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## Arousal and Mood Factors in the "Mozart Effect"

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### ABSTRACT

*Some* investigators of the "Mozart effect" have not controlled for the influence of differences in arousal or mood induced by treatment conditions. Studies by Rideout and colleagues reported differences in spatial reasoning after listening to a Mozart sonata compared against a relaxation instruction tape. The conditions may have affected subjects' arousal differentially, with the sonata increasing arousal and the relaxation instructions decreasing arousal, which could have affected spatial reasoning performance. Evidence is cited in support of this suggestion and indicates the importance of analyzing the influence of arousal differences in Mozart effect research.

The "Mozart effect" is an alleged increase in spatial reasoning scores immediately after hearing a Mozart piano sonata (9, 10). Controversy has emerged over the existence of the effect (3,8, 16, 18). In a series of studies, Rideout and colleagues (12, 13, 14) obtained results consistent with an effect. Rideout (11) criticized the suggestion by Steele and colleagues (15, 17) that these results may be due to a procedure that confounded mood or arousal differences between listening conditions. Further, Rideout stated that Steele adhered to this position in defiance of logic and the results reported in Rideout and Laubach (13). Rideout's assertions are incorrect on both points.

Steele, Ball, and Runk's suggestion (15) came from consideration of Rideout's experimental design, which examined the difference in subjects' spatial reasoning scores after hearing a Mozart sonata or a progressive relaxation instruction tape. The fundamental problem with the design is that there is no neutral control condition. Both music and relaxation conditions use treatments established to change mood or arousal. Presentations of Mozart's music have been used often to increase arousal or produce elation (19). Exposure to progressive relaxation instructions are designed to reduce arousal, by definition, and are effective in a variety of circumstances (2). Hence, in Rideout's procedure, listening to the Mozart sonata may have exposed subjects to a treatment that increased arousal and listening to the relaxation tape may have exposed subjects to a treatment that decreased arousal. Thus, an arousal difference between conditions, as an effect either from one or both treatment conditions, could be confounded with other properties of the experimental situation. Arousal differences have been shown to affect performance on cognitive tasks (4,5) so mood or arousal differences could account plausibly for a "Mozart effect" in Rideout's procedure. Both Chabris (3) and Nantais and Schellenberg (6) have proposed, using similar reasoning, that arousal and differences in listening-preference may explain results related to the Mozart effect. Steele and colleagues (16, 18) included silence as a neutral condition, measured subjects' mood, and obtained results that indicated both the Mozart and relaxation conditions produced significant arousal changes in the directions suggested by the literature. In contrast, Rideout's studies (12, 13, 14) have not employed a neutral arousal condition nor measured mood.

The assertion that Rideout and Laubach (13) refutes an hypothesis of arousal differences is incorrect also. Rideout's (11) evidence is that spatial reasoning scores during the relaxation condition of Rideout and Laubach were slightly higher than scores from unpublished "pilot studies," designed to equate the difficulty of different forms of his spatial reasoning task. Rideout would like readers to conclude that these similar values indicate no decrease in arousal after listening to a relaxation tape.

It is difficult to judge the validity of that comparison. The number of pilot studies and the number of subjects in the pilot studies were not reported, nor were the procedures used in the pilot studies. The scores from the pilot studies and Rideout and Laubach's Mozart effect study were not compared directly by statistical test.

Moreover, the comparison involves a fundamental problem. Comparison of results in one study with results in a different study to establish the effect of some factor is an instance of Campbell and Stanley's "static group" comparison (1). An example of a static-group design would be to compare the grade point average of students who participated in music programs against those of students who did not participate. The presumption is that music program participation is the sole factor which explains any difference between the groups. However, there is no means of establishing that the two groups were equivalent at the outset. There may be several differences between students who choose to participate and students who do not. For example, students from impoverished backgrounds may need an afterschool job and cannot

participate in a music program. An afterschool job may reduce the amount of time available for study, and this may reduce grade point average. Thus, music program participation was not the sole difference between the groups.

Rideout (11) suggested readers compare the relaxation-condition scores in his "Mozart effect" study and scores from undescribed pilot studies. note similar spatial reasoning scores, *and* conclude that listening to relaxation instructions does not decrease arousal. Rideout, however, did not establish that the two groups were equivalent when presented with a spatial reasoning task. For Rideout's argument to be plausible, subjects in his earlier pilot studies would have needed to be exposed to the spatial task without any other treatment. Since the pilot studies concerned the question of equating task difficulty and not a Mozart effect, it seems reasonable to infer that the procedures were different between the pilot studies and the Mozart effect studies. If procedures were different, then many procedural factors could explain either a difference or lack thereof in spatial reasoning scores across studies. The general point is that one cannot assume the pilot studies' subjects and the Mozart-effect subjects constituted equivalent groups at the moment each group was given a spatial reasoning task. Therefore, listening to relaxation instructions would not be the sole difference between groups.

There is doubt about the Mozart effect's existence (3, 7, 16, 18). Even if the effect could be produced reliably, the finding of significant mood, arousal, and listening-preference influences in Mozart-effect research suggests a very different explanation from the "neural resonance" theory of Rauscher. Shaw, and Ky (10).

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