Making Sense of Deviance: Outliers in the Case Series Approach

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The case series approach to cognitive neuropsychology allows for theories that make quantitative predictions about functional associations to be tested (Schwartz & Dell, 2010). But even if these associations are observed, there may be individuals who significantly deviate from the predictions of the association. These outliers may reveal the limitations of the theory being tested and provide an opportunity to develop a better one. I discuss a recent case series that used a single outlying individual to address the causes of letter perseveration in spelling (Fischer-Baum & Rapp, 2012) to illustrate this point.

The prevailing theory of perseveration posits a common deficit—a failure to activate the current target—leading to both perseverative and non-perseverative errors (e.g., Cohen & Dehaene, 1998). This theory predicts an association testable in a case series; individuals who produced more non-perseverative errors should also produce more perseverations. In a case series testing this prediction, Fischer-Baum and Rapp (2012) found a significant correlation in this direction. But they also identified one individual in their sample who produced many more perseverations than predicted by his non-perseverative error rate.

Had this outlier been ignored, the significant correlation would simply have been taken as support for the failure-to-activate theory. But the presence of an outlier suggests a limitation of this theory. It cannot explain individuals who primarily produced perseveration errors. Because of this limitation, the theory of why individuals perseverate may need to be modified to include an additional deficit. Fischer-Baum and Rapp posited a failure to inhibit a response after it is produced to explain the case that deviates from the predictions of the failure-to-activate theory.

This modified theory can now account for all of the individuals in the case series and makes some novel predictions. In what other ways should the outlier differ from the rest of the sample? Fischer-Baum and Rapp (2012) identified one prediction specific to individuals with a failure-to-inhibit deficit—that letter perseverative errors should be observed in all tasks that involve spelling. When they tested this prediction on the participants in the case series, only the original outlier perseverated in all spelling tasks. This result provides positive evidence that the outlier suffered from a failure-to-inhibit deficit while the remaining participants did not.

Outliers have been reported in many case series. While it is possible some outliers simply represent noise in the data collection, others may reveal ways in which the theory being tested is insufficient. The theoretical implications of outliers must be serious considered. Theories that can account for all of the individuals in a case series and that correctly make novel predictions certainly should be preferred over theories that cannot account for certain observations.

References


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