

# Usability of Mixed Reality in Awake Craniotomy Planning



Moon et al. (2022), in *British Journal of Neurosurgery*

## Products

Elements Viewer and Mixed Reality Viewer, Magic Leap 1, Elements Segmentation Cranial, Elements Distortion Correction Cranial, Elements SmartBrush, Elements Fibertracking

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## Clinical Background

When resecting tumors in eloquent brain areas, the ultimate goal is maximum safe resection. Awake craniotomy has been established to achieve this goal when speech areas are in close proximity to or even infiltrated by the tumor in order to reduce the risk of dysphasia. Against this background, further supporting solutions which help illustrate the approach to a multidisciplinary team and facilitate their collaboration are relevant. The use of mixed reality (MR) as a supplement for navigation in preoperative planning can aid in this. With the Mixed Reality Viewer, several Magic Leap headsets can be registered in the same virtual viewing space, allowing the team to discuss individual surgical steps.

## Aim of Study

The aim of this trial was to quantitatively assess the usability of the Mixed Reality Viewer to plan multi-disciplinary awake glioma surgery and intraoperative language testing.

N = 10 consecutive patients, team of 10 participants (2 anesthetists, 5 neurosurgical trainees, 2 speech therapists, 1 neuropsychologist)

## Stages & Results

- Multi-disciplinary planning based on 3D reconstructions of Elements Viewer in virtual space
  - **Stage 1:** Virtual reconstruction to simulate surgical access and anesthetic considerations (Elements Segmentation Cranial)
  - **Stage 2:** Discussion of testing protocols for cortical mapping overlaying the cerebral cortex (Elements Segmentation Cranial)
  - **Stage 3:** Discussion of testing protocols for subcortical mapping using 3D fiber reconstructions (Elements Fibertracking)
  - **Stage 4:** Discussion of incision site and craniotomy planning considering vasculature (Elements Segmentation Cranial)
- **System Usability Scale (SUS) = over all applications Ø 71.5\***  
\*5-point scale of user agreement adding up to a single score (0-100).

## Summary

- SUS score for Mixed Reality Viewer of 71.5 considered above average indicating a **favorable user experience and positive overall usability.**
- **MR viewing perceived useful:**
  - **Speech therapists** benefited most from visualizing tumor location and understanding its spatial relationship to relevant cortical areas and fiber bundles in 3D
  - **Anesthetic team** found that it is beneficial to review the positioning of the patient and the tumor location regarding the impact of this on surgical and anesthetic access
  - **Neurosurgical team** considers the opportunity to practice the surgical approach and understand the anatomy in detail of great value