I have
a few semi-allies in this view in the class; Mitch also argued in class that attention could be divided between
two tasks & Tom mentioned a similar view early in the semester. My own experience suggests:

I have found a way somehow (although I am not sure how) of being able to split between looking at
the metronome and the music so it no longer seems distracting. I also found it helpful to set the
metronome to accent (with a different pitch) the downbeat, so I felt I could actually look at the metronome less often. Maybe that’s how I managed to divide the attention somehow between both— one group of senses is attending to the music (sight & tactile) and another sense is attending to the tempo (hearing). This seems too simplified, though, because when I am playing I do not really feel like I am attending to the notes on the page much, and the rhythm feels somewhat internal, not just hearing the metronome (journal entry dated 2/22/02).

However, one might counter that this might not in fact be “split” attention, but rather the process of learning one task by combining component tasks. Further evidence from other, completely separate skills performed simultaneously is needed to fully justify my conclusion favoring split attention.

While in general attention aids performance, I found with my self-observation project that sometimes attention actually inhibits performance. “I decided to try focusing less attention on areas that seemed more difficult... I found that focusing less conscious attention was actually helpful once I had rehearsed a piece a couple of times before” (from journal entry dated 2/16/02). Johanna reported a similar experience involving too much attention as a problem with her knitting project in class discussion.

Concepts

Concepts exist as a composite structure based on both distinctive features & prototypes constructed from those features. The function of concepts is to decide what something “new” actually is, or to realize that we need to create a new concept for it. Conceptual categories are compilations of the fundamental features of something as defined by the individual at the current time. This essentialist view defines concepts in terms of conjunctive & disjunctive rules like a dictionary definition or a math theorem; people create them.

At the same time, a prototype exists for each category. This prototype may exist in many forms: a visual image, a lexical definition, a fragment of sound, or any combination of the above. Prototypes have the added benefit of dealing with the possibly illogical idea of having thousands of “bins” of conceptual categories in our mind, down to a bin for each specific object. The problem with so many bins is similar to the problem of template theory for pattern recognition; there are simply too many to be believable as the sole method of recognition or categorization. Prototypes typically produce more agreement & are typically easier for people to visualize & produce as well. In addition, prototypes can explain the human tendency to “hedge”; that is, to say it is somewhat like x or a poor example of y, rather than strictly it is or is not x (or y).

Rosch’s research supports the prototype view of concepts. She states that the internal structure of concept prototypes is unavoidable. Categorization is based on internal images of good examples of a category being matched to varying degrees to novel stimuli. Her research on the hierarchical structure of natural concepts, including superordinate, basic level, & subordinate levels, supports the idea of prototypes for concepts existing at the “basic level” for a category (a piano for a musical instrument for example).
Some would argue if we have a prototype which is an average of a conceptual category, we must also have the members of the category. This is true to a point; we need to have experience with different members of the category in order to average them into the ideal prototype, but we do not have to store all of the members of the category for future use. In addition, the class discussion regarding non-average prototypes (in which a person who does something that is not the norm still mentions the same prototype as those who do act in the “normal” manner). The prototype serves as a type of label quickly identifying conceptual categories or bins.

In this way, concepts are similar to pattern recognition. People have the option of taking either an essentialist approach to concepts or a prototype view or combining the two approaches. As Yates suggested in class, people may have two ways of thinking (essentialist & prototypical) & both may be possible & effective in various degrees dependent upon the context of the situation. They use whatever is the most efficient & effective for the given situation & concept. My theory uses both approaches, but is not merely a combination of the two. Rather, concepts exist on a continuum, with “best” examples lying in the middle of that particular concept’s part of the continuum, while “poor” examples are on the end of the concept’s section & thus, through “fuzzy logic,” can be seen either as examples of that particular concept or the one adjacent to it. This helps explains the multiple conceptual choices for recognition of ambiguous figures.

This continuum approach would be beneficial to, & is just now entering the realm of possibility for, the DSM-IV-R. Currently, the DSM-IV-R takes an essentialist approach of disorder concepts. The problem with this approach is defining the boundaries between who has a clinical disorder & who does not. This is especially true of major unipolar depression. After all, how do we know someone who has had 5 depressive symptoms for 2 weeks (the current criterion) is more depressed than someone with 4 depressive symptoms for 2 years is? Even a prototype approach, defining the “typical” clinically depressed individual, would make more sense than this. However, my continuum approach seems the most logical, though it still has its own flaws. When, for example, does the fuzzy boundary area between disorder & “normal” functioning mean one deserves a clinical diagnosis or one does not?

Being able to combine approaches avoids the flaws possible to either approach. If one merely took an essentialist approach, one would have difficulty with ambiguous figures (such as the cat bed made into a hat that Jenn mentioned in class) or why people construct a definition of an object when asked for one rather than merely recalling one word for word, like a dictionary. Similarly, the prototype approach explains why some examples of a conceptual category seem to be better than others to us. For example, a piano seems to be a much better example of a musical instrument than a straw, yet both can be used as musical instruments. However, a prototype approach can be prone to error as well. Something may look remarkably like our
prototypical image of a concept & yet not be a member of that conceptual category. Therefore, the prototype approach is the first, “quick & dirty” approach to concept recognition. If it fails or is uncertain, we have the ability to break the object down into its distinctive features & take an essentialist approach.

Novel Concepts

When encountered with a novel stimulus, we can break it down into smaller pieces in our minds and then compare those pieces to a type of database of characteristics of concepts with which we are already familiar. If the novel stimulus does not match exactly, we must make a decision whether to include it in a current conceptual category and thus expand the same concept, or create a new concept. In this respect, novel concept creation is an extension of pattern recognition. We first attempt to match the novel stimulus by means of the dual “bottom-up” & “top-down” processes, but if even in their intersection there is no match, we create an abstract new idea or conceptual category to define this new stimulus. This decision is made allowing for a certain percentage of error. For example, if all characteristics of a novel stimulus match a current conceptual category except for one seemingly minor detail, chances are we will simply place the new stimulus within the same currently existing category.

While there is no specific percentage of error cut-off point for determining whether or not a new concept needs to be formed, a general trend exists in that the farther the novel stimulus is from fitting our prototype of a concept, the more likely we will create a new concept to define the novel stimulus. A child’s concept of a bird or a fish would be an image of an example of the first bird or fish the child saw, either in person or on TV. The lexical concept of what is a bird, fish, etc., is the last to develop and most complex, as each individual word in the definition may carry a slightly different meaning to different individuals. A possible refutation of a child’s first concept being visual could be made in the case of a blind child. However, it would still hold that the first concept would be sensory (perhaps auditory or tactile in this case) and then the lexical concept would develop later.

Innate Concepts

My theory allows for a limited few innate concepts, which would be basic to survival & include the four universal emotional states. There is a basic level of perception; children begin as almost blank slates—not quite the tabula rasa proposed by Locke because there is a basic level of minimal innate knowledge. The main reason we have a basic few innate concepts such as these is that we need to have a starting point for OTT-like processes used in part for pattern recognition & entirely for imagery. I do concede that “learning involves choosing from among possibilities & modifying from a start point” (class discussion).

Complex concepts are not built out of simple ones; the two are fundamentally different. My (or anyone’s) concept of a concrete object (such as a chair) like my image of it is very different than my abstract
concepts (such as how I define justice, honesty, peace), which in turn are much more complex than my concrete “object” concepts & not formed from them or based upon them.

Ontology

Ontologies, like concepts, attention, imagery, and pattern recognition, are malleable and ever changing beliefs about what is real. Though the rate of change may be slower than the previous topics, especially when societal ontology is concerned, it cannot be denied that change is constantly occurring. A point made by Melissa during class discussion applies here. Ontologies, whether societal or individual, are similar to the elusive Truth referred to by Plato in his allegory of the cave. Before one sees the people walking by, one believes that the Truth is their shadows. These shadows, in terms of our ontology discussion, equate to the mystical, medieval ontology which divided the world into hidden forces at work above and below the moon (sublunary and superlunary). Descartes is largely responsible for our current ontology in which the world is not only mechanistic, but is in fact a machine. If it cannot be measured (in the cgs—centimeters, grams, and seconds system), then it cannot exist. Because both the shadows and the people are “Truth” in the Plato allegory, merely different perspectives on the same experience, it follows that both the medieval and current cgs ontology can be “real” interpretations.

“Changes in Thinking”

In my first draft, I used a simple form of feature theory (although I did not know to call it such) exclusively to explain pattern recognition. I also stated that pattern recognition begins with external stimulation of the sense receptors, a point which I have retained in this modified draft. However, after consideration of other factors which are not well explained by this theory (such as ambiguous figures) as well as other theories, primarily OTT, I have decided that feature theory & its emphasis on external stimuli is only the beginning of the pattern recognition process (as opposed to the entire process). Another process is needed to explain the top-down processing that occurs simultaneously with this bottom-up perception. This secondary top-down process is similar to OTT, although necessarily not identical to due to my inclusion of the feature theory as valid.

The main change I made in my view of imagery relates to visual images of those who have been 100% blind for their entire life. Before, I placed the condition that a person had to have had some experience with visual stimuli in order to form visual images. Now, based on the research discussed in class & my own conversation/research interview with my family friend who was born without eyes I have changed my view to include no difference between the blind (no matter for how long) & sighted in the mere ability to form images, including visual ones. I still hold that the visual images created by the sighted & the blind may be different in some aspects (e.g. a blind person’s image may look nothing like mine, but then again my image
may look nothing like another sighted person’s image either), but the functionality of the images remains relatively stable & constant for both. My changes in the imagery section are a bit more difficult to pinpoint because this was an area of my theory that was somewhat less developed (than pattern recognition) in my previous theory.

The attention section has undergone a minor overhaul for this draft. For example, while I still maintain that attention can be split, I now condition that view relative to the amount of experience & skill a person has at each task being accomplished simultaneously. A person has to be relatively well skilled in both, or at least one of, the tasks being done concurrently in order for attention to be split successfully between them. The metaphor to explain attention has been changed from a filter or sieve metaphor to the frame of a movie camera. This metaphor works better for me because it is more flexible (you can change lens or distances or angles—how do you change a sieve?) & it is more in line with the metaphors used in the other portions of the theory, specifically imagery, which also has a movie metaphor. Since the second draft, a selectivity model has been added to my capacity model (similar to what Kahneman intended with his capacity theory).

The concept section has undergone the most drastic change of all the sections. Rather than an abstract, categorical approach based solely on features (my first theory), I now take a concept continuum approach. This approach attempts to combine both essentialist & prototype views into a separate, new metaphor that is more flexible than them both.

“Comparison to Standard View”

My view on pattern recognition is strikingly similar to the standard view expressed by the class in the first draft. Indeed, when reading the summary comments about pattern recognition expressed by the class as a whole I almost felt as though I was reading my own argument from the first draft, with the exception that I made no reference to schemas. Other than that, I held (& still do) that there is a basic level of perception, children begin as almost blank slates, features are parts of objects that are critical to identifying them successfully, & context & past experience are important to pattern recognition.

When one does not consider pattern recognition, however, my views seem at times radically different from the modal view. For example, images are not simply pictures—that view reduces their complexity far too much. At the very least, images are a type of synthesis of all sensory modalities combined into a streaming “picture” filled with almost seamless motion. It is similar to the once proposed “smellovision”—a moving picture which includes all senses, including smell & taste, & in a limited & rather abstract way, touch. I used to agree that blind people (that is, the blind from birth) do not get visual images, but I no longer feel
that view is valid in light of the research in this area. I never considered images a copy of received sensation (which sounds like the modal view is Kosslyn's); again, the process is far more complex than that.

In terms of attention, there is less discrepancy between my old view & the standard one than my new view or my theory of imagery, but at the same time there is less agreement than there was for pattern recognition. Attention no longer acts as a filter but rather a flexible camera crew, but it can be split, although now I place some restrictions upon when this split can & cannot occur successfully. In addition, I agree that that skill &/or familiarity has an important effect on attention. The level of skill & prior experience with a task is one of the main determinants of whether or not a person can divide his/ her attention while successfully accomplishing a task in my view. I therefore place even more emphasis on the role of skill & familiarity than I did in my previous theory. I did not specify anything regarding the role of one's interests in determining attention; upon reflection I suppose interests may play a minor role in determining the focus of attention & holding this view in no way conflicts with my theory.

For concepts, my view does match the standard one in that I also define concepts to be like abstract categories composed of compiled features. However, my primary focus is on concepts as a continuum, accounting for both categories & prototypical “best examples.” Likewise, concepts are based on past experience & association in my view. I did not specify any innate concepts, & my theory allows for a limited few innate concepts, which would be basic to survival & include the “universal” emotions of happiness, sadness, surprise, fear, etc. Like others, I use the imaginary child’s initial acquisition of a concept as part of the foundation of my theory. I do not agree that complex concepts are built out of simple ones; the two are fundamentally different. My (or anyone's) concept of a concrete object (such as a chair) like my image of it is very different than my abstract concepts (such as how I define justice, honesty, peace), which in turn are much more complex than my concrete “object” concepts & not formed from them or based upon them.

Finally, I disagree entirely with the standard “historical” view. CGS is not the correct way to look at things any more than the medieval ontology was (or is). A basis for subjective & unobservable methods of looking at the world is lacking in cgs, just as a “scientific,” standardized empirical way of viewing the world was missing in the medieval ontology. It is horrendous to me to make such a blanket statement as the medieval ontology was wrong; it is no more “wrong” than cgs. The only difference is that the flaws in each are in different areas. These two ontologies can (& I would argue should) be considered complementary to one another, each helping to correct the others' inherent flaws. While this view may alienate me from the majority view in the class, Turing is not correct in assuming computers can think. It all depends on how you define “think.” If you define “thinking” as meaning that one can compute & solve problems, than yes, I
suppose computers can “think.” However, if by “thinking” you mean the totality of human thought, no, computers cannot “think” any more than any other machine.

“Theory Strength”

The current theory has an approximate strength of 9.5. There are some common assumptions for each portion of cognition, such as the influence of prior experiences. Likewise, I realize that by holding to OTT for one process (imagery) & not using it as much for another (pattern recognition) may weaken the overall structure & strength of the theory in its entirety. However, there is still too much that cannot be satisfactorily explained (to me, anyway) by OTT in terms of pattern recognition for me to adopt OTT exclusively for both processes. However, the theory has its strengths in the minimal number of metaphors (a movie metaphor for imagery & attention, & a continuum metaphor for concepts). The problem with this is that there are still more than one metaphor, & the metaphors necessarily make explaining some complex or unusual phenomenon more difficult to explain (resorting to the experience on the set of the movie to explain affective imagery for example). Despite these limitations, the overall theory has a relatively strong core, even though it may need work at some of the more detailed levels.

“End Questions”

1. How does pattern recognition work?

Pattern recognition occurs when sensory receptors receive information from external stimuli. These stimuli are then translated and the raw input from them are compared to basic characteristics of objects and experiences stored in memory for each sense in the feature theory component of pattern recognition. Feature theory accounts for “instant” recognition as well as how we narrow the possibilities of identity for a novel object by selecting the correct “category” for it based on its features (a desk would instantly be categorized as an inanimate object, for example). Simultaneously, a “top-down”, OTT-like process works to project expected patterns based on the limitations provided by the feature theories. These disparate processes work cooperatively to recognize a pattern & meet in the middle to determine the object. Each separate process (both “bottom-up” & “top-down”) compensate for the flaws of the other— where the other cannot identify an object working alone (such as ambiguous figures for “bottom-up” processes).

Pattern recognition is not a simple translation process, however. Therefore, the previous experiences of the individual play a role in pattern recognition, requiring repetition of any one stimulus or pattern (even if only repeated one additional time) for a pattern to be established and recognized.

2. How does imagery work?

Imagery is an internal sensory creation, involving one or more senses, one of which is typically visual. Imagery works much like a movie crew, with individual differences determining how “technologically recent”
the equipment is (an old silent movie projector or state-of-the-art). This film crew would be rather sophisticated, however. Some experiences coded in imagery, such as smell, taste, & even affective responses, would come more from the experience on the set than the crew's perspective. Images that are stored are combined with newly created images to make an almost seamless sequence of events, with a few jumps in sequence possible due to faulty image storage or recall.

Both new image formation & image recall are processed based on Yates’ OTT theory. Expectations of the individual can also impact the creation (or lack thereof) of images, both of personal experiences and abstract ideas. There is essentially no difference in visual imagery ability between the sighted & the blind. The only exception to this may be that a blind person’s image & a sighted person’s image of the same object may appear dissimilar.

3. How does attention work?

Attention works as a movie camera crew that selectively narrow or widen the amount of stimuli brought into consciousness by zooming-in or out while avoiding overload. Attention can be split between a few different stimuli, but the attention given to each individual stimulus must necessarily be less than 100%, even if routinization may lead one to believe one’s full attention can be focused away from a seemingly automatic task. In other terms, my theory combines Treisman’s attenuation model with Kahneman’s allocation of capacity model (actually one highly similar to it) through the use of a movie crew metaphor. The selection of stimuli that are allowed into the frame of consciousness depends upon, among other things, whether a stimulus is novel or potentially harmful to the individual. There are some limitations upon when attention can or cannot be divided. The main restrictions involve the amount of expertise or prior experience with the skill(s) being performed simultaneously & the number of senses involved with each skill (whether there is an overlap of sensory modality use or whether each task requires the use of different senses). Therefore, attention, according to my theory, is defined as the allocation of capacity (however minimal) & the processes involved in deciding when attention should be re-focused.

4. How do concepts work?

Concepts are a continuum of possible categorical representations of stimuli. Similar to pattern recognition, concepts are categorical representations of the fundamental characteristics of a given thing. These categories represent the overall range of one particular concept on a given continuum. In addition, a sensory prototype exists for each concept, which can then develop into a lexical definition. This prototype is adapted or a new concept is created as novel stimuli are encountered which do not fit any of the existing categories. The prototype is the middle of the given concept’s section of the continuum. The ends of the
range can be classified as either that concept or the adjacent one depending on the situation & context by means of “fuzzy logic.”

“Self-Observation End Questions”

1. What did I learn about cognition?

The simplest way to state what I have learned about cognition from this project is merely to say it is more complex than I could possibly imagine before undertaking this process (project). More specifically, I still think that attention can be split between tasks once adequate experience is acquired with a skill. By the end of the semester I could play some of the simpler pieces from the beginning of the semester while holding a completely separate conversation (about upcoming musical theatre auditions at the community playhouse). For pattern recognition, I learned concrete examples for what otherwise seemed like an abstract theoretical idea of “recognition.” For example, I learned a few basic scales for certain key signatures & could both “recognize” the key of a given piece as well as notice “accidentals” placed within that piece. For concepts, I learned how concepts I already knew could be applied in a different way as well as a few new concepts, such as the accidentals just mentioned. I knew about staccato as it applies to vocal technique. In that context it refers to a cutting off of airflow to a vocalized note (ideally using the diaphragm to do so) or a constriction of the throat & vocal cords. However, for keyboard it involves a flexibility of the wrist & a continuous “bouncing” motion.

2. What did I change my mind about?

I changed my mind about the role of imagery in learning & performing a skill. I expected it to be of great importance & used often if not constantly. However, I found that most of the time I did not use imagery. Occasionally I would deliberately use images from various modalities (most often auditory or tactile), & they did help as I predicted they would. But their impact was much smaller than I initially predicted.

Early on I changed my mind about the skill itself quite a bit once I realized that my first choice would just be too difficult to make work. I could not decide between a music-related skill (this one or tap dance) or a language skill (learning sign language or Spanish). I also wanted to continue a skill I started learning last October (capoeira & Afro-Brazilian dance) or a skill that I already knew but was “rusty” (juggling), but I was not sure if these would have been acceptable. Toward the end of March I did start to regret my choice, but I found a way to keep this skill interesting by changing my focus & final goal for the project.
3. **What were some factors of the project that surprised me?**

Factors that surprised me include the lack of importance of imagery-related techniques already mentioned as well as the essential nature of rhythm to the project & the strangely complicated role of transference from vocal work.

Rhythm is far more important to playing keyboard than it is to vocal work. With vocal work, if you have not yet developed a strong sense of rhythm you can still “get by” with relying on your accompanist & use specific phrases of the music as vocal cues. With keyboard, you suddenly are that accompanist for either yourself or someone else) that is relied on & must be flexible.

I had hypothesized early on that my vocal training & my slight abilities with other musical instruments as well as this one specifically would aid me in my skill progression. This was not clearly the case. At some points it seemed to be of great help, providing insight into “problem measures,” but at others it was a distraction to be avoided. I could not find a pattern within the observations that explained this phenomenon, so it remains a mystery to me even now that the project is completed for the semester.

4. **In what ways did my observations agree/disagree with text or class material?**

My observations agreed with both Kahneman’s & Treisman’s attention theories, which is part of the reason I decided to combine the two for my theory. I could split attention, but I was also easily distracted by important (“low threshold”) words, such as my name or the word “late” (such as my roommate saying “Aren’t you going to be late to class if you keep playing that?”).

My observations fail to support any of the discussed pattern recognition or imagery theories. When I first learned how to play, “features” were important (which is why I kept them in my theory) & attended to specifically— the placement of a note on the staff, the “look” of a note, the key signature, etc, but later on I did not feel like I even noticed “features” directly & would not even be able to tell people the key of a piece that I had learned or the names of a given progression of notes. My hands “just knew” how to play the progression. However, I do not think it was OTT either; I was not projecting any expectations onto new music, other than simply the fact that it would indeed have notes. As for imagery, as I have already stated my experiences with it were far & more infrequent than I anticipated. The experiences I did have could be explained by any of the theories we discussed in class or the text.

My observations regarding concepts were highly subjective & “unscientific,” such as “I must have enough grasp on the basic concepts that I sounded to her like I knew what I was talking about (journal entry dated 2/20/02). Therefore, none of these observations were terribly useful for either the project or the theory essay.
5. How do I feel about the project as a whole?

It is difficult to really say how I feel about the project as a whole. My feelings toward it over the course of the semester varied from what is the point of this “since I am not making progress nearly as quickly as I had initially hoped to” to “I’m feeling pretty good about this project again” to “when I compare it to the beginning of the semester (almost), I am very satisfied with my progress to this point. Maybe I can do this” (journal entries dated 3/19/02, 4/11/02, & 5/2/02, respectively). So the trend seems to be increasing satisfaction with the project as the semester progressed (& so did my skill as a result).

But an overall feeling about the project is still elusive. I suppose if I had to choose a word or phrase at the current moment (5/5/02) it would be “indifferent” or “glad to no longer have to journal.” I enjoy learning new skills, but I have never been fond of keeping journals & have often felt that teachers only assign them to make sure you actually do the project throughout the semester (instead of “cramming” it at the last minute, but this technique seems pointless because every good student knows how to fake journal entries & could do so if they really wanted to). This is probably not what Dr. Yates was hoping for as a reaction to the project, but if it helps at all, I would say it was useful in learning the cognition concepts discussed this semester, even if journalizing itself did become a tedious chore.