The Prefrontal Cortex

- Most recent addition in evolution. Have undergone tremendous evolutionary expansion
- Present in all mammalian species
- Associated with the expansion of cognitive abilities
- Massive synaptogenesis in this region in infants between 7 and 12 months old.

Functions:
- Abstract reasoning
- Executive function
- Social behavior
- Personality

The Prefrontal Cortex

- Ratio of Frontal Lobe to Brain is largest in humans
- This ratio is considerably smaller in other species
- This ratio is associated with cognitive abilities.
Core deficits with PFC lesions
- Motor Planning, Gaze, Speech
- Loss of divergent thinking and spontaneous production
- Impaired response inhibition and inflexibility
- Inability to manage delayed outcomes
- Increased impulsivity
- Impaired social behavior
- Personality changes

Matrix Reasoning Test
Select the item from the list that best fits in the missing slot. Uses logic and abstraction, sensitive to frontal lobe damage.

Wisconsin Card Sorting Test
Sort according to unspoken rule; examiner changes the rule often. Patient only receives correct/incorrect feedback. Can patient adapt to new rule?
Stroop Interference
- Stroop Task – developed by John Stroop 1935.
- Goal: name the color, DO NOT READ the word!

- Sensitive to frontal and anterior cingulate deficits

Iowa Gambling Task (Damasio & Bechara)
Played like a card game with “good decks” and “bad decks”. Normally subjects don’t go broke, unless they have frontal lobe deficits.

Tower Construction Tasks
Tower of London: Reach goals shown to the subject
Tower of Hanoi: Reach the goal told to the subject
Verbal Fluency

- **Letter (Phonemic) Fluency**
  - Instructions: Name as many words beginning with the letter I’m going to give you as you can in one minute. No proper nouns (i.e. no names). No duplication and no double use of the same stem with a different suffix. E.g. “friend” and “friendly” don’t count as two words.
  - Your letter is “F”

  Average for 18-29 year olds
  13 words

- **Category Fluency**
  - Instructions: Name as many words that belong in this category as you can possibly think in one minute.
  - Your category is “Animals”

  Average for 18-29 year olds
  20 words

Trail Making Test Part B

- Sequencing numbers and letters by connecting the dots as 1-A-2-B....
- Sensitive to task switching deficits
- Requires intact working memory
- Reaction time is the key measure
- Sensitive measure of executive function.
Clinical Case Study (from UCSF)

A 51-year-old male real estate lawyer began to embezzle money at work, regularly listing mysterious expenses on his travel reimbursement forms, which turned out to be purchases of pornographic materials via the internet.

A few of the female law clerks complained that he often made inappropriate comments about their physique and that he stared at them in a way that made them uncomfortable.

His work had dramatically deteriorated, and rather than working with his clients, he spent most of the day at work shuffling papers, reading magazines or downloading pornography onto his computer.

He was eventually asked to leave the firm but made no attempts to find a new job. His wife and children reported that over the past year he had lost interest in them and watched television without speaking when at home.

He developed a strong desire for potato chips and gained 15 lbs. His manners deteriorated, and he stuffed his mouth, often choking at the dinner table.

Examination and Neuropsych Tests

Profoundly apathetic and indifferent and denied any wrong-doing at work, passively shrugging his shoulders when his tearful wife described his problems.

When asked about his future, he was very optimistic, stating that he could make lots of money as a real estate mogul if he wanted.

Speech was fluent, but the patient insisted on telling off-color jokes. He commented on the examiner's old age. He failed badly on word generation, getting six d words and nine animals with normal being 12 d words and 15 animals.

On the Trail-Making Test "Trails B", he made frequent perseverative errors. He correctly named 55 of 60 words on the Boston Naming Test. He copied complex designs without error and remembered most of the designs after 5 minutes. Similarly, he remembered seven of nine words in 5 minutes.

Diagnosis and Discussion

This patient presented with classic signs of FTD, including poor judgment lack of insight disinhibition, apathy and compulsive overeating, which led him to be fired from his job and alienated from his wife.

Like many patients with FTD, despite a relatively intact MMSE visuospatial and language function, he failed badly on tasks of generation and executive function.