

SHORT AND SWEET

The sickening rug: A repetitive pattern pattern

to motion-sickness-like symptoms

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**Abstract.** The nauseogenic properties of a patterned rug that reputedly caused motion-sickness-like symptoms in those who viewed it was the topic of this study. Naive observers viewed a 1:1 scale image of the black-and-white patterned rug and a homogeneous gray region of equivalent luminance in a counterbalanced within-subjects design. After 5 min of viewing, symptoms were assessed with the simulator sickness questionnaire (SSQ), yielding a total SSQ score and sub-scores for nausea, oculomotor symptoms, and disorientation. All four scores were significantly higher in the rug condition. Observers also reported significantly more self-motion perception in the rug condition, even though they were seated during the experiment. Results are consistent with

time ago. He had recently purchased a rug (about 3 m × 1.6 m) that consisted of a repetitive pattern of black and white squares laid out in regular columns and rows (see figure 1). Once home, the rug was laid out, and he and his wife looked at their recent acquisition, only to experience disorientation, dizziness, headaches, and nausea that

symptoms. In addition to what were described to us as motion-sickness-like symptoms

a perception of self-motion was reported.

Motion sickness is unusual among 'sicknesses'. No bacteria, virus, poison, or physical 'problem' is responsible for its onset. Instead, sensory/perceptual processes regarding



is sensory conflict (Reason and Brand 1975), a lack of agreement between sensory inputs (mostly visual and vestibular) compared to those that occurred in similar environments in the past.

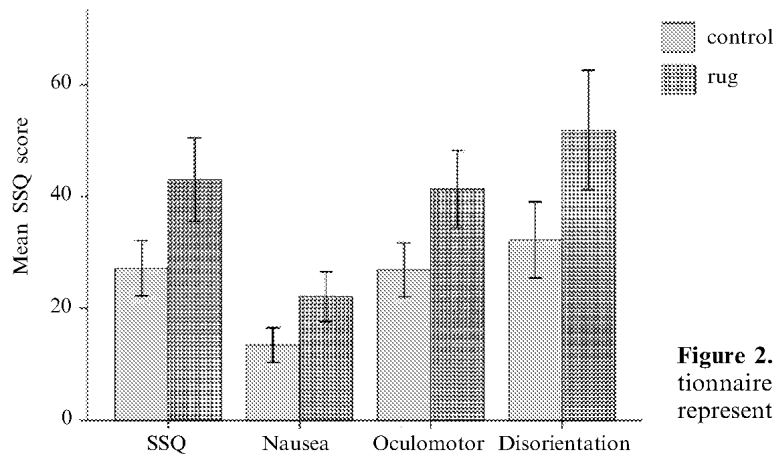
Unpleasant motion-sickness symptoms, that can include dizziness, headache, vertigo, and nausea, are typically associated with passive self-motion or visually induced self-motion. Actual self-motion in a vehicle such as a boat, automobile, or aircraft can lead to sea sickness, car sickness, or air sickness. Visually induced self-motion, orvection (Fischer and Kornmüller 1930; Tschermak 1931), is often the result of a moving display, such as those that are often present in vehicle simulators (Hettinger et al 1990); they can lead to simulator sickness. Even watching a film or video shot from a first-person perspective (Bubka and Bonato 2010) can lead to simulated self-motion and subse-

been reported that about 4% of patients with epilepsy are susceptible to visually induced seizures (Wilkins 1995). In many of these patients only visual patterns invoke seizures (Jeavons and Harding 1975). Some of the patterns known to lead to seizures look suspiciously similar to the sickening rug that is addressed in this paper. However,

Furthermore, they were reportedly not the only ones who were affected by the rug.

ing patterns such as grating is also not new. Previous research suggests that, when striped patterns are viewed, illusions of motion and unpleasant symptoms can result. When

ness' of square-wave gratings that varied in spatial frequency, Wilkins and colleagues (1984) were surprised when 11 of their 29 participants reported symptoms such as eyeache, tiredness, headache, and dizziness. The patterns used in their experiments were similar to the rug shown in figure 1 except that the design of the rug resulted in a repeated pattern on both the  $x$  and  $y$  axes. Wilkins (1995) has also devoted an entire



**Figure 2.** Simulator sickness questionnaire (SSQ) results. Error bars represent  $\pm 1$  SE.

SSQ scores were significantly higher in the experimental (rug) condition (see figure 2). This result was revealed for total SSQ scores ( $t_{21} = 2.7$ ,  $p = 0.014$ ), as well as nausea ( $t_{21} = 2.5$ ,  $p = 0.02$ ), oculomotor symptoms ( $t_{21} = 2.8$ ,  $p = 0.01$ ), and disorientation ( $t_{21} = 2.1$ ,  $p = 0.05$ ) sub-scores. Mean ratings of perceived self-motion were also significantly higher ( $p = 0.004$ ) in the experimental condition (4.7) compared to the control condition (2.7). Collectively, results suggest that simply viewing a 'rug'

intensely when the rug was viewed, even though participants were instructed to remain

These results are preliminary and hence limited in some ways. Head and body movements were not measured. Perhaps participants did move more when viewing the

fied as a possible cause of motion sickness (Stoffregen and Smart 1998). Nystagmus eye movements have also been associated with motion sickness (Ebenholtz et al 1994). Many participants also reported the perception of a 3-D effect. Perhaps accommoda-

tion and vergence information clashed, causing a visual intrasensory conflict. Hence, measuring eye movements might also provide some insights into the sickening-rug phenomenon. Furthermore, some of the symptoms rated in the SSQ are non-specific in that they may indicate some form of motion-sickness or visual stress, the symptoms of which can overlap.

Bottom line: be careful what you buy. You might have to look at it for a while and

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