
Aphasic polyglots: both of the following patterns seen

(1) both languages affected (suggests same brain areas used for both languages) (2) differential recovery of languages suggests differential localization

Case 1

Subject

right-handed 37-year-old male
seizure onset at age 4
reared in Holland, monolingual in Dutch
partial left temporal lobectomy at age 23
emigrated to U.S. at age 28
IQs: verbal 69, performance 89 (tested in English)
WADA: left-hemisphere-dominant

Materials

black-and-white slides with line drawings of 45 objects
(e.g. bell, hand, car) superscripted with "This is a ____"

Procedure

tested on all slides in both English and Dutch prior to surgery

same procedure as Ojemann et al (1989):

naming first carried out in English at all sites
then repeated in Dutch
same number of samples in each language at each site (average 2.2)
performance compared to that on control objects
(no stimulation, same criterion as on test items - immediately preceding object had to be named correctly)

5.6% errors in English (126 objects), 15.5% in Dutch (84 objects)

23 cortical sites selected (excluding motor cortex)
stimulation initiated at beginning of an object picture and continued for four-second duration of that picture

stimulation applied only when previous object named correctly
motor strip not sampled
no stimulation on consecutive slides
no sites stimulated consecutively

Results

stimulation at some sites disturbed naming on all samples: \( p < .01 \)
at other sites, naming disturbed on only some samples:  p < .05
(asterisk in Figure 1)

open circles = no errors

Dutch:  top half of circle
English:  bottom half of circle

of 23 sites,

10 sites showed no effects in either language
6 sites showed effects in both languages (all samples)
7 sites showed differential effects

2 sites - only Dutch significantly disturbed
4 sites - only English significantly disturbed
1 site - both languages disturbed
(English 3/3 trials, Dutch 2/3 trials)

differences probably not due to differential difficulty (English 29/50, Dutch 28/50),
but probably to age of acquisition

Case 2

Subject

left-handed 20-year-old female
seizure onset at age 6
first language English; bilingual since infancy in Spanish
IQs:  verbal 112, performance 123 (tested in English)
WADA: right-hemisphere-dominant
no family history of left-handedness

Materials

same as in Case 1

Procedure

tested on all 57 slides in both English and Spanish prior to surgery
22 cortical sites preselected (excluding motor strip, which was not tested)

naming first carried out in English at all sites
then repeated in Spanish
same number of samples in each language at each site (average 3) control objects (no stimulation):

4.1% errors in English (246 objects), 30.8% in Spanish (146 objects)

under stimulation:

21.5 errors [sic] in English (65 stimulations)
41.5% errors [sic] in Spanish (65 stimulations)

Authors assume her Spanish was disturbed more under testing conditions, but this could easily point to lower Spanish-language competence as well

Results

stimulation at some sites disturbed naming on all samples (solid half circles in Figure 2):

p < .05 (English)
p < .05 (Spanish, but only at two sites)

at other sites, naming disturbed on only some samples (vertical lines in Figure 2):

p < .05 (English)

solid or lined sites with white dots: p = .05 - .20 (Spanish)

asterisk in Figure 2 = single nonsignificant errors:

p = OR > .10 (English)
p > .30 (Spanish)

open circles = no errors

English: top half of circle Spanish: bottom half of circle

white dots = p > .05 but < .2

of 22 sites,

2 sites showed more than a single error in both languages, but only English was significantly affected
7 sites showed differential effects

4 sites - only Spanish disturbed (2 significantly)
3 sites - only English significantly disturbed

single arrow = 5 samples in each language

English: all correct
Spanish: all errors (3 arrest, 1 omission, 1 error)

performance on two languages significantly different (Spanish worse), p < .01
double arrow = 5 samples in each language
   English: 2/5 correct, the other 3 arrested
   Spanish: 4/5 correct, one error

   performance on two languages non-significantly different (English worse), p > .10

Discussion

sites common to both languages in center of language areas
   Case 1: both frontally and parietaally
   Case 2: posterior temporal lobe only

   peripheral to this are sites, both anterior and posterior, with differential
   organization of the two languages

   sites devoted to a language tend to cluster together

   Case 1: English only, middle frontal gyrus
   Case 2: Spanish only, middle portion of middle temporal gyrus

   sites involved in different languages on adjacent gyri, separated
   by less than one (or even one-half, p. 412) centimeter

   second language in each case represented in a wider area of cortex
   than primary language