Homonyms: How Word Function Affects Storage and Retrieval

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Abstract

Language processing involves many different brain functions. An aspect of language is word concepts, which are stored and accessed separately from another aspect of language, the visual and auditory store of the word. Homonyms allow us to understand how these systems are set up better by giving us access to an individual word with more than one word concept. By employing studies that deal with homonym function, we are able to see homonym processing as a function of time, and by employing fMRI imaging, we are able to understand what types of processes the brain undergoes in comprehending a homonym as compared to a word with one sole meaning.

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Language has been viewed upon as one of human kinds greatest adaptations. The ability to comprehend, store, and apply words, either through visual stimuli (the written word), or auditory stimuli takes many different brain processes. Lexical access is the skill of comprehending auditory or visual signals to pull out conceptual information, or comprehending conceptual information to retrieve auditory or visual forms of the word in reference (Weis, Grande, Pollrich, Willmes, & Herbe, 2001). Of specific interest under the umbrella of language and lexical access is how we process words with multiple meanings. Polysemous words include those which have related meanings, such as paper in the physical sense (as in a sheet of paper), compared with a written work (as in this very cognitive psychology paper). Homonymous words are those that have separate meanings but the same pronunciation, as in bark being a substance found on the outside of a tree, or the sound a dog makes (Beretta, Fiorentino, & Poeppol, 2004). By better understanding how we access and process these words as compared to words with one solitary meaning, we gain access into better understanding how it is we comprehend, store, and apply words in general.

In 2003, Ferreira and Griffin conducted a study with college aged participants whose first language was English. When asked to name the subject of a picture after being presented with a priming unfinished sentence, participants were statistically more likely to answer incorrectly if the sentences missing word was connected to the picture, as in “nun” for the picture of a priest. Furthermore, participants were also statistically more likely to answer incorrectly when the sentences missing word was a homonym of a word connected to the image, as in “none” for a picture of a priest. This study shows that homonymous words are linked in our lexical storage, and that accessing a word might also mean accessing its homonymic counterparts (Ferreira & Griffin, 2003).

Beretta, Fiorentino, and Poeppol found further evidence of how our lexical storage works in a 2004 study using MEG recordings and timed response on right handed college aged English speakers. The participants were asked to indicate if a word presented was a real word or a nonsense word. Intermixed in these real words were homonymous words and polysemous words. They found longer response time to words that were homonyms than those that were not. They also found polysemous words were accessed faster than words with fewer related meanings. These two results indicate that homonyms alternate conceptual meanings are stored separate from each other, whereas polysemous words were stored together in our lexical storage (Beretta et al., 2004).

Because polysemous words originate from a conceptual link between their forms, there is a direct association between their word form and all their definitions, making good sense that there is a quicker response time in reaction, as the two definitions are stored together. The results indicating a longer response time to homonyms is slightly harder to understand, though Beretta et al. believe this is due to interference. By this, they mean that when presented with a word that is a homonym, it takes longer to identify it as a word because the participant is pulling conceptual information from many different areas which has the outcome of interference between the two separate concepts (Beretta et al., 2004).

Primary Data Selection

Weis, Grande, Pollrich, Willmes and Herbe (2001) presented a study that attempted to show just how we access information from our lexicon. Citing prior research, the paper discusses the three different levels of processing for understanding a word, which are conceptual, lexical, and sub lexical knowledge. They discussed how words are units in our lexical storage that link sound information to conceptual information. An area that had not been touched upon, they elaborated, was how far word form processing can be removed from conceptual information. By a method of setting up a test of finding a homonym while in an fMRI machine, they believed they could do just that.

Using an fMRI machine while prompting participants (right handed males, between 20 and 35) with two words would let them physically see what brain actions were taking place. They would provide participants with words such as “river” and “money” to elicit the word “bank”. They would also prompt participants with two related words with no singular word tying them together, such as “father” and “child”, resulting in an association that could be “mother” or “family”. Associating these two words would be less difficult in the sense that there was no one right answer. The control in this task was the reading of two unrelated nouns. Because of the fMRI reading, participants were asked to think about an answer and respond after the scanning, so as not have motor functions picked up by the scanning.

Results showed access to non-homonyms and unsolved homonym relations activated the same network known as the semantic network (Weis et al., 2004). Homonyms that were solved activated a bilateral network which is our visual word form lexicon, consisting of our super marginal and angular gyrus (Weis et al., 2004). This result helps differentiate what goes on in the brain when processing concepts than when processing word forms. The homonym task requires word form knowledge, and a solved homonym keys a specific area of the brain that holds the information, whereas an unsolved homonym in search of an answer accesses the same network as normal concept word relations, never activating the visual word form lexicon. This means, until fruition, we conceptualize all words through one network, and upon realization of identical word form, we activate a separate network. Their research also found that a successful homonym search took two seconds longer than a conceptual search of two words, a delay that can be seen in time ordered fMRI images which also indicates a separate function between the two tasks of finding a specific word with two definitions versus finding a word that conceptually links two others.

Discussion

Language and its relationship with brain function is a multi tiered process. We have seen how homonyms themselves are linked in our lexical storage (Ferreira & Griffin, 2003). We have also seen how homonyms word forms require additional brain processing due to the possible interference between their definitions, resulting in a time delay (Beretta et al., 2004). These two findings help show that, though the actual word is stored as one lexical entry (if you think of one, you think of the other), their definitions are stored separately, which makes for a longer processing time.

We have also been able to see, through fMRI imaging, exactly how we process the information (Weis et al., 2001). This allows us to understand the function of searching for a specific word versus searching for a word concept; through time delayed fMRI images, we are able to see the additional time needed to process homonyms as compared to non-homonym words, and the brain functions that are going on in that additional time.

Taking these studies into consideration, we can suggest further studies that might help us to better understand language processing. Because language is multi-faceted, that there are many different languages, each with their own homonym forms; it would be interesting to see how separate languages interact within homonym processing (“si” in Spanish versus “see” in English). Bilingual studies might also shed some light into how we learn new languages; if they interact heavily with our previous language and if so, for how long. Also, a word such as “mom” or “dad” has an ever changing connotation throughout our various life stages; seeing how we store this word (if it is accessed as a homonym) might give us clues to how lexical storage is affected through time. By using the fMRI study as conducted by Weis et al., and applying it to these other areas of homonyms, we may be able to unlock more knowledge about how word storage and concept storage relate and differ, and in doing so, learn better ways to present information and have it understood.

References

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