What happens in the brain when we read?
Where are they?

table
Tisch
tavola
Visual zones
What and Where

V4 (color)  
Face recognition  
Perceive Facial Expression
Face recognition
Drawing the reality

- Egyptian: 3,000 BC
- Hebrew: 1,200 BC
- Greek: 600 BC
- Roman: 114 AD
Faces to Letters

6 years old

9 years old
Do you recognize this?
Consequence

Mirror Me
Invariant Representation
Invariant Representation

READ

read

road

clock
cloak
Two pathways for reading

Learning
Slow
and analytic

Instant word recognition
Used by expert readers
Mastery
Gaining Mastery

Up to 7 or 8 characters, no word length effect
19th century discoveries
Paul Broca

1861

- Broca’s area
- Motor area
- Primary auditory area
- Wernicke’s area
Broca’s aphasia

Yes... ah... Monday... er... Dad and Peter H... (his own name), and Dad.... er... hospital... and ah... Wednesday... Wednesday, nine o’clock... and oh... Thursday... ten o’clock, ah doctors... two... an’ doctors... and er... teeth... yah.
Carl Wernicke

1874

- Broca’s area
- Motor area
- Primary auditory area
- Wernicke’s area
Wernicke’s aphasia

“You know that smoodle pinkered and that I want to get him round and take care of him like you want before” meaning “The dog needs to go out so I will take him for a walk”
Main language areas

- Primary motor cortex
- Primary somatosensory cortex
- Broca's area
- Primary visual cortex
- Wernicke's area
- Primary auditory area
Wernicke’s area: semantic

The cat bites the dog.
The dog bites the cat.
Dog cat the bites the
Broca’s area: syntax rules

The girl takes the eat.
Then she eats it.
The chicken takes the strawberry
Then he strawberries it.
Internal syntactic representation
Syntactic trees

```
S
  NP  VP
    N  V
  YouTube shows Comp
        that
  S'    S
    NP   VP
      Det N V NP
           cat plays piano
```
Ambiguities

“He looked at the dog with one eye”
This morning the kids who exhausted their parents slept.

Even if the kids spoke loudly their parents slept.
Language network in babies

Dehaene-Lambertz et al, Brain and Language, 2010
7 bébés de trois mois
Syntax and children

[-finite]

a. pas manger la poupée (N2)
   (not eat the doll)

b. pas tomber bébé (N4)
   (pas fall baby)

c. pas casser (D1)
   (not break)

d. pas attraper une fleur (D2)
   (not catch a flower)

e. pas chercher les voitures (P1)
   (not look for the cars)

f. pas rouler en vélo (P3)
   (not roll on bike)

[+finite]

g. Patsy est pas là-bas (N6)
   (Patsy is not down there)

h. veux pas lolo (N4)
   (want not water)

i. marche pas (D2)
   (works not)

j. me plait pas monsieur là (D5)
   (pleases me not the doll)

k. est pas mort (P2)
   (is not dead)

l. trouve pas (P3)
   (finds not)
Third part of the symbol

table
Tisch
tavola
What about dyslexia?

Typical Brain / Dyslexic Brain comparison

Typical

- Broca’s area, Inferior frontal gyrus (articulation/word analysis)
- Parieto-temporal (word analysis)
- Occipito-temporal (word form)

Dyslexic

- Broca’s area, Inferior frontal gyrus (articulation/word analysis)
Focus on letters or whole word?

Activates inappropriate right brain circuits.

Inability to generalize.

Results a little better at first.

Results not so good at first. Ability to generalize.
Active pedagogy

- 4 study, 4 test
- 6 study, 2 test
- 8 study, 0 test

Graph showing the percentage of students who fail class over time, with categories of lecture and active classroom types.
Exploration results

# Different Actions Performed During Play

![Bar Chart: Number of different actions performed during play across different conditions.](chart1.png)

- Direct Instruction
- Baseline
- Accidental
- Intentional
- Interrupted

* p < .05

# Functions Discovered During Play

![Bar Chart: Number of functions discovered during play across different conditions.](chart2.png)

- Direct Instruction
- Baseline
- Accidental
- Intentional
- Interrupted

* p < .05
Conclusions

- We re-use our natural abilities to read.
- A letter is not an object.
- Mastered word is automatically recognised.
- Letter by letter awareness is not optional.
- Mastering is also plugging word to others.

And... It is much easier to do a Davis program than to understand what happens inside the brain!!!
occupational preoccupations
(your brain at work)