Language and the human brain

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Animal language?
Protective coloration
Vervet alarm calls

- Eagle alarm call
- Snake alarm call

Kanzi
Kanzi
Is this language?

4 quick examples
1.

Where are the words, anyway?
Answer:

Baby statisticians?

Saffran, Aslin, Newport, 1996
2.

What a big vocabulary you have!

Do you want to eat a VIOLET CRUMBLE?
3.

Syntax, syntax, syntax

that the

The mouse sees the dog. The dog barked.
The dog the mouse sees barked.

4.

Saying one thing, meaning another
This car is a lemon.

If you do that, you’ll be sorry.

If I were you, I’d hate myself.

The Voringian Binx glorphed the Knappaboar.
Language really is different

A language organ in the brain?
Brain of Leborgne - Left Hemisphere
Many brain regions keep their day job too

Brain regions that are active in expert chess players during the end game of chess

Nichelli et al. (1994).
MENTAL ROTATION:
Imagining the Movement of an Object

The mental rotation task

SAME

MIRROR

Mental Rotation FMRI Data
Ark, Haist, & Stiles (in prep)

Parietal Lobe
- Visual attention
- Visual memory
- Image generation
- Spatial manipulation

Fusiform Gyrus
- Object Recognition

Area MT
- Perception of motion
Brain areas that process environmental sounds

Dick, Saygin, Galati, Pitzalis, Bentrovato, D’Amico, Wilson, Bates, Pizzamiglio
(in revision)

Brain areas that process language

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The integrative brain

Hearing (speech) alone  Seeing (lips) alone

Hearing (speech) & Seeing (lips) together

• The left hemisphere
• Many more regions involved
A gene for language?
When a Gene Goes Wrong

Newly Discovered Gene

Offers Clues on Depression
pyramidal cells

mossy cells

muscle cells

sperm cells

Purkinje cell
A gene for language?

The KE family

3 generations

30 family members

15 afflicted members
Human FOXp2

Mouse FOXp2

nearly identical!!

BASAL GANGLIA
Chimpanzees cannot voluntarily control vocalizations

Language depends on rapid and complex vocal movements

A very small change in FOXp2 makes this possible

Small changes can lead to big differences
A new machine built out of old parts

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The connections really matter
Coronal section of brain (looking forward)

Scanning the brain of Leborgne – Nina Dronkers
Superior longitudinal fasciculus of Leborgne

Right Hemisphere
Other things matter, too
Development:
The importance of starting small
Putting it all together...
Thank you