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General principles of serial order representation

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One common approach to issues of domain-generality in language processing has been to look for brain or cognitive mechanisms that are shared between linguistic and non-linguistic tasks, through neuroimaging, neuropsychology and even dual-task paradigms. But arguments for domain-generality need not rely on identifying a common neural substrate. Indeed, it is possible that some aspects of linguistic representations are governed by domain-general principles, even without there being a common brain system shared across multiple domains. To illustrate this point, I will discuss a recent series of cross-domain experiments designed to probe how the order of items in a sequence is represented.

The ability to represent not only the items in a sequence but also their order is critical for language processing. The words LEMON and MELON are made up of the same set of letters and sounds; in written language, what distinguishes these words is letter order, while in spoken language, what distinguishes them is phoneme order. This problem of serial order is not exclusively a language problem; many non-linguistic tasks also rely on order processing. Starting with Karl Lashley (1951), researchers have argued for domain-general principles of serial order processing. Do domain-general principles govern how order is represented in linguistic sequences?

My own approach to this question has relied on cross-domain experimentation. My colleagues and I have carried out comparable experimental paradigms and data analysis techniques with a range of different sequence production tasks (e.g., single word spoken and written production, verbal and non-verbal immediate serial recall). Specifically, we have analyzed patterns of perseveration errors, either generated by brain-damaged or unimpaired individuals, to adjudicate between competing hypotheses for how serial order is represented. In experiments with both linguistic and non-linguistic stimuli, we have identified the same scheme for representing the order of items in a sequence – one in which an item’s position is defined relative to the beginning and end of the sequence. These results led us to conclude that domain-general principles underlie serial order representation.

While it is possible that there is a common neural system for serial order representation, identifying such a system is not necessary for the claim that serial order representation is based on domain-general principles. Grossberg (1986) argued that general principles of serial order may arise because of limitations on neural computation while Endress, Nespore and Mehler (2009) argued that general principle arise because of domain-general constraints on learning. Identifying general principles of cognitive processing may be evidence for a different type of domain-generality than the type supported by the shared neural mechanism approach.

References

