

Physiologic Word Recognition from Cognitive State

Publications by a Stanford group support recognition of words from brain waves,¹
^{2 3 4 5} with recent enhanced success. Other investigators publish above chance
magnetoencephalographic (MEG) word recognition.⁶ EEG instant detection in syllables
of “a content of category which the testee wishes to speak” quotes Kiyuna et. al. Patent #
5785653 “System and method for predicting internal condition of live body.”⁷ A stated
use: “the present invention may be use (sic) to detect the internal condition of
surveillance in criminal investigation.” NEC Corporation licensed this patent. Remote
EEG communication with Armed Forces or clandestine application is the cited use for
Mardirossian Patent # 6011991 “Communication system and method including brain
wave analysis and/or use of brain activity.”⁸ Technology Patents, LLC licensed the
patent, which proposes transmitter capable skin implants, and utilizes neural networks
(artificial intelligence.) Publications unreferenced by current papers are a US technical
report of prior results from Stanford comparable to the recent articles, dated 1975,⁹ and
an apparent Russian report before 1981.¹⁰ The direction of robots by detecting mental
states such as imagining raising the directionally appropriate arm or spinning cubes is
reported.^{11 12 13} Emotion differentiation by EEG is also patented, referencing Air Force
research.¹⁴

Theoretical framework for EEG word recognition reports based on the activation
of brain cell assemblies is elaborated¹⁵ for extensive publications of averaged EEG word
category differentiation, also consistent with word recognition. EEG differentiation of
words rated as to affective meaning such as good-bad, strong-weak, or active-passive is

reported.^{16 17} Based on EEG/MEG responses, words are readily distinguished from non-words,^{18 19 20} or pictures,²¹ can be differentiated as to length,²² and visual nouns can be differentiated from action verbs.^{23 24 25 26 27} Brain wave patterns distinguish proper names from common nouns,²⁸ animal names from numerals,²⁹ or content from function words.³⁰^{31 32 33} Concrete versus abstract words,³⁴ and unambiguous versus ambiguous noun/verbs³⁵ have distinctive EEG patterns. Face, arm, or leg action verbs are reported distinguished by brain waves as well.^{36 37}

Similar category specificity is emerging from function magnetic resonance imaging (fMRI) studies. Different fMRI brain activation loci for face, natural and manufactured object recognition are reviewed.³⁸ Neural network differentiation of fMRI response to noun categories for fish, four legged animals, trees, flowers, fruits, vegetables, family members, occupations, tools, kitchen items, dwellings, and building parts is reported.³⁹

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