see Bayesian model.

see Bayesian probability.

Phantom perceptions arise almost universally in people who sustain sensory deafferentation, and in multiple sensory domains.

The question arises 'why' the brain creates these false percepts in the absence of an external stimulus? The model proposed answers this question by stating that our brain works in a Bayesian way, and that its main function is to reduce environmental uncertainty, based on the free energy principle, which has been proposed as a universal principle governing adaptive brain function and structure. The Bayesian brain can be conceptualized as a probability machine that constantly makes predictions about the world and then updates them based on what it receives from the senses. The free-energy principle states that the brain must minimize its Shannonian free-energy, i.e. must reduce by the process of perception its uncertainty (its prediction errors) about its environment. As completely predictable stimuli do not reduce uncertainty, they are not worthwhile of conscious processing. Unpredictable things on the other hand are not to be ignored, because it is crucial to experience them to update our understanding of the environment. Deafferentation leads to topographically restricted prediction errors based on temporal or spatial incongruity. This leads to an increase in topographically restricted uncertainty, which should be adaptively addressed by plastic repair mechanisms in the respective sensory cortex or via (para)hippocampal involvement. Neuroanatomically, filling in as a compensation for missing information also activates the anterior cingulate and insula, areas also involved in salience, stress and essential for stimulus detection. Associated with sensory cortex hyperactivity and decreased inhibition or map plasticity this will result in the perception of the false information created by the deafferented sensory areas, as a way to reduce increased topographically restricted uncertainty associated with the deafferentation. In conclusion, the Bayesian updating of knowledge via active sensory exploration of the environment, driven by the Shannonian free-energy principle, provides an explanation for the generation of phantom percepts, as a way to reduce uncertainty, to make sense of the world [1)].

1)
De Ridder D, Vanneste S, Freeman W. The Bayesian brain: phantom percepts resolve sensory uncertainty. Neurosci Biobehav Rev. 2014 Jul;44:4-15. doi: 10.1016/j.neubiorev.2012.04.001. Epub 2012 Apr 11. Review. PubMed PMID: 22516669.