How context influences language processing and comprehension

Cutting edge technology is helping researchers track eye movement and brain activity to the millisecond in a bid to understand how we process language and extract meaning from what we see, read and hear. One of the leaders in the field is psycholinguistics expert Dr Pia Knoeferle from Berlin’s Humboldt University, where she studies how humans learn, use, and understand language.

As a discipline, psycholinguistics traces its history back to the early 20th century debate about acquired and innate language. That distinction between the two was developed in the 1950s and 1960s by psychologists such as BF Skinner, who argued that all language must be learned, and the philosopher and linguist Noam Chomsky, who believed that humans possess an innate language facility.

Modern psycholinguists focus on various aspects of language, for example how children and adults learn language (acquisition and language learning), how language develops from an initial idea to the spoken or written word (production), and the processes by which a wide variety of language users understand language (comprehension). Dr Knoeferle’s work focuses on comprehension and what types of information in a sentence are used to build meaning. She is particularly interested in how context – especially visual context – contributes to language processing.

Dr Knoeferle’s research makes use of technologies which study ocular and neural activity to the millisecond, to record in real time how subjects respond to language stimuli. These include eye-tracking technology, which monitors the subject’s gaze and eye movements during language tasks, for example when looking at text and images on a computer screen. It also involves the study of brain activity in response to a similar stimulus – called ‘event-related brain potentials’.

Language processing: theory and empiricism

In a recent paper “Predicting variability of context effects in language comprehension”, published in the Journal of Cultural Cognitive Science, Dr Knoeferle presents an in-depth review of language processing theory. She focuses in particular on research into prediction in language comprehension; that is, how we can begin to understand and predict meaning before we actually encounter a specific word.

Work in this area of psycholinguistics has developed over the past 40 years. Initially, researchers looked at how syntax – language structure – might enable individuals “to recover an interpretation from language input in real time”. They concluded that comprehension should be viewed as a two-stage process. In this way, the order of key words, for example a subject, verb and object, initially helps to suggest meaning. This meaning is subsequently fleshed out by other words.

The development of technologies has further enabled the study of brain activity while people perform various tasks. Among the most notable findings for linguistics has been the discovery of event-related brain potentials – brain responses to words and other stimuli. Measured to around 400 / 600 milliseconds post stimulus – ‘the N400 / P600 effect’ – brain potentials show how quickly the brain reacts to expectations of a word and semantic associations (N400) as well as to structure-related processes (P600).

Language in context

Dr Knoeferle looks at what the research literature says about context-focused approaches to comprehension. Studies have looked at verification and the interaction between listening and looking, for example asking subjects to verify a sentence in the context of a picture. Research has also considered ‘semantic priming’, in which brain responses to a second stimulus are found to be faster when that second stimulus is related to a first one (such as the word ‘cat’ following ‘dog’) than when it is unrelated (e.g., the word ‘disc’ following ‘dog’).

Our immediate environment can affect language comprehension in real time.
Characteristics such as literacy, language skills and, most importantly, age affect how quickly individuals integrate context into comprehension. The research literature suggests that a visually depicted action affects comprehension more rapidly in young adults than it does with kindergarten children, or with adults aged over 60.

Regarding how words relate to the situation and environment in which they arise, Dr Knoeferle finds there is a relatively direct and strong connection between action words and images, for example between seeing an image of someone painting and understanding the word ‘paint’. However, seeing someone smile is far more ambiguous and could relate to a range of things or words. They may be happy or amused, be looking forward to something, or be trying to cheer someone up, and related words could be ‘happy’, ‘amused’, or ‘compassionate’.

As a result, Dr Knoeferle argues that context has a greater effect for language that relates to things and events: “Referential cueing of information in visual context elicits – on average and by comparison – more rapid and stronger effects than non-referential mediation of visual context.”

Considering comprehension processes, when either distinct or similar language cues or prompts contribute to the same comprehension process, Dr Knoeferle argues they affect comprehension in a similar manner: “Imagine you hear language about a musician and it’s unclear whether she is acting or actualisation. Such ambiguity could be resolved via marking in language or also showing who is acting.” However, if the comprehension processes to which marking in language versus context depictions contribute are distinct, the comprehension effects will show up as distinct.

CONCLUSION

Dr Knoeferle’s study aimed “to derive a more principled account of context effects” in language comprehension and her scholarly review of 40 years of psycholinguistics research and the concepts it has produced more than fulfills her brief. Providing ample evidence that language does not take place in a vacuum and cannot be separated from its (social) context, Dr Knoeferle equally finds that context effects are variable.