The Spiral After Effect (SAE) as a Measure of Motion Sickness Susceptibility and the Effect on the SAE of an Antimotion Sickness Drug and a Central Nervous System Depressant

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Abstract. A study was carried out to determine whether the spiral after effect (SAE) could be considered a reliable measure of motion sickness susceptibility as measured by Reason's motion sickness questionnaire (MSQ). In an initial correlational study it was found that MSQ scores were significantly correlated with neuroticism (N) scores on the Eysenck Personality Inventory. However, the correlation between MSQ and a measure of the SAE duration was not significant. In the subsequent controlled drug study it was shown that both dimenhydrinate, an antiemetic, and temazepam, a minor tranquilizer, decreased the duration of the SAE; although significance was only obtained with the latter drug. The results of both experiments are discussed in terms of Reason's theory of motion sickness and it is suggested, on the basis of Reason's results and those obtained in the present study, that the SAE has both a cortical and a vestibular component in its mechanism of action.

Key words: Spiral After Effect (SAE), Motion Sickness Questionnaire (MSQ) Dimenhydrinate — Dramamine — Temazepam.

Introduction

The notion that the spiral after effect (SAE) was associated with vestibular function was first introduced by Lotze (1852) and Classen (1863) who advanced explanations based upon "giddiness" or "visual vertigo". Since that time very little attention has been paid to this idea. The usual tests of motion sickness susceptibility have involved subjects being subjected to periodic motion on swings, flight simulations and simulations of rough sea conditions. The idea that motion sickness can be caused by mere movement in the visual field is a comparatively recent one. In 1953 Crampton and Young induced motion sickness in their subjects by placing them upon a chair in a small rotating room. Subjects were requested to watch the floor and walls of the room as it rotated and in this way the authors were able to divide their subjects into a susceptible and a non-susceptible group dependent upon whether or not they felt nauseated by the movement. This type of test is very
often used in flight training for pilots and astronauts who have to spend extended periods in a slowly rotating environment, for example, see Reason (1970) and Reason and Graybiel (1972). Recently Parker (1971) has tested subjects for motion sickness susceptibility by having them watch a film taken from a car racing down an alpine road. Using volar sweating as his criterion, Parker was able to divide his group into susceptibles and nonsusceptibles.

Reason (1968) in an attempt to elucidate the primary sensory characteristics which predispose some individuals to motion sickness carried out an experiment to test the hypothesis that motion sickness susceptibility (as measured by biographical questionnaire) would be positively and significantly related to two measures derived from the SAE phenomenon, namely (a) a persistence measure, and (b) a measure reflecting the slope of the plots: SAE persistence against log stimulus duration (induction period). In another paper Reason and Benson (1968) showed that a positive and highly significant relation exists between the reported persistence of spiral and labyrinthine after sensations, i.e. individuals who tend to report relatively long SAE's also report long post-rotatory labyrinthine sensations (and conversely).

The result of Reason's experiment was that the SAE slope value was positively and significantly correlated with the motion sickness susceptibility (MSQ) score. Reason interprets the slope variation as a reflection of characteristic individual differences in the way the central nervous system "receives" or transduces stimulus intensity. In other words, the possibility exists that there are characteristic individual differences in the magnitude of the sensory response that is produced in relation to a given level of stimulus energy. Reason refers to these as "receptivity differences". He suggests that those individuals who characteristically produce steep SAE slope plots, and who are relatively susceptible to motion sickness may be those who tend to produce an idiosyncratically large sensory response to a given level of sensory input. Reason hypothesizes that individuals with relatively steep SAE slopes are more "receptive" to the intensity component of the inducing stimulation and vice versa. It seems reasonable to argue that if motion sickness depends upon the perception of a particular kind of motion stimulation, then individuals who perceive that stimulation as being more intense should also be more susceptible to its ill-effects.

With regard to the SAE, Reason states that the justification for its use as a diagnostic research tool, has been in the assumption that inter-personal variation in after effect duration can reveal pathological and idiosyncratic modes of cortical function (Holland 1965). On the basis of Reason's findings it can be suggested that part of this variation is explicable in terms of "receptivity differences".