Patients with visual “snow” have normal equivalent input noise levels

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Introduction

Visual snow is a poorly understood symptom. Patients report seeing “snow”, much like the visual noise on a TV screen after transmission ends. We hypothesize that what the patients see as “snow” is their own intrinsic visual noise. Our measurements assess whether visual-snow patients have increased levels of intrinsic visual noise.

Methods

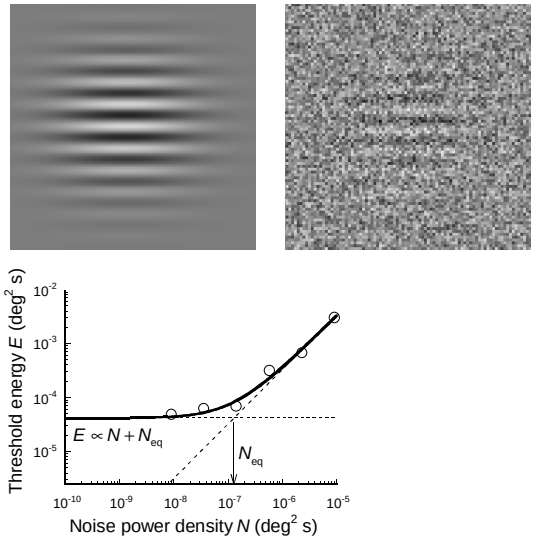


Fig. 1. We quantified the intrinsic visual noise as an equivalent input noise by measuring grating identification thresholds with and without added display noise. Past equivalent noise measurements have shown that central vision is limited by intrinsic noise. We compute three parameters: transduction efficiency, cortical noise parameter *k*, and high-noise efficiency (Pelli & Farell, 1999; Raghavan, 1995; Raghavan & Pelli, in prep.).

We tested 5 patients with visual snow symptoms and 16 normal observers. We measured threshold contrast for identification of orientation (horizontal or vertical) of a gabor (1 c/deg, 0.75 deg space constant, 100 ms duration) displayed in various amounts (including none) of dynamic white noise at background luminances of 0.8 and 80 cd/m². Pupil size was measured by an infrared camera.

Results

All patients reported the snow to be stronger at lower light levels, but there was no difference between patients and controls on the three parameters we measured (Figs. 2, 3, 4).

Fig. 2.

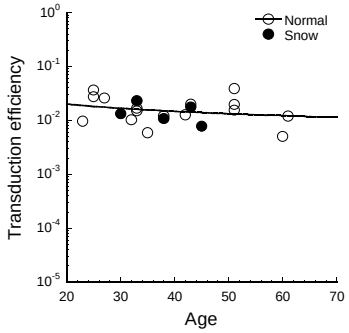


Fig. 3.

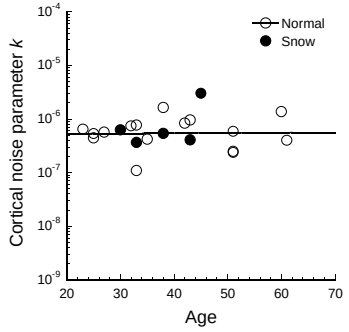
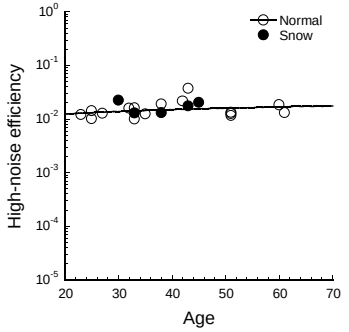


Fig. 4.



Discussion

Most normal observers report seeing “snow” only at very low light levels. Presumably this is because the low light level produces a high level of photon noise. The patients’ description of their “visual snow”, including its inverse dependence on light level, suggests that they are indeed seeing their own intrinsic visual noise.

Our visual-snow patients also report abnormally intense sensations in other sensory modalities. All five of our patients also suffer from tinnitus, three have intense tactile sensations, and two patients reported intense experience of smells. This suggests increased perceptual gain in several sensory modalities.

Conclusion

The visual-snow symptom is luminance-dependent, but is not a result of increased levels of intrinsic visual noise. Our measurements show that visual-snow patients have normal equivalent input noise, normal contrast sensitivity, and normal high-noise efficiency. Their only abnormality appears to be an increased perceptual gain, i.e., an intensified experience.

References

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