

Questions, Week 4

Neural Bases of Language

Submitted October 2, 2005

1 Short Answer

- (1) How do the results that a subject with CK would do similar to controls in face matching but worse than controls in greeble and object matching, both support and dispute that the FFA responds selectively to faces?
- (2) Compare and contrast the idea of "reading as serial letter processing" and "reading as mediated by sound representation." Begin by describing the fundamental traits of each theory and then cite one piece of evidence per theory (pro or con).
- (3) Give evidence regarding the subject CK that supports the notion that, within the FFA, face and expertise processing are different.
- (4) Explain the phonological deficit hypothesis of dyslexia and its implications on the way we process the meaning of words.
- (5) What are some differences between the "VWFA" and "FFA"?
- (6) According to the reading "The Psychology of Reading," what is one argument against the word-as-visual template model of reading words?
- (7) Dyslexia is an abnormality in auditory processing. Name some of the deficits associated with dyslexia and one of the major problems in defining specific impairments to diagnose the disorder.
- (8) When reading words or symbols either with noise or without noise, what is the difference in activation between the M100 and the M170?
- (9) It has been shown that text written in AlTeRnAtInG cAsE sUcH aS tHiS has led to problems in word identification, and consequently, may significantly impair the reading process. Assess the validity of this statement.
- (10) Give three performance or neuropathological characteristics that are typically associated with developmental dyslexia.
- (11) Why must we consider experimental design when noting that dyslexics display an auditory M100 with a longer latency than controls?
- (12) You are given the stimulus "blick" in a pronunciation task. Using the Paap et al. analogic model, as given in "The Psychology of Reading" how would you go about pronouncing this word?

- (13) Semantic processing is considered a higher-level language component, whereas phonological processing is considered a lower-level one. Given this view, how is it possible for a dyslexic to understand and define a word that they are given when they are unable to read it?
- (14) What are 2 characteristics of developmental dyslexia?
- (15) In "The Man Who Mistook His Wife for a Hat," Dr.P has a degenerative process in the visual parts of his brain that essentially means he lacks what?
- (16) A person with what kind of dyslexia would have a problem reading the word 'cough' and why?
- (17) What are cortical microgyri?
- (18) Explain how in the Boatman, and Gordon article entitled, "Transcortical Sensory Aphasia: Revisited and revised" the experimenters used a with-in subjects design, and how this design was implemented.
- (19) Describe the left fusiform gyrus in terms of both the classic view, and 1-2 pieces of evidence that blur the picture
- (20) What is the phonological model? Why would this impair reading performance, but not comprehension, in a dyslexic individual?
- (21) Categorization tasks and lexical decision tasks are used to judge whether or not a subject has accessed the meaning of a given word. Explain the difference between the two and tell whether they are effective or ineffective methods.
- (22) What is a possible reason that visual word form area in the fusiform gyrus, which is specialized in recognizing letter strings, develops reliably in a precise location in the brain, despite the fact that this location is not a specialized module specifically for word recognition?
- (23) What is the word superiority effect?
- (24) Using evidence about the VWF, explain why the pseudoword drump is more likely to make sense in the English lexicon than tlurgm:

2 Multiple Choice

- (25) According to the article by Sally E. Shaywitz called "Dyslexia", which of the following are myths about Dyslexia. I. Mirror Writing is a symptom of dyslexia II. Eye training is a treatment of dyslexia III. Dyslexia can be outgrown IV. Dyslexia is associated with abnormalities in visual and auditory processing
 - a. all of the above
 - b. I., II. III.
 - c. none of the above
 - d. IV., II., III.

- (26) Which of the following statements is/are true in regard to developmental dyslexia? i. Dyslexia is associated with abnormalities in auditory as well as visual processing. ii. Reading development (in persons with developmental dyslexia) does not occur later than other comparable academic developments. iii. Reading is impaired only for words; non-word readings is not impaired. iv. One common misconception is that reading is slow in developmental dyslexia.
- i & ii
 - ii & iii & iv
 - iii
 - i
- (27) According to the "classic view" the left fusiform gyrus:
- is activated more by words than control stimuli
 - specific to the visual modality
 - insensible to lexical factors
 - all of the above
- (28) The following describe function words except:
- closed category
 - lack of their use in Broca's aphasics is called 'telegrammatic' speech
 - prepositions & conjunctions
 - exemplify the generative ability of our grammar
- (29) You are looking at the results of a study on the processing of letter strings by dyslexic adults. Knowing that M100's are sensitive to noise level and M170's are sensitive to letter strings, in which of those reactions do you think there would be a significant difference between the dyslexics and regular adults?
- Both
 - M100
 - Neither
 - M170
- (30) The VWFA is insensitive to which of the following: 1. auditory stimulus only 2. word frequency in the lexicon 3. the abstract representation of a word 4. change in typeface
- 1, 2, 3
 - 1, 3, 4
 - 2, 4
 - 1, 2, 4
- (31) Why is it that although in general, words in English with irregular spellings take readers longer to pronounce when presented than words with regular spellings, this time difference disappears when the irregular word is frequent in the language?
- One becomes habituated with frequent exposure to a word, and pronouncing it upon sight becomes an automatic process not exhibited with infrequent words.

- b. Frequent words with irregular spellings, unlike infrequent words, are accessed by the same method as words with regular spellings, so there should be no difference in response times.
 - c. Although words with irregular spellings and words with regular spellings are accessed by two different systems, with frequent exposure to a particular word the system for irregular spellings, usually slower, becomes faster in retrieving proper pronunciation for that particular word.
 - d. Words with regular spellings are always accessed and pronounced more quickly than those with irregular spellings.
- (32) An individual suffers from a disorder that impairs his or her ability to separate written words into their basic phonological parts on the phonological level of language processing. What disorder does the person most likely suffer from?
- a. dysarthria
 - b. Wernicke's aphasia
 - c. developmental dyslexia
 - d. apraxia of speech
- (33) Which of the following statements about the Visual Word Form Area is incorrect?
- a. It is located in the right fusiform gyrus
 - b. Damage to VWFA associated with severe impairment to written word comprehension
 - c. It is multi-modal
 - d. Does not respond to consonant strings or pseudo-words
 - e. All of the above
- (34) which of the following are NOT associated with developmental dyslexia
- a. visual processing abnormalities
 - b. auditory processing abnormalities
 - c. focal reorganization of cortical layers
 - d. lower level auditory problems
- (35) Dyslexics show a longer and larger M100 response to speech sounds than normal subjects. This result is taken to show what?
- a. Dyslexics have more difficulty in understanding the semantic meanings of sounds.
 - b. Dyslexics are more sensitive to speech sounds.
 - c. Dyslexics have more difficulty in understanding speech sounds.
 - d. Dyslexics should have a harder time understanding written text.
- (36) Recent models characterize dyslexia as being caused by an impairment to the:
- a. lower level phonological processing ability
 - b. visual processing ability
 - c. higher level semantic processing ability
 - d. both B and C
- (37) Visual Information in the right eye is processed in the:

- a. Right occipital lobe
 - b. Left fusiform gyrus
 - c. Left occipital lobe
 - d. Right fusiform gyrus
- (38) If I am a dyslexic student, I would have the least amount of trouble taking what kind of exam?
- a. multiple choice
 - b. oral
 - c. essay format
 - d. fill-ins
- (39) Which of these is not a type of acquired dyslexia?
- a. Broca's dyslexia
 - b. Deep Dyslexia
 - c. Pure Alexia
 - d. Surface Dyslexia
- (40) Which of the following is FALSE about the VWFA (visual word form area)?
- a. It has been found to be abnormal in dyslexics
 - b. Reading is not possible without it (answer)
 - c. Shows activation for letter strings
 - d. Lies in extremely close proximity to the LIMA (Lateral Inferior Multimodal Area)
- (41) Aunt Sally suffered a stroke. She experienced a lot of damage to her left hemisphere. Aunt Sally now confuses words like "cow" and "bull." She really makes a lot of semantic errors. The doctor evaluates her and tells you she has:
- a. Pure alexia
 - b. Mammalian dyslexia
 - c. Surface dyslexia
 - d. Deep dyslexia
- (42) Chose the correct statement:
- a. The visual cortex is not sensitive to faces but is sensitive to letters.
 - b. The visual cortex is sensitive to faces but is not sensitive to letters.
 - c. The Left Fusiform Gyrus is sensitive to faces.
 - d. The Right Fusiform Gyrus is sensitive to letters.
- (43) The "word superiority effect" is supported by evidence that...
- a. Skilled readers can easily read words in many different fonts or in alternating case.
 - b. Readers are better able to identify letters in the context of a word than in isolation.
 - c. There may be two distinct areas in the left fusiform gyrus, the VWFA and the LIMA.
 - d. We activate phonology to some extent when reading.
- (44) Which of the following concerning the 'Visual Word Form Area' (VWFA) is NOT correct?

- a. associated with a portion of the left fusiform gyrus
 - b. damage or dysfunction of VWFA is highly associated with impairment of written word comprehension and lexical decision
 - c. damage or dysfunction of VWFA is associated with impairment on tasks requiring oral reading and oral naming
 - d. all of the above
- (45) Which of the following statements is not true about developmental dyslexia?
- a. It involves an abnormal VWFA.
 - b. It involves abnormal auditory processing.
 - c. It involves a focal reorganization of cortical layers.
 - d. None of the above.
- (46) In Rayner & Pollatsek's parallel model of word and letter identification, there are three stages of detection. Which of the following is NOT one of the stages?
- a. feature detectors
 - b. letter detectors
 - c. semantic detectors
 - d. word detectors
- (47) According to the lecture on dyslexia, a person with surface dyslexia would have trouble with which one of the following words?
- a. howl
 - b. besides
 - c. bowl
 - d. dog
- (48) Parallel Letter Detection is when...
- a. you have a stimulus word, and you process the letters in the word one by one.
 - b. you have a stimulus word, and this activates feature detectors, which activates letter detectors, which lastly activates the word detector.
 - c. you have a sentence and process the entire sentence as a whole.
 - d. you process the word's letters two at a time, in parallel.

3 Open-ended Research Question

- (49) Do dyslexics have issues with pseudowords auditorily? What common errors might arise in their describing said patterns orthographically?
- experiment: present dyslexics of a young age (5-7) with patterns of phonemes auditorily, ask them to repeat patterns verbally. Then have them write what they have said. A variation could be to weight the repetition of certain patterns, and certain recombinations of elements between patterns. Basically seeking some statistical hints at phoneme acquisition in language-developed children.

- (50) If someone has an accident and receives damage to both the visual word form area and the face fusiform area (a heavy blow to the back of the head) before critical period, would their respective functions be able to relocalize?
- (51) Once a word is identified, do readers of logographic systems mentally divide words into phonetic components to access meaning as it is maintained by the phonological model that readers of alphabetic systems do?
 BONUS: Being that, dyslexia is considered a phonological deficit, one could test both "normal" readers and dyslexics to see if the dyslexic readers exhibit the same or analogous deficits on tests timing decoding of meaning of presented words as compared to the normal readers. If so, this may indicate that phonological representations are used in this process.
- (52) How does word/pseudoword perception differ from number perception? Rayner and Polatsek's article presents that idea that there are 2 routes to the lexicon, a direct route from printed letters to the lexicon, and an indirect route that involves "initially transforming the printed letters into a sound rep and accessing the lexicon via the sound rep." By examining the way the brain processes number strings as opposed to letter or symbol strings, we would gain insight into the latter route to the lexicon described above, since there is not number to sound representation, and moreover no number lexicon. MEG could determine the presence of the M100 and M170, and compare this to the effect of consonant strings/symbol strings/pseudowords/words (all of which have already been researched.) Essentially, this research question is how do numbers effect the visual word form area.
- (53) In the chapter from Sack's book the agnosiac Dr P can no longer unify all of the individual features in his visual field. The subject could give a very detailed analysis of an object presented to him, such as the glove. I am assuming the the agnosiac still has a firm grip on what a face would entail, such as a nose, eyes, and so on. If presented an image of a face the agnosiac would be oblivious to this. But if the agnosiac is told that what he is looking at is a face then would he be able to identify the other constituent parts of the face as he can forcefully mold the raw visual stimulus to fit the mental template that he has of what a face should be?
- (54) Does the m100 onset time decrease as a subject becomes habituated to an auditory signal (both word/nonword)?
 the test is obvious, habituate subjects to both words and non words (separately) and analyze the m100 data to see if its onset is modulated by habituation, i.e. do subjects become faster at processing sounds that are expected..
 Are cortical microgyria present during developmental dyslexia or just aquired dyslexia? If it is both then maybe we can discover if the problem could somehow be genetic and therefore isolate that gene.
- (55) Are their brain differences between dyslexic boys and girls (persay, under the age of 5) in brain organization?
- (56) Is it possible to train the VWFA so that its activity will increase in adults when given word form stimuli?
- (57) Given that phonological representations don't develop normally in dyslexics, and that they have abnormal auditory processing, do they also fail to categorically differentiate phonetic

boundaries? We have discussed a phonological contrast experiment which found that normal listeners categorically separate the phonemes T and D in spite of variable acoustic representation. If we gave this same test to dyslexics, would we see a less distinct categorization? While we know that dyslexia is not a lower level auditory problem, and as such we would assume that dyslexics would be able to differentiate tones in a way that is comparable to controls. The Dyslexia article that we read the author discusses that dyslexic children may have trouble identifying the correct number of phonemes in spoken words, and an example discusses that "volcano" could be read as the phonologically similar "tornado". If dyslexics are found to have a less clear differentiation in the T/D test, then this would support that dyslexics exhibit abnormal phonological processing, and perhaps lend some insight into where those problems begin. In order to examine this we could simply rerun the MEG mismatch study conducted by Phillips et al. with age/gender matched groups of dyslexics and controls.

- (58) According to Sally Shaywitz' article entitled "Dyslexia..." (1996), there is concrete evidence that women activate both the left and right inferior frontal gyri for phonological processing whereas men only activate the left inferior frontal gyrus. There is also evidence that left handers tend to lateralize language more than right handers. Could it be that left handers are also more likely to "compensate" for dyslexia?
- (59) Does the VWFA respond the way it does because of our expertise of language or are these responses innate? Is the VWFA a result of familiarity with the written word or is evolution giving us a head start? Would a person who is illiterate show the same patters of activation as a person who can read? Furthermore would a child who has just learned to read show the same pattern of activation as a person who has been reading for many years?
- (60) How is the function and/or development of the VWFA different for illiterate adults? What about people who did not learn to read until past the "normal" time (ie. as adults (and have no indication of linguistic processing difficulties)?

BONUS: These questions are in response to the evidence that the LFG shows activity for lexical tasks that do not require an ability to read, such as naming and repetition, and this statement from the McCandliss, et al, paper: "The progressive development of the VWFA seems closely tied to the progression of skill, rather than being merely a matter of maturation" (297). For the former question, one could have a group of stimuli known to activate the LFG, some of which require literacy and some of which don't, for both a control group of literate adults and the group of illiterate subjects. Also, assuming that at least some of the illiterate adults know the difference between letters and non-linguistic symbols, one could use stimuli similar to that which Tarkianen et al. used and see if the mere ability to distinguish between letters and non-linguistic symbols makes a difference in the response of the VWFA. (The same could be accomplished by using literate adults and replacing the Latin letters from Tarkianen's project with symbols from another writing system like Chinese that the subjects cannot read but know are letters (or syllables, depending on the language). I don't know how easy this would be (to round up as subjects, or to come up with a way to judge their "level of literacy"), but it would also be interesting to have a variety of levels of literacy in a subject group to possibly be able to "map" the development of the VWFA. One could also potentially try to do the same sort of mapping with children, but I think in that case one would have to take into account the children's devel-

opment of general linguistic skills, not just reading. With adults, however, assuming that they don't have any linguistics impairments, one could assume that they have adult-like language skills and thus just focus on the development of reading.

For the latter question, one could possibly test McCandliss' statement about the development of the VWFA, and see if it makes a difference if linguistic "maturation" is fully achieved before the "skill" of reading. If the brain's possibility for a visual modality of language remains unused for a long time, will it be more difficult to develop, or does other (non-linguistic) complex visual processing keep that area "active" enough that it doesn't matter when one learns to read? Both of these ideas are obviously really big projects, but I think could relatively easily be broken down into more specific experiments.

- (61) In the reading on the psychology of reading, they discussed at great length the process involved in pronouncing words, especially non-words or new words. They talked about how we go back to "neighboring" words to find sounds that are similar and then are able to combine all of these previous rules to pronounce words. How would this be affected by the many different accents that can come with one language, for example English. I myself pronounce some words with a southern type accent and others without, but I don't think it has to do with the sounds because if I really concentrate I know how words are correctly pronounced and can do it, so I don't think I transfer the sometimes odd accent to new words. I was wondering what effect this would have on the idea of using neighboring words. Also, if there are numerous neighboring words and we don't always pronounce the sounds the same, how do we know which one to pick?
- (62) The Left Fusiform Gyrus has been shown to have activation in functional imaging studies during a variety of lexical tasks, such as Braille reading. Since this area is also part of the VWFA, and Dyslexics have an abnormal VEFA, do they have a problem reading braille, even if it is not visually observed, and how does it differ from visually seeing a word stimulus?
- (63) My question stems from the chapter on the psychology of reading. Could the question concerning whether we process the meaning of words because of the visual or phonological properties be examined by using deaf signers and blind readers of Braille? Are deaf signers able to read orthographically represented words the way that those with normal hearing or are they impaired based on their lack of phonological representation of words. Perhaps this idea could be explored and if this were the case it may shed some light on how important phonological representation is to processing the meaning of words. As far Braille readers do they convert the tactile symbols into phonological code in order to process what the words are representing or do they simply match the symbols directly to the word as a person with normal vision would do from the visual representation directly to meaning. I am not sure if this has been explored but I would be interested to know the results.
- (64) We know that the FFA is responsible for both face and expertise processing. We also know that dyslexics do not differ from controls in facial processing. Thus would it not be plausible to try and make dyslexics experts in reading, and thus solve their problem? **BONUS:** Work with dyslexic subjects on a one on one basis. Teach them to overcome their disability and with time, they should be able to read properly. Of course, this seems too easy so there must be some drawbacks. The M170 is probably not sufficient enough to

read and M100 is probably needed for reading despite level of expertise. Furthermore, a dyslexic's disability might hinder them from being able to be an expert at reading.

- (65) Can the fusiform face area (FFA) be primed to activate for visual representations of expert words?

This question comes from lecture and class discussion on 9/27 and is important to neurolinguistics because it addresses the issue of where visual representations of words appear in the brain and if (with training) certain visualizations of words will appear to be active in specialized regions as well as where processing can occur.

BONUS: The way I would suggest setting up a study to investigate this question would be to create a condition similar to that in which participants learned all about "greebles." Since the FFA has been shown to activate in the case of expertise for a visual clue, one might be able to hypothesize that it would also activate for visual input of expert words.

BONUS: In a similar manner to the way in which the greeble experts were trained, the participants of the experiment could be trained on 20-30 "new words." The participants would receive the new word and all the relevant information about it (definition, part of speech, etc.) and be expected to study it. Once they had been properly trained an MEG session would occur in which they were primed with these expert words and the results would activate the activity of this expert word task in the brain.

- (66) How would someone who obtained Broca's aphasia due on reading tasks if they already had developmental dyslexic?
- (67) Dyslexia is both a visual and auditory disorder. If dyslexics are taught to process language more symbolically through repeated sequences and memory prompts, could they overcome their impairments?
- (68) Why does microgyria cause abnormal auditory processing?
- (69) Is it possible for adults learning to read for the first time to be dyslexic, or is there a critical period for the disorder?
- (70) The Visual Word Form Area (VWFA) is a unimodal brain-region that has been demonstrated to be associated with impairment on tasks requiring lexical output, written naming, oral reading, and oral naming. Is there an associated shift to tactile processing in the case of blind individuals?
- (71) How are long words processed in the brain while reading- letter by letter or as the entire word? My hypothesis is that long words are broken down into smaller phonological units and these chunks are the units that are processed. To test this, a lexical decision test can be administered in which the subject is timed while reading the word "independence" and then while reading a word that is displayed as broken up into chunks- ex: in dep en dence. Find out whether there is a difference in times.