

## Music Brain Research Chronology

**1985** -- Gordon Shaw, Dennis Silverman and John Pearson present the trion model of the brain's neuronal structure. (Proceedings of the National Academy of Sciences, USA 82 [1985]: 2364-2368).

**1989** -- Experiments in which musicians perform mental rehearsals of music indicate that music and other creative skills, such as mathematics and chess, may involve extremely precise firing patterns by billions of brain neurons. (Leslie Brothers and Gordon Shaw, *Models of Brain Function*, edited by R. Cotterill. Cambridge: Cambridge University Press, 1989).

**1990** -- Computer experiments reveal that trion firing patterns can be mapped onto pitches and instrument timbres to produce music. This suggests that the trion model is a viable model for the coding of certain aspects of musical structure in human composition and perception, and that the trion model is relevant for examining creativity in higher cognitive functions, such as mathematics and chess, that are similar to music. (Xiaodan Leng, Gordon Shaw and Eric Wright, *Music Perception*, Vol. 8, No.1 [Fall 1990]: 49-62).

**1991** -- Xiaodan Leng and Gordon Shaw propose that music may be considered a "pre-language," and that early music training may be useful in "exercising" the brain for certain higher cognitive functions. (*Concepts in Neuroscience*, Vol. 2, No. 2 [1991]: 229-258).

**1993** -- Pilot study finds that preschool children given music training display significant improvement in spatial reasoning ability. (Frances Rauscher, Gordon Shaw) Experiment with college students finds that, after listening to a Mozart sonata, they experience a significant although temporary gain in spatial reasoning skills. (Frances Rauscher, Gordon Shaw and Katherine Ky, *Nature*, Vol. 365 [1993]: 611).

**1994** -- Stage II follow-up to pilot study again finds that music training improves spatial reasoning in preschool children. This gain does not occur in those without music training. (Frances Rauscher, Gordon Shaw, Linda Levine and Katherine Ky, Paper presented at the American Psychological Association, Los Angeles [August 1994]).

**1995** -- Follow up to first Mozart study confirms that listening to Mozart improves spatial reasoning, and that this effect can increase with repeated testing over days. However, the effect may not occur when music lacks sufficient complexity. (Frances Rauscher, Gordon Shaw and Katherine Ky, *Neuroscience Letters*, Vol. 185 [1995]: 44-47).

**1997** -- Study finds that keyboard training causes long-term enhancement of preschool children's spatial-temporal reasoning (Frances Rauscher, Gordon Shaw, Linda Levine et al, *Neurological Research*, Volume 19 [1997], 2-8).

**1999** -- A field experiment supports the earlier finding by demonstrating that classroom keyboard instruction improves kindergarten children's spatial-temporal performance. (Frances Rauscher, Mary Anne Zupan, *Early Childhood Research Quarterly*, 1999).

Enhanced learning of proportional math through music training and spatial-temporal training: children given piano keyboard training along with a specially designed Math Video Game training scored significantly higher on proportional math and fractions than children given a control training along with the same video game. (Amy Graziano, Matthew Peterson and Gordon Shaw, *Neurological Research*, Volume 21 [1999], pp. 139-152).

**2000** -- A study finds that a curriculum combining piano lessons, educational math software and fun math problems can help second graders achieve scores on advanced math concepts and Stanford 9 math scores comparable to those of fourth graders (Matthew Peterson, Mark Bodner, Stephen Cook, Tina Earl, Jill Hansen, Michael Martinez, Linda Rodgers, Sydni Vuong, Gordon Shaw, 2000, submitted for publication).

Source:

<http://www.amc-music.org/musicmaking/brain/chrono.htm>