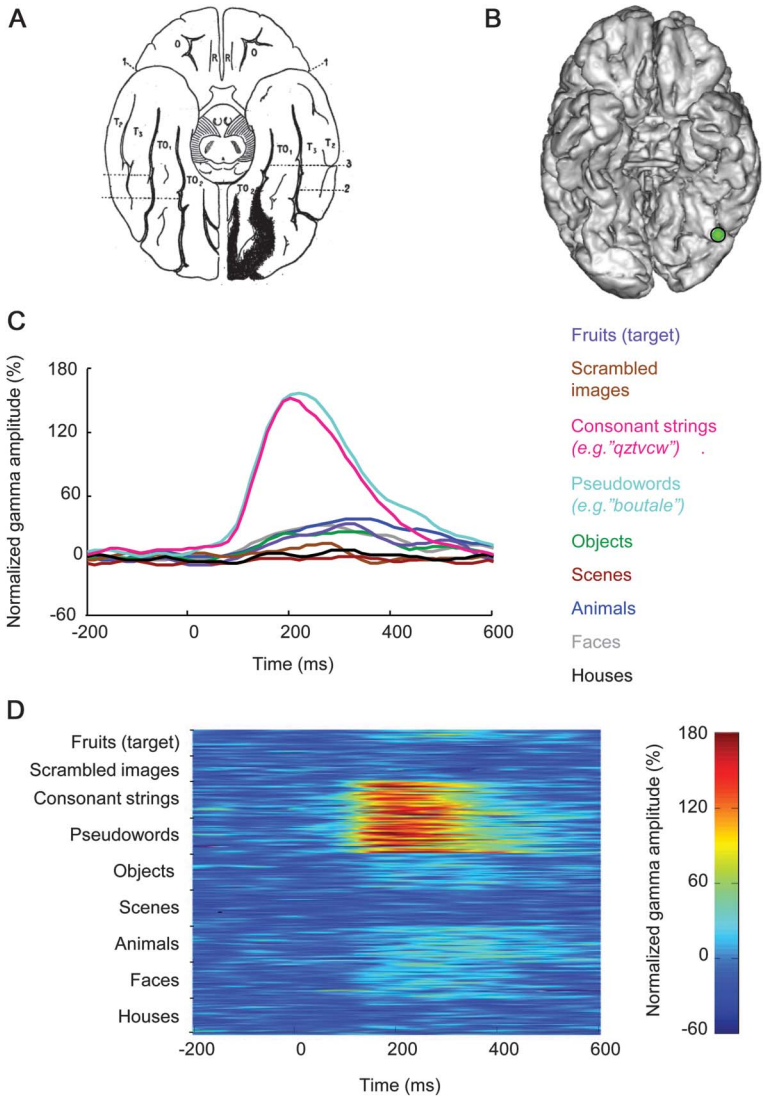
Dejerine's reading area revisited with intracranial EEG

Selective responses to letter strings

Figure 1 **Strong neural specialization for reading in the visual word form area: Recordings from depth electrodes**



(A) Dejerine's drawing (1891)[3] of the lesion in a patient "who suddenly observed that he could not read a single word, while he could write and speak quite well." (B) Localization of the recording in patient P.M. (Talairach: −44x, −57y, −10z). (C) Mean broadband gamma response (50–150 Hz) to pronounceable pseudowords with a phonetic but no semantic dimension (e.g., "boutale"), unpronounceable consonant strings with no semantic or phonetic dimension (e.g., "qztvcw"), and other visual objects. We used pseudowords and consonant strings to minimize top-down lexical feedback that could arise for real words. (D) Trial-to-trial gamma power responses. Figure e-2 shows the T1 scan of one single patient's brain.

Supplemental data at www.neurology.org

The visual word form area in the ventral occipitotemporal cortex develops with acquisition of reading skills. It is debated whether this region is specialized for reading[1] or is rather a general-purpose area associating visual form (words, objects) with meaning. An outline of this debate can be found in appendix e-1 on the *Neurology*® Web site at www.neurology.org. We recorded intracranial EEG in 2 patients with epilepsy (figures 1, e-1, and e-2)

and found neural populations responding almost exclusively to letter strings, over 500% of all other responses. With the exception of the fusiform face area, such specific responses have never been described before in the human visual system.[2] Strong specialization in the human brain can thus be achieved also through cultural learning.

Carlos M. Hamamé, PhD, Marcin Szwed, PhD,* Michael Sharman, PhD, Juan R. Vidal, PhD, Marcella Perrone-Bertolotti, PhD, Philippe Kahane, MD, PhD, Olivier Bertrand, PhD, Jean-Philippe Lachaux, PhD*

*These authors contributed equally to this work.

From the Laboratoire de Psychologie Cognitive (C.M.H., M. Szwed), CNRS (UMR7290), Aix-Marseille Université, Marseille; Lyon Neuroscience Research Center (C.M.H., J.R.V., M.P.-B., O.B., J.-P.L.), Brain Dynamics and Cognition Team, CNRS (UMR5292), INSERM (U1028), Université Lyon 1, Lyon, France; Jagiellonian University (M. Szwed), Kraków, Poland; Université Pierre et Marie Curie University (M. Sharman), Paris; Institut National de la Santé et de la Recherche Médicale (M. Sharman), Institut du Cerveau et de la Moelle Épinière, UMRS 975, Paris; and Grenoble University Hospital (P.K.), Grenoble, France.

Author contributions: J.P.L. and J.R.V. designed the experiment. M.P.-B. and J.R.V. performed the experiment with additional help from C.M.H., J.P.L., P.K., and O.B. C.M.H. analyzed the iEEG data and M. Sharman analyzed the MRI data. M. Szwed wrote the paper with additional contributions from C.M.H. and J.P.L.

Study funding: Supported by the Fondation pour la Recherche Medicale (FRM), BrainSync FP7 European Project (grant HEALTH-F2-2008-200728), and Agence Nationale de la Recherche OPENVIBE2 and MLA grants to J.R.V. and J.P.L. C.M.H. was supported by a Fyssen Fondation Postdoctoral Grant. M. Szwed was supported by a "Homing Plus" grant from the Foundation for Polish Science (2011-4/13) and a European Research Council Research grant (no. 230313).

Disclosure: The authors report no disclosures relevant to the manuscript. Go to Neurology.org for full disclosures.

Correspondence to Dr. Szwed: mfszwed@gmail.com and Dr. Hamamé: carlos.hamame@inserm.fr

1. Dehaene S, Cohen L. The unique role of the visual word form area in reading [see also the accompanying opinion (246–253)]. Trends Cogn Sci 2011;15:254–262.
2. Vidal JR, Ossandon T, Jerbi K, et al. Category-specific visual responses: an intracranial study comparing gamma, beta, alpha, and ERP response selectivity. Front Hum Neurosci 2010;4:195.
3. Dejerine J. Sur un cas de cécité verbale avec agraphie suivi d'autopsie. Mém Soc Biol 1891;3:197–201.

Dejerine's reading area revisited with intracranial EEG: Selective responses to letter strings

Carlos M. Hamamé, Marcin Szwed, Michael Sharman, et al.

Neurology 2013;80;602-603
DOI 10.1212/WNL.0b013e31828154d9