The realm of auditory hallucinations

I read with interest the Article on the phenomenology of auditory hallucinations by Angela Woods and colleagues,[1] which explores the complexity of the rich and varied experiences of voice hearers. Hearing, along with smell, is one of the most powerful senses that can be perceived by an individual, and it can have a lasting impression. The authors use hermeneutic phenomenology in this study. This survey gives an experiential perspective on hearing voices and throws light on many factors from the point of view of the voice hearer and the clinician, and is a useful adjunct to the previously published literature, which is fairly sparse, on this fascinating subject.

The authors provide first-hand accounts of auditory hallucinations from voice-hearers' perspectives, representing a new way to understand the conceptual landscape of this multidimensional phenomenon without any preconceived assumptions. This approach provides a framework to inform existing neurocognitive models and, in turn, a new cognitive behavioural therapy method for such individuals.[2] The study gives individual vignettes that provide a deep understanding of how the basic structures of consciousness become deranged, resulting in an anomalous experience. According to Kapur,[3] hallucinations are usually due to the abnormal salience (or an exaggerated, amplified, aberrantly recognised internal representation) of percepts and memories.

The scientific literature is divided on whether misattributed inner speech due to atypical self-monitoring or reality monitoring is the cause.[4] Models of auditory hallucinations that link self-monitoring deficits leading to misattribution of inner speech to an external source, however, do seem to be supported by studies using brain stimulation techniques.[4] An aspect that could have been studied is how the auditory hallucinations progressed over time and whether they started out as benign experiences and progressed to more critical and intrusive ones. This aspect is important in view of the fact that the prevalence of auditory hallucinations is about 5% in the normal population without any psychopathology.[5]

A useful concept proposed in this study is a model for phenomenological subcategorisation of auditory hallucinations, which has implications for different antipsychotics being prescribed for different categories.[5,6] Furthermore, a detailed categorisation of auditory hallucinations in children and adolescents, with any special features noted, would have been illuminating because the frequency of auditory hallucinations is reported to be high in this subpopulation.[7] Another aspect that could have been addressed by the authors is how accepted voice-hearers are in society generally.[8]

The study encompasses a broad demographic range. Any cultural, social, and religious similarities and differences in the auditory hallucinations encountered would have been interesting to note. Another area that could be investigated is the role of memory in auditory hallucinations because MRI studies of the areas of the brain activated immediately before auditory hallucinations implicate the parahippocampal gyrus, a region used in memory processes.[2] However, the information collected in this study could form the basis of future prospective, randomised controlled trials, which would be helpful to guide researchers and clinicians alike.

I declare no competing interests.

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Cosmetic neurosurgery, ethics, and enhancement

We read with interest the Personal Views on cognitive enhancement by Plewnia and colleagues[1] and Sahakian and Morein-Zamir.[2] Substantial advances in understanding of the neural underpinnings of normal and abnormal human behaviour have occurred during the past two decades. For example, much of that behaviour, from simple motor movements to complex cognitive tasks, is now understood to be governed by a diverse array of neural circuits, each consisting of critical nodes. Node dysfunction can affect entire circuits, leading to brain disorders such as Parkinson's disease, major depression, and Alzheimer's dementia.[1]

Treatment is focused on correction of pathological circuits, to re-establish both their structural and functional equilibrium. Deep-brain stimulation (DBS) is a surgical procedure that places electrodes into critical circuit

nodes and uses electricity to reset activity within them. DBS has been used in more than 100 000 patients worldwide, mostly for treatment of motor circuit disorders: Parkinson's disease, dystonia, and essential tremor.[3] Its effectiveness in these disorders has led to its investigation in other circuit-based disorders, such as those related to mood, anxiety, and memory. The ability to alter and correct such fundamental brain functions has led some to ask whether use of DBS should be limited only to strictly pathological states. In other words, does a surgical analogue to pharmacological and non-invasive cognitive enhancement exist?

DBS has already been used to modulate activity in non-pathological brain circuits. A case report published by our group in 2008[4] described a patient undergoing DBS for management of morbid obesity. The hypothalamus was stimulated intraoperatively, leading to specific and vivid recollections from the patient's youth. After surgery, the patient's autobiographical memory substantially improved compared with his preoperative baseline. This finding led our group to investigate DBS in disorders of memory, and we are now doing the first multicentre trial of DBS in early-onset Alzheimer's disease (NCT01608061). Investigators of an additional study[5] further reported that DBS of the entorhinal cortex in patients with refractory epilepsy and otherwise normal memory resulted in significant improvements in a spatial memory task. Such results suggest that memory circuitry might indeed be accessible in healthy patients and subject to modulation and enhancement.

Although DBS has been highly effective at managing motor symptoms, data, especially long-term data, are still lacking for its use in pathological mood and memory states. To discuss surgical cognitive enhancement as anything more than a theoretical possibility is therefore premature. However, we believe that several factors—including technological advances, shifting definitions of what is pathological, and public demand—could contribute to development of a surgical cognitive enhancement discipline in the future. These questions should therefore be considered early, and the ethical principles that will help frame future discussions should be established or reaffirmed.[6-8]

Currently, the neurosurgeon's ethical obligation remains strictly to the patient with a clearly defined pathological disorder, with efforts geared towards treatment for established disease and prevention of morbidity and mortality. As researchers, neurosurgeons should be aware of the ethical principles guiding their work, and be mindful that much needs to change, conceptually and technologically, to tip the risk–benefit balance towards intervention in non-pathological states.

I declare no competing interests.

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Author's reply

Nir Lipsman and Andres Lozano add their valuable neurosurgical perspective on the opportunities and challenges of cognitive enhancement.[1,2] Deep-brain stimulation (DBS) is definitely a well-established technique to restore impaired motor and conceivably cognitive function by interfering with dysfunctional network activity.[3] Nevertheless, the notion of so-called surgical cognitive enhancement needs further reflection.

To characterise DBS as a surgical procedure might be misleading. The associated notion of a discrete intervention to reset pathological brain activity does not fully accord with the need to provide continuous stimulation, including the challenge to find and maintain individually effective and tolerable stimulation parameters. The crucial roles of dynamic and flexible interactions between a stimulatory intervention, linked neural circuits, and the individual's environment need to be taken into account.[4] For adequate conception, assessment, and application of neuromodulatory techniques, including DBS, the associated continuous adaptive and maladaptive neuroplastic processes should be addressed. At least in the cognitive domain, they form the basis of beneficial or adverse effects, and implicate the need for targeted and continuous shaping of this process, typically by cognitive-behavioural interventions. Accordingly, the idea of a surgical analogue to pharmacological and non-invasive cognitive enhancement needs a well-founded concept for the key processes that follow implantation of the electrode.

In this context, the term "cosmetic neurosurgery" can be ambiguous because it suggests the feasibility of a quick fix for cognitive performance that is deemed to be below the standard. Performance in cognitive tasks can be improved by many methods, such as training, pharmacological interventions, and non-invasive brain stimulation.[5] Therefore, it is not