Streamin' your dreamin'

Neural Decoding of Visual Imagery During Sleep

T. Horikawa,[1,2] M. Tamaki,[1]* Y. Miyawaki,[3,1]† Y. Kamitani[1,2]‡

Visual imagery during sleep has long been a topic of persistent speculation, but its private nature has hampered objective analysis. Here we present a neural decoding approach in which machine-learning models predict the contents of visual imagery during the sleep-onset period, given measured brain activity, by discovering links between human functional magnetic resonance imaging patterns and verbal reports with the assistance of lexical and image databases. Decoding models trained on stimulus-induced brain activity in visual cortical areas showed accurate classification, detection, and identification of contents. Our findings demonstrate that specific visual experience during sleep is represented by brain activity patterns shared by stimulus perception, providing a means to uncover subjective contents of dreaming using objective neural measurement.

Together, our findings provide evidence that specific contents of visual experience during sleep are represented by, and can be read out from, visual cortical activity patterns shared with stimulus representation. Our approach extends previous research on the (re)activation of the brain during sleep (*24–27*) and the relationship between dreaming and brain activity (*2*, *3*, *28*) by discovering links between complex brain activity patterns and unstructured verbal reports using database-assisted machine-learning decoders. The

Horikawa et al. (2013) Neural Decoding of Visual Imagery During Sleep. Science 340, 639

Is it any wonder people are afraid of technology?