

## How Alcohol Affects the Brain: A fMRI Math Study

By

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Research on the long-term development of children exposed to alcohol prenatally has often found that Math skills are more affected than other academic areas like Reading or Spelling (e.g., Howell, et al., 2006; Goldschmidt, et al. 1996). This finding suggests that the damage that alcohol causes to the developing brain has more impact on the functions that support the development of mathematical skills than on those that support language. This finding provides a tool to help understand how the brain works when it has been exposed to alcohol. Recently, it has become possible to study the brain “at work” using a technique called functional neuromagnetic resonance imaging (fMRI). Using this technique, it is possible to observe the areas and systems in the brain that use more oxygen during certain tasks. These areas are working “harder” at these times and we assume that this shows us the systems that are involved in certain kinds of mental effort.

To examine how the brains of alcohol-affected adults work, 14 young adults (7 alcohol-exposed; 7 controls) from a longitudinal study were imaged while they performed a simple subtraction task. As they held very still in the imaging magnet, they were shown a problem like  $(9-7=?)$ . Then they were presented with a choice of two answers (2 4) and had to press a button to indicate the right choice. A “control” condition used letters instead of a Math problem. Because this was a very simple procedure, both alcohol-affected and control groups had almost 100% correct answers. However, when the “brain maps” of alcohol-exposed and control groups were examined there were striking differences. Controls showed activation in only two areas, the temporal and the prefrontal regions, which are well known to be associated with efficient math processing. In contrast, the alcohol-exposed group had much more wide spread activation including many more parts of the brain. These differences suggest that in order to reach the same level of accurate functioning on a simple subtraction problem, alcohol-exposed people have to “recruit” extra brain cells and extra parts of their brains. For them, it is a much more effortful task that cannot be done with the efficiency shown by those who were not alcohol-exposed. It is not hard to imagine the implications of this difference when presented with more complex tasks.

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