Deep Brain Evidence

S. Holloway¹, I. Stevens²,³, G. Lázaro-Muñoz²,⁴, T. Williamson²,⁵, F.X. Shen⁶,⁷,⁸


Present Limits of Brain Evidence in Court
- Neuroscientific evidence is increasingly being introduced into the legal system, both in the U.S. and globally [1].
- To date, however, almost all brain evidence introduced in courtrooms has been surface-level measurement, e.g., EEG, MRI, fMRI [2].
- Moreover, all brain evidence has been collected before or after, but not during, the legally relevant behavior, e.g., fMRI scan of defendant after an alleged crime [3].
- Given current scientific limitations, courts struggle with Group to individual (G2i) inference challenges [4].

The Emergence of “Deep Brain Evidence” (DBE)
- As contrasted with surface-level brain evidence we introduce the term “Deep Brain Evidence” to refer to real-time, individualized brain evidence measured beneath the skull by deep-brain stimulation (DBS) recording devices.
- Some DBS devices are “always-on.” Adaptive deep brain stimulation systems capture local field potentials via electrocorticography recordings (Fig 1) [5].

Research Team & Methods
- Interdisciplinary team with expertise in neuroraw, neuroethics, and neuroscience to explore courtroom implications of Deep Brain Evidence.
- Legal analysis of caselaw; neuroethics analysis of emerging DBS neurotech.
- Part of a Dana Center for Neuroscience & Society Pilot grant & feedback at Neurotech Justice Summit [6].

Figure 1. From Medicine to Law: How Deep Brain Evidence Might Be Introduced in Court
A: Deep brain stimulation (DBS) device is implanted into an individual’s brain for medical purposes, e.g., Parkinson’s disease, seizure disorders, treatment-resistant OCD [7]. The AI-enabled DBS device records brain activity in specified areas 24-7. B: The individual is in a car crash, and the DBS device was recording brain data during the entire crash sequence. C: The individual is sued by the other driver in the crash, and at issue is the individual’s mental state while driving.

Our key question: Can / should the DBS evidence be introduced in court?

ANALYSIS:
Potential BENEFITS of using DBE in court
- **Individualized**: DBE is a solution to the G2i problem by providing courts with individualized brain evidence.
- **Timely**: Always-on DBE could provide legal system with evidence of brain activity in a legally relevant actor at the time of the legally relevant action, analogous to courtroom use of FitBit data [12], e.g., brain activity while a plaintiff was driving or while a defendant was shooting.
- **Baseline & Repeated Measures**: As compared with one-time brain scans, always-on DBE provides courts with repeated a baseline and repeated measures of individual brain activity.

Potential CONCERNS with using DBE in court
- **“Seductive allure”:** DBE not dispositive of legal issues, e.g., neural correlates of “intent” remain unknown, but jurors may be overly-persuaded by DBE evidence [13].
- **Within-person inference challenges**: Not yet clear how to interpret changes over time in individual brain activity; also, if time of legal event is unknown, hard to identify which recorded signals are relevant [14].
- **Limited scope**: DBE only records select brain networks.
- **Privacy & constitutional rights**: Significant concerns about government and third-party access to an individual’s brain data.

RECOMMENDATIONS:
Assessing Evidentiary Admissibility of DBE
- **Lawyers and Judges**: Given low legal standard for relevant evidence, must analyze DBE’s probative value [15].
- **Lawyers and judges**: Improve understanding of these issues via new training programs and resources.
- **Judges**: Even if relevant, DBE may be unfairly prejudicial, warranting exclusion from evidence [16].

Considerations for DBS researchers
Previous publications regarding DBS consent typically consider:

- Intraoperative risks & safety concerns.
- Possible versus probable postoperative outcomes.
- Likelihood of treatment efficacy.
- Need for ongoing maintenance and programming.

Reference: Scan QR Code for References.

Funding: Research reported in this poster was supported by a grant from the Dana Foundation. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funder.

Recommended Additional Language for Consent in DBS Research
The data gathered through this study could potentially be used as legal evidence, e.g., real-time evidence of your brain activity might be relevant in some criminal and civil proceedings. Your research records could potentially be opened by court order or produced in response to a subpoena or a request for production of documents. [If applicable: discuss Certificate of Confidentiality].