Reading 7C

1. The writing system:
   1. Grapheme – unit of written language that corresponds to a phoneme (steak s t ea k).
      1. All spoken languages distinguish between consonants and vowels
      2. No common relationship in written languages, they are much more varied.
      3. (show different pictures of languages, like Hebrew, Chinese).
   2. Types of writing systems:
      1. Alphabetic scripts – English and European languages
         1. Basic unit of representation is grapheme = phoneme
         2. Some are one to one
         3. English is many to many (give examples)
      2. Consonantal scripts – Hebrew and Arabic
         1. Not all sounds are represented, vowels are not written at all
      3. Syllabic scripts – Japanese kana, Cherokee
         1. Written units represent syllables
      4. Logographic/ideographic scripts – Chinese Japanese kanji
         1. Each symbol is a morpheme
      5. One issue with all these different writing systems is that processing must be different for different languages (most research here is in alphabetic scripts)
2. Preliminary model of reading
   1. Think about how you might pronounce the words that are you seeing
      1. Spelling to sound correspondence – for regular words where the grapheme matches the phoneme and you don’t need anything special to sound them out.
      2. Regular words – graphemes have the standard pronunciation
      3. Irregular words – do not match sound to spelling rules (vase, have)
      4. (note: grapheme to phoneme correspondence, spelling to sound, etc all mean the same thing)
   2. Nonwords
      1. Pronounceable nonwords or pseudowords – things that are not words but we can sound out.
      2. We can also spell these words when you hear them aloud.
   3. Dual route model
      1. The ability to read nonwords/regular words and then say irregular words on the other hand.
      2. (show picture)
      3. Lexical route or direct access – used for irregular words with special pronunciations
      4. Grapheme to phoneme conversion (GPC) route – also tends to be called the indirect or nonlexical or sublexical route
         1. Used for reading nonwords and regular words
         2. Phonological recoding (sounding it out)
         3. Does not use the lexicon at all
         4. Hooked on Phonics!
      5. Most people see reading as a race between the two routes, tend to be slow when we have to relay on lexical route – especially for new or weird words
   4. Compared to other models
      1. Parallel coding models – models that have at least two routes, sometimes more.
      2. How useful are those extra routes? Is it necessary to explain all the data?
      3. Phonological mediation – going from print to phonology to meaning
      4. Most researchers believe that there is direct access from print to semantics
3. Processes of normal reading (dual route model)
   1. Reading nonwords – reading NW goes through the GPC route which implies that they are all alike
      1. Pseudo homophone effect – NWs that sound like a word when pronounced (brane, nite)
         1. These are more confusable with words, we are faster to name them and slower to reject them as NWs
         2. Visual similarity or phonological similarity? – research shows that it seems to be the visual similarity that causes this effect
         3. The GPC route also seems to use orthography
      2. Glushkos Exp – lexical effects on NW reading
         1. Words with regular neighbors – taze (gaze, laze, maze), feal (real, seal, deal)
         2. Words with irregular neighbors tave (have), fead (dead)
         3. Words with irregular neighbors take longer to name, also make pronunciation errors (i.e. use irregular sounds pove as love instead of cove)
         4. Implies that the GPC has a visual component which matches to the lexical side.
      3. Priming NW
         1. The cue word in a priming task will influence which way you pronounce a nonword with irregular neighbors (yead, bead, head)
         2. LOUCH, primed with feel sound like touch; primed with sofa sounds like couch
         3. Must involve lexical/semantic information
   2. Word processing – words are accessed directly through the lexical route, words should all be the same given regularity of sound to spelling rules
      1. Pronunciation regularity affects response times, but in a weird way.
         1. Regular words are said faster than the frequency matched irregular words ‘
         2. Low frequency regular words are named faster than low frequency irregular words
         3. Also influenced by the number of friends (similar pronunciations) and enemies (conflicting pronunciations)
      2. Orthography also matters, we have trouble with words with low bigram frequency (yacht – ya and ht are not common)
      3. These results could be explained by the race hypothesis – there’s a race for both sides
      4. Glushko Exp – words are affected by the regular and irregular pronunciations of neighbors
         1. All regular gang (bang, hang, rang)
         2. Not all regular pint (mint, dint)
   3. Pronunciation neighborhoods
      1. Friends and enemies both influence the pronunciation time
      2. Faster for large neighborhoods
      3. Also interacts with reading ability – good readers do not show regularity effects when you control for neighborhood
      4. Page 215 picture.
      5. Classification table -
         1. Regularity of the pronunciation with sound to spelling rules
         2. Words share the same body – rime (final vowel and terminal consonants)
   4. Phonological mediation
      1. Sound may have an influence on accessing a words meaning
      2. Exp:
         1. Category decision task – is this a fruit? Yes to pear, no to pour, make a lot of false positives to PAIR
      3. Also make lots of errors in LDT when there are homophones, seems to be confusing feedback from lexical and phonology routes
      4. Most dominant thought is that the reason we get this phonology interaction is the “weak phonological view” or that it comes from the indirect route to semantics (GPC)
      5. Strong phonological view is phonological mediation – get meaning from sound and can’t recognize words without sound (inner speech coming up next!)
      6. Support:
         1. People gaze longer at sole and soul even though the spelling makes it non ambiguous (sound is ambiguous)
         2. Maybe only poor readers have to do this
         3. May only occur for low frequency homophones
         4. Gaze times were longer for brake when break should have occurred – implies meaning was activated first, then sound later
      7. May be that when you are “racing” the lexical route, in some circumstances it’s slow, so the GPC has time to assemble the sound, which requires you to make a decision.
   5. Silent reading and inner speech
      1. We seem to activate the phonological code during silent reading (probably after meaning)
      2. Tongue twisters (she sells sea shells…) take longer to read – if it was purely meaning, then that wouldn’t be the case. Those phonemes all being the same seem to slow us down.
      3. Inner speech is obviously not the same thing as overt speech – we can read much faster silently than aloud, overt articulation does not inhibit inner speech
      4. Inner speech seems to help comprehension – helps you retain information in working memory to create a picture of what you are reading.
   6. The role of meaning in accessing sound
      1. Phonological mediation is that we use sound to access meaning
      2. But what about the times that you have to know the meaning to create the sounds? (row, bow, tear)
         1. I tied my shoelaces in a bow.
         2. I took a bow when I finished my performance.
      3. You have to access meaning to figure out how to pronounce the word.
   7. Speed reading?
      1. These courses *do not* work.
      2. When you increase your reading speed above the normal rate, comprehension declines.
      3. Just and Carpenter exp
         1. Gave people easy text and difficult text to read
         2. Normal readers did better on both
         3. Speed readers got the same gist of the information, but were terrible at the details.
      4. Speed reading is essentially skimming, but for comprehension you need information to stay on the fovea for a period of time.
4. Normal reading evaluation
   1. Problems with the simple dual route model
      1. Lexical effects of reading nonwords, which should be read by the GPC side
      2. Effects of regularity on pronunciation – which should be read by the lexical side
   2. The race model better explains the data.
      1. Regularity effects arise when the output from both sides appears at the same time.
   3. It may be that skilled readers are able to control which information they pay attention to.
5. Neuropsychology of adult reading disorders: acquired dyslexia
   1. Types of disorders
      1. Acquired disorders – disorder caused by brain damage is acquire if it affect an ability that was previous intact
      2. Developmental disorders – a disorder where the normal development or acquisition of a process is affected
      3. Dyslexia – disorder of reading
      4. Dysgraphias – disorders of writing
   2. Types of dyslexia
      1. Central – involve high level processes
      2. Peripheral – involve lower level processes
         1. Visual, attentional, letter by letter reading, neglect dyslexias
         2. All of these distract from the visual information
   3. Surface dyslexia - dyslexia where the person has trouble with exception words / irregular words
      1. Over regularization errors – tend to pronounce irregular words with regular sound to spelling rules
      2. Most people interpret this as a break down of the GPC non lexical route
      3. MP – normal accuracy reading nonwords, but less accuracy and problems with the irregular words (biased by frequency)
      4. Types?
         1. Type 1 – highly accurate at reading regular and pseudowords
         2. Type 2 – some impairment of reading regular and pseudowords
         3. Type 2 influenced by lexical variables – so lexical route partially in tact, and GPC partially in tact
   4. Phonological dyslexia – a type of dyslexia where people can read words quite well but are poor at reading nonwords
      1. This should be a problem with the GPC route, they can read irregular words fine (using the lexical route), can’t read NW because there is no memory of how to say them.
      2. WB could not read NW at all (some trouble with lexical route)
      3. Problems/Things you see:
         1. People are better if they are pseudohomophones (nite for night)
         2. Have trouble with words that require inflections (emphasis)
         3. Derivational errors – read a grammatical relative of the target (performing instead of performance)
         4. Visual errors – read as another word that orthographically the same (perform, perfume)
      4. Types
         1. Some seem to be vision based – have trouble with complex phonemes (au) versus one to one mapping IKO
         2. Some seem to be sound based – can read pseudohomophones but not NW
      5. Three stage model of GPC:
         1. Graphemic analysis – parses letter strings into graphemes
         2. Print to sound conversion – assigns phonemes to graphemes
         3. Phonemic blending stage – sounds are assembled into phonological representation
      6. Phonological dyslexia appears to be caused by a general phonological deficit
         1. Would also have problems with rhyming, phonological short term memory, phonological synthesis (what does c a t spell out), phonological awareness (what word is left if you take the p out of spoon?)
6. Deep dyslexia – disorder of reading characterized by semantic reading errors
   1. Shows the same signs as phonological dyslexia
   2. Semantic paralexias – reading error based on a word’s meaning
      1. When people produce a word related to the meaning of the word shown (daughter – sister, pray-chapel)
   3. Symptoms
      1. Semantic errors
      2. Visual errors
      3. Substitute incorrect function words
      4. Derivational errors
      5. Can’t pronounce NWs
      6. Image ability effect – if it’s easier to form a mental image of a word, it’s easier to read
      7. Nouns are easier than adjectives
      8. Adjectives are easier than verbs
      9. Function words are harder than content words
      10. Writing is impaired
      11. Auditory STM is impaired
      12. Reading ability depends on the context of the word
   4. Patients vary on which symptoms the have, which indicates that there may not be a single underlying cause
   5. Types
      1. Input – have trouble finding the exact semantic representations of words when reading
      2. Central – severe auditory comprehension deficit with reading trouble
      3. Output – can get the semantic representation, but have trouble with phonological output
   6. Right Hemisphere hypothesis
      1. The more of the left hemisphere that is damage the more severe the deep dyslexia
      2. Therefore the brain plasticity picks up in the right hemisphere, but it’s just not that good at the language thing
   7. Summary – this whole thing is messy!
      1. How does the dual route model explain deep dyslexia?
      2. The right hemisphere hypothesis doesn’t actually tell us anything about normal reading
      3. (figure 7.2 on page 226)
      4. Must be a nonsemantic direct access route that gets at phonology given orthography (that does not pass through semantics first), and a semantic direct access route that allows us to say the correct version of a homograph
7. Models of Naming
   1. Revised dual route model – added a third route to the model to account for acquired dyslexia information
      1. Page 228 picture
      2. Routes
         1. Non lexical route for putting together pronunciations from GPC
            1. Standard GPC (spelling to sound rules)
            2. Body subsystem – uses information about orthographic and phonological rimes
         2. Direct route now: semantic direct route
         3. Nonsemantic direct route
      3. Fits with data:
         1. Lexical effects on NW and regularity effects on words are the interaction between lexical and non-lexical routes
            1. Interference during retrieval of information
            2. Conflict at resolving multiple phonological forms
         2. Surface dyslexia is the loss of the ability to get to the orthographic lexicon
         3. Phonological dyslexia loss of the indirect route
         4. Deep dyslexia is still a mess
      4. Sub models
         1. Multiple levels model? – different levels of spelling to sound information (phoneme rime, word level correspondence)
         2. Dual route cascaded – based on the three route model, with cascaded processing
            1. Basically connectionist model set up in stages
         3. Summation model – direct route is reading through semantics, but when it’s broken, it still gives you some activation, therefore creating correct pronunciation.
   2. The analogy model – single route model with an explicit pronunciation mechanism
      1. Pronunciation – occurs by making an analogy with other similar words
         1. When a word is activated, it activates it’s neighbors
         2. When the neighborhood is all normal (or rhymes) pronunciation is fast
         3. When the neighborhood is a mix of regular and irregular versions, pronunciation slows and sometimes errors occur.
      2. Problems
         1. Not clear how information is segmented
         2. Makes incorrect predictions about how words are pronounced
            1. Pook? - should be like book hook look cook rook, but it’s not.
         3. Also doesn’t describe the dyslexias
   3. Connectionist models
      1. Seidenberg and McClelland (1989) model (page 230 picture) – triangle model (because of the shape of the picture)
         1. Similar to the interactive activation model
         2. Reading and speech involve three pieces of information: orthographic, meaning and phonological
         3. These pieces of information are all connected to each other with feedback connections
         4. No route involved GPC rules?
         5. Parts (see figure 231)
            1. Three levels, each with many simple units
            2. Input hidden and output layers for each one
            3. Connections that are inhibitory or excitatory
            4. The weights of connections between levels are **learned**
            5. Back-propagation – algorithm for learning input output pairs in connectionist networks; works by reducing errors between actual output and desired output of the network (give example)
            6. Wickelfeatures – phonemes represented by activation distribution over units – usually triplets (each phoneme/grapheme represented as the unit and then the units around them – have gets #ha-hav-ave etc).
         6. Testing
            1. Model was “trained” – or given all the words in the word norms database (Kucera and Francis)
            2. Given activation to the orthographical units – which then feed into the phonological units
            3. Given at the frequency that they are seen in real life
            4. After training the model was tested for accuracy

Phonological error scores – supposed to mirror a naming task – given orthographic input and see if it comes out right

Orthographic error scores – LDT task, given features and see how they got the words (and how fast)

* + - * 1. Pretty good representation – gave the same speeds in naming and LDT that people would
      1. There is no separate mechanism for regular and irregular words – they are all about patterns of activation – much simpler
    1. Revised Model PMSP (plaut mcclelland Seidenberg ….peterson/Patterson)
       1. Used more realistic information to train the model (information with phonological restraints – how it occurs in language)
       2. Orthographic units were constrained to letters that occur together in language
       3. The original model did badly on nonwords because of the Wickelfeatures – it was a dispersal of spelling-sound rules.
          1. For example GAVE was represented as A with G V, which didn’t relate it to SAVE – even though those two As are exactly the same
          2. New model allowed activation to let those two be the same
       4. Accessing semantics – the new model also assessed the way we access semantic information
          1. Through OS – orthography to semantics directly
          2. Through OSP – orthography to phonology to semantics indirectly
          3. Trained the sound to semantics side – because kids know what spoken words are before they read.
          4. Then trained the spelling to sound rules
          5. Then put all three together – performs like people do.
    2. Connectionist models of dyslexia
       1. Modeling surface dyslexia – lesioned or cut out hidden units in PMSP model, which caused it to act like someone with surface dyslexia
          1. They damaged the model by resetting some of the weights to zero.
          2. Found that some of them reset themselves back (so why some people have varying degree of problems with dyslexia)
       2. Exploring semantic involvement in reading
          1. Semantic glue hypothesis – semantic representations bind phonological representations together
          2. In dementia, you often see surface dyslexia – because these representations are breaking down over time
          3. In surface dyslexia the connections to semantics are broken, so they are just relying on phonemes which is why you see the problem with irregular words
       3. Modeling phonological dyslexia – general problem with phonological processing – the representations are broken at the phonological level, not at the GPC connections
          1. Phonological impairment hypothesis – have overall trouble with phonemes
          2. People can still read because of the relationship between semantics and phoneme representations
       4. Modeling deep dyslexia – model was trained by back prop to associate word pronunciations with representations for the meanings of words
          1. Sememes – (show meme picture) – semantic representations are patterns of activation across the network
          2. Cleanup units – representations that are complex relationships between features, creates a “semantic space” – show 3d picture
          3. Attractors – a point in the connectionist network to which related states are attracted
          4. They lesioned different units (made them zero, added noise, and took them out) to mimic the different findings for deep dyslexia
          5. Paralexias occur because the same pattern of activation is seen but the wrong word gets activated or wins activation because of the lesions (i.e. the clusters are close, overlap a lot, and you just choose the wrong one)
    3. So which model is best? Lots of arguments.
       1. They seem to argue different points of view (regularity versus consistency) but it’s hotly debated which one is right.